T.C.
ISTANBUL AYDIN UNIVERSITY
INSTITUTE OF GRADUATE STUDIES

MORPHOLOGICAL PROCESSING OF INFLECTION AND DERIVATION IN L1 AND L2 TURKISH

MASTER'S THESIS

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Department of English Language and Literature
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MARCH, 2021

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ONAY FORMU

DECLARATION

I hereby declare that all information in this thesis document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all materials and results, which are not original of this thesis. (02/11/2021)

Refika Çimen

To my dear family,

FOREWORD

I am grateful to all the people who have helped me through the journey of completing this thesis. First of all, I would like to express my gratitude to my thesis supervisor Assist. Prof. Dr. Filiz Cele for the invaluable guidance, constant support and constructive feedback she provided me with throughout the process of writing this thesis. This work owes so much to her unique insights and broad experience in the field. I am also wholeheartedly grateful to the members of my thesis committee, Assist. Prof. Dr. Pavel Logačev and Assist. Prof. Dr. Ayse Betul Toplu, for their careful examination of this thesis and their invaluable feedback.

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March 2021 **Refıka Çimen**

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ABBREVIATIONS

ERP : Event Related Potentials
L1 : First Language
L2 : Second Language
MEG : Magnetoencephalography
RT : Response/Reaction Time
SOA : Stimulus Onset Asynchrony
AoA : Age of Onset of Acquisition

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MORPHOLOGICAL PROCESSING OF INFLECTION AND DERIVATION IN L1 AND L2 TURKISH

ABSTRACT

The present study investigated how native speakers and second language learners of Turkish process inflectional and derivational word forms through a masked priming experiment. More specifically, the aim of this study was to find out whether the word category of target words was a determining factor for the processing route of inflected and derived prime words that preceded them. To this end, two lists of stimuli were prepared with a focus on two different word categories, i.e., verbs vs. nouns. In one list, prime words were followed by verbal target stems, whereas in the other list, they were followed by nominal target stems. Since it has been found in some earlier studies that morphologically-related primes can facilitate the processing of target words due to their orthographical and/or semantic relationship with the target words, the present study also incorporated orthographically and semantically related primes in both lists. As a result, each list included prime-target pairs in six different conditions: Identity (e.g. *bakmak - BAKMAK, büyü - BÜYÜ*), Inflection (e.g. *baksa – BAKMAK, büyüyü - BÜYÜ*), Derivation (e.g. *bakım – BAKMAK, büyücü - BÜYÜ*), Orthography (e.g. *bakkal – BAKMAK, büyük - BÜYÜ*), Semantic (e.g. *gör – BAKMAK, sihir - BÜYÜ*), Unrelated (e.g. *tüket – BAKMAK, şeker – BÜYÜ*). Another important feature of the current study is that the same target stems were used for different types of prime words, which makes this study unique. With this experimental design, we aimed to make a direct comparison between different conditions and thus determine the true nature of any priming effects. To explain, this design would allow us to find out whether the priming effects that we found were due to orthographical or semantic similarities between the primes and the targets or were resulting from a morphological relationship between the primes and the targets. The masked priming experiment was administered to 24 native speakers and nine L2 learners of Turkish at an SOA of 50 ms. The responses of the participants were then subjected to a mixed analysis of ANOVA. The results revealed several differences in the priming patterns of the nominal and verbal stimuli. First of all, L1 speakers of Turkish relied on different processing routes for inflected verbs and inflected nouns. We found a decompositional processing pattern for inflected verbs, but full-form storage for inflected nouns. On the other hand, word category did not lead to different priming patterns for nominal and verbal targets that followed derivational primes since full-priming effects were found for both word categories. As for L2 speakers of Turkish, word category was a significant factor for the preferred processing route of inflected word forms. It was found that inflected verbs did not prime their targets. However, L2 speakers showed a certain degree of sensitivity to

the morphological structure of inflected nouns. In a similar way, priming patterns differed for nominal and verbal targets that followed derivational primes. Partial priming effects were obtained for verbal targets following derivational primes, whereas derivational primes led to full-priming effects in nominal targets. This result suggests that L2 speakers of Turkish rely on different amounts of morphologically-structured processing for derivational nouns and verbs. Finally, orthographically- and semantically-related words did not prime their targets at all, suggesting that all priming effects found in the current study were morphological in nature.

Keywords: *Word Processing, Masked Priming, L1-L2 Turkish, Decomposition, Full-listing*

D1 VE D2 TÜRKÇEDE ÇEKİMLENMİŞ VE TÜRETİLMİŞ YAPILARIN BİÇİMBİRİMSEL İŞLEMLENMESİ

ÖZET

Bu çalışmada Türkçeyi ileri yaşta ikinci dil (D2) olarak öğrenenler ile anadil (D1) konuşanlarının çekimsel ve türetimsel sözcük yapılarını nasıl işlemledikleri maskelenmiş çağrıştırma deneyi aracılığıyla araştırılmıştır. Bu çalışmanın amacı, özellikle hedef sözcüklerin türünün, çekimlenmiş ve türetilmiş çağrıştırıcıların işlemlenme yönteminde belirleyici bir etken olup olmadığını öğrenmektir. Bu amaçla, iki farklı sözcük kategorisine, yani fiil ve isimlere odaklanılarak iki uyaran listesi hazırlanmıştır. Bir listede, çağrıştırıcıları fiil hedefler takip ederken, diğer listede çağrıştırıcıları isim hedefler izlemiştir. Daha önceki bazı çalışmalarda biçimbirimsel olarak ilişkili çağrıştırıcıların hedef sözcüklerin işlemlenmesini ortografik ve/veya anlamsal ilişkileri nedeniyle kolaylaştırabildiği bulunmuştur, bu nedenle bu çalışmada her iki uyaran listesine de ortografik ve anlamsal olarak ilişkili çağrıştırıcılar da dahil edilmiştir. Bunun sonucunda, her bir liste altı farklı durumdaki çağrıştırıcı-hedef çiftlerinden oluşmuştur: Özdeş (örn. bakmak - BAKMAK, büyü - BÜYÜ), Çekimlenmiş (örn. baksa - BAKMAK, büyüyü - BÜYÜ), Türetilmiş (örn. bakım - BAKMAK, büyücü - BÜYÜ), Ortografik İlişkili (örn. bakkal - BAKMAK, büyük - BÜYÜ), Anlamsal İlişkili (örn. gör - BAKMAK, sihir - BÜYÜ), İlişkisiz (örn. tüket - BAKMAK, şeker - BÜYÜ). Bu çalışmayı aynı zamanda benzersiz kılan bir diğer önemli özelliği de, farklı türdeki çağrıştırıcılar için aynı hedef sözcüklerin kullanılmış olmasıdır. Bu deneysel tasarımla, farklı durumlar arasında doğrudan bir karşılaştırma yapmak ve böylece ortaya çıkabilecek çağrıştırma etkilerinin gerçek kaynağını tespit etmek amaçlanmıştır. Yani bu tasarım, çağrıştırma etkilerinin, çağrıştırıcı ve hedef kelimeler arasındaki ortografik veya anlamsal benzerliklerden mi kaynaklandığının, yoksa çağrıştırıcı ve hedef sözcükler arasındaki biçimbirimsel bir ilişkiden mi ortaya çıktığının bulunmasını sağlamıştır. Maskeli çağrıştırma deneyi, 50 ms'lik bir SOA'da 24 adet D1 Türkçe konuşanına ve dokuz D2 Türkçe konuşanına uygulanmıştır. Ardından katılımcıların yanıtları, ANOVA ile analiz edilmiştir. Sonuçlar, isim ve fiil uyaranların çağrıştırma yöntemlerinde bazı farklılıklar ortaya koymuştur. Öncelikle, Türkçe D1 konuşanlarının çekimlenmiş fiiller ve çekimlenmiş isimler için farklı işlemleme yollarını kullandıkları görülmüştür. Çekimlenmiş fiiller biçimbirimsel ayrıştırma yöntemiyle işlemlenirken, çekimlenmiş isimler bütünsel listeleme yöntemiyle işlemlenmiştir. Öte yandan sözcük türü, türetilmiş çağrıştırıcıları takip eden isim ve fiil hedefler için farklı çağrıştırma yöntemlerine yol açmamış, her iki kelime türünde de tam çağrıştırma örüntüsüne rastlanmıştır. D2 Türkçe konuşanları için ise, sözcük türünün, çekimlenmiş sözcük formlarının işlemlenme yönteminde belirleyici bir faktör olduğu bulunmuştur. Çekimlenmiş fiiller hedeflerini çağrıştırmazken, D2 konuşanları çekimlenmiş isimlerin biçimbirimsel yapısına belirli bir derecede duyarlılık göstermiştir. Benzer şekilde, türetilmiş çağrıştırıcıları takip eden isim ve fiil

hedeflerin çağrıştırma örüntülerinde de farklılıklar gözlemlenmiştir. Türetilmiş çağrıştırıcıları takip eden fiil hedefler için kısmi çağrıştırma örüntüsü elde edilirken, türetilmiş çağrıştırıcıları izleyen isim hedeflerde tam çağrıştırma örüntüsü gözlemlenmiştir. Bu bulgu, D2 Türkçe konuşanlarının türetimsel isim ve fiiller için farklı derecelerde biçimbirimsel işlemlemeden faydalandığını göstermektedir. Son olarak, ortografik ve anlamsal olarak ilişkili sözcükler, hedeflerini çağrıştırmamıştır, bu da mevcut çalışmada tespit edilen tüm çağrıştırma etkilerinin biçimbirimsel bir yapıda olduğuna işaret etmektedir.

Anahtar Kelimeler: *Sözcük İşlemleme, Maskelenmiş Çağrıştırma, D1-D2 Türkçe, Biçimbirimsel Ayrıştırma, Bütünsel Listeleme*

1 INTRODUCTION

1.1.1 Background to the Present Study

Humans comprehend, process and produce countless words every day. This remarkable capability brings out a question regarding the organization of and access to the mental lexicon. In recent decades, a considerable amount of psycholinguistic research has been aimed at understanding how the human mind represents and accesses morphologically-complex forms. Much research has been driven by the question of whether morphological processing takes place through a rule-based route or is based on full-form representations of words. Whereas this question has given rise to a considerable amount of research on native language (L1) processing, the issue has expanded to second or foreign language (L2) processing in recent decades. A close look to the previous literature brings several core issues to attention regarding the processing of language by L1 and L2 speakers.

The major issues of language processing were first addressed in L1 studies, which mostly focused on two morphological phenomena: inflection and derivation. Previous studies offered differing explanations about the nature of mechanisms that underlie the processing of inflectional and derivational morphology. Earliest morphological processing models include the full-listing model and the decomposition (or rule-based) model, both of which propose a single mechanism for accessing morphologically complex word forms. The full-listing model claims that fully listing complex word forms requires fewer linguistic computations and provides processing economy (Butterworth, 1983; Frauenfelder & Schreuder, 1992; Henderson, 1984). However, several researchers have challenged this account by postulating that morphologically complex words are parsed into their constituents and accessed as decomposed units because it could burden the memory to store each morphological variant of a word (Fruchter, Stockall, & Marantz, 2013; Hankamer, 1989; New, Brysbaert, Segui, Ferrand, & Rastle, 2004; Stockall & Marantz, 2006). In recent decades, another processing model has been suggested by Ullman (Ullman, 2001a, 2016), who suggested a dual-mechanism model in which declarative and

procedural memories are dissociated for a combination of rule-based computation and whole-word recognition.

The discussions regarding the processing of morphology in L1 has been carried into L2 recently. The primary question that has been addressed by L2 researchers has been whether L1 processing and L2 processing differ or are similar. This has generated two opposite views. One view postulates a shared system for L1 and L2 speakers, which means that they use the same processing mechanisms and rely on the same neural systems for morphologically-complex words (Indefrey, 2006; McDonald, 2006; Perani et al., 1998). The other view, however, posits that L1 processing and L2 processing are different in fundamental ways. The previously mentioned Declarative/ Procedural model, for example, suggests that late L2 learners differ from L1 speakers considerably in terms of grammatical processing, especially the processing of inflectional word forms (Ullman, 2005, 2016). This model also argues that L2 processing remains limited to declarative storage, rather than computational mechanisms, for the most part. The view that L1 and L2 speakers rely on distinct mechanisms for morphological processing has also been emphasized by the Shallow Structure Hypothesis (SSH), which claims that decomposition is burdensome for L2 speakers due to their low level of morphological sensitivity and higher reliance on lexical and semantic cues (Clahsen & Felser, 2006).

These two views have been tested in a considerable number of studies using a selection of experimental methods and techniques such as ERP, masked or unmasked priming task, and lexical decision experiment in recent years. Several masked priming studies reported that L2 speakers have difficulty processing especially inflectional forms due to their reduced sensitivity to the inflectional morphology (Clahsen, Felser, Neubauer, Sato, & Silva, 2010; Silva & Clahsen, 2008). Yet, it was also found that L2 speakers show reduced priming effects for derivational forms, which was taken as evidence that unlike inflected words, the morphological structure of derived words is subject to a certain degree of sensitivity in L2 speakers (Clahsen, Balkhair, Schutter, & Cunnings, 2013; Silva & Clahsen, 2008). On the other hand, investigation of the regular/irregular dichotomy with L2 speakers has shown that L2 speakers demonstrate partial priming effects for the irregularly-inflected words similar to L1 speakers, which led some researchers to suggest that L2 speakers show

native-like performance when processing irregularly-inflected forms (Neubauer & Clahsen, 2009).

As aforementioned, both L1 and L2 processing of derivation and inflection has led to a lot of investigation and resulted in inconclusive findings. This calls into question whether something may be lacking in earlier studies. A closer look to the literature shows that the investigation of inflectional and derivational processing has primarily rested upon such issues as regularity, productivity, proficiency, and frequency. Yet, an examination of the previous literature from a broader perspective reveals a shortcoming regarding the investigation of the full-listing/decomposition dichotomy in different word categories. Most of the earlier studies have kept the processing of morphology limited to certain word categories due to their focus on aforementioned factors, and thus the role of word category has been ruled out automatically.

Although there are very few L1 and L2 studies which directly address the issue of word category in the investigation of inflectional and derivational processing, their findings show that it may be worth examining the issue from a perspective based on word category. These studies have brought about several overlooked aspects of morphological processing such as a distinction found between nominal and verbal inflection (Baayen, Dijkstra, & Schreuder, 1997), the differential effect of morphological regularity on nouns and verbs (Tsapkini, Jarema, & Kehayia, 2002), and priming effect differences between nominal and verbal inflections (VanWagenen & Pertsova, 2014), in addition to offering significant implications for L2 processing as well (Ahn et al., 2014; Portin et al., 2008; Vainio, Pajunen, & Hyönä, 2014). Though scarce in number, these findings recall a difference between the lexical organization of verbal and nominal inflection. Against this background, the present study aims to close a gap in the literature by investigating the processing of inflected and derived word forms in L1 and L2 Turkish with a particular focus on different word categories. More specifically, this study is aimed at identifying whether word category has a determining role in the processing route of morphologically complex words in L1 and L2 speakers, and thus to provide a comparison of L1 processing and L2 processing and help to determine their similarities and/or differences. In this regard, the current study is important in that it investigates and compares L1 and L2 processing of not only inflection, but also

derivation since the studies examining derivational processes is more limited as compared to inflectional research and have offered inconclusive results so far. Looking at these issues from a point of view that rests upon the role of word category may provide an explanation to the contradictory findings in the mental lexicon literature and offer a broader perspective on the processing of complex morphology.

This current study investigates the aforementioned issues through a masked priming experiment conducted with adult L1 and L2 speakers of Turkish. The experiment incorporated both noun and verb targets for inflected and derived primes since it is one of the primary goals hereof to look into the influence of word category on morphological processing. This study is unique in that it is the first study, to our knowledge, to directly compare the role of word category in L1 and L2 speakers. It is also a unique study in that it uses the same targets for six different prime types including orthographically- and semantically-related prime words, which offers a direct comparison between different conditions and determine the exact source of any priming effects.

This thesis consists of seven chapters. The current chapter serves as an introductory section to the primary issues in the psycholinguistic research of morphology. Chapter 2 will review the various aspects of and previously-suggested issues about derivational and inflectional morphology, as well as an overview of the morphological characteristics of Turkish, in which this study is conducted, and the morphological focus of this study. Chapter 3 will focus on the mental lexicon models and earlier L1 researches that have examined these models. Chapter 4 will discuss the L2 studies that have investigated the inflectional and derivational processing. Following the literature review, Chapter 5 will present the methodology of the current study together with the research questions and details about the participants, tasks and items utilized. Finally, Chapter 6 will present the results of the study and their implications will be discussed in Chapter 7.

2 LINGUISTIC BACKGROUND

This chapter provides an extensive look to the inflectional and derivational processes as well as the morphological characteristics of Turkish and English, the two languages which are under investigation in this study. Since it is one of the main purposes of this study to investigate any potential differences between the processing of inflection and the processing of derivation in L1 and L2, it is considered to be of utmost significance to examine the relevant morphological processes and their application in English and Turkish as well as the morphological characteristics of these two languages to determine if any significant result of this study may stem from the linguistic differences between inflection and derivation or between the two languages in question.

2.1 Inflectional and Derivational Processes

Henderson (1985) defines morphemes as the smallest meaningful units of languages. Morphemes are divided into stems (e.g. *hire, hope*) and affixes (e.g. *-ing, -ful*), which come together through an extensive variety of combinations to create morphologically complex words. Inflection, derivation and compounding constitute the distinct linguistic processes through which languages form morphologically complex words. Inflection and derivation are the processes of attaching an inflectional or derivational affix to a stem (e.g. *hiring, hopeful*), whereas compounding includes two or more stems combined into a new word (e.g. *desktop*). It is important to note, however, that the current study investigates the processing of inflected and derived words only; therefore, this section exclusively focuses on the overview of inflectional and derivational morphology.

Whereas the distinctive natures of inflection and derivation have generally been acknowledged in traditional linguistic discussions, theoretical linguists fail to reach an agreement about whether they qualify as two distinct phenomena (Kutlay, 2017). Some researchers suggest that inflection and derivation should not be classified as separate phenomena due to the similarities in their affixation processes

(Aronoff, 1994; Bochner, 1992). To explain, it is claimed that the morphology of inflection and derivation are similar because they involve the same kind of affixation procedures such as prefixation, infixation and suffixation or because some affixes might be used both to derive and inflect words (Şafak, 2015). However, inflection and derivation are separated from each other based on their distinctive features in traditional linguistic descriptions. The main distinction between them is generally drawn based on the fact that they belong to different levels of language.

Inflectional operations are essentially required by the grammatical context, and thus, inflection is regarded as a component of the syntax (S. R. Anderson, 1992; Bauer, 2003). Inflections create surface variants of stems by modifying their grammatical features such as tense, aspect and number (e.g. *wave – waved, book – books*) rather than altering their semantic content (Bozic & Marslen-Wilson, 2010). In other words, an inflectional operation does not lead to a new lexeme distinct from the stem; therefore, neither does it add new lexical entries to the mental lexicon. In contrast to the "lexeme-preserving" nature of inflectional morphemes, derivation is a process of creating new lexemes in the mental lexicon and the use of a derivational affix is not determined by the grammatical or syntactic context (Blevins, 2006). Therefore, derivation is seen as a component of the lexis (S. R. Anderson, 1992; Bauer, 2003). Derivational morphemes both alter the meaning of stems and sometimes change their grammatical category (e.g. *happy* and *happiness* are distinct lexemes in different grammatical categories, ie. *happy* is an adjective and *happiness* is a noun). In this regard, realization-based theories of morphology assume different morpholexical representations for inflected and derived forms in the mental lexicon (S. R. Anderson, 1992).

In addition to the definitional and functional differences mentioned above, Stump (1998) makes a distinction between inflection and derivation based on productivity. Accordingly, inflectional morphology is more productive and semantically more regular than derivational morphology. For example, English plural suffix *-s* can be attached to almost all countable nouns and it will always express the plural for every noun it attaches to (e.g. *books, tables, students, houses*), yet the denominal adjectivalization with the suffix *-ship* can be applied to a limited number of nouns (e.g. *boyish, womanish,*schoolish, *manish*) and its meaning may show variance (e.g. *selfish*: concerned primarily with one's own interests, *childish*: in the

manner of a child). Similarly, Bozic & Marslen-Wilson (2010) note that unlike the predictable meaning of inflected words, derivational processes may create context-dependent or even idiosyncratic words with semantically transparent (e.g. *safe–safely, teach–teacher*), or semantically opaque (e.g. *arch– archer, wit–witness*) meaning.

One last distinction between inflection and derivation is drawn with respect to the position of inflectional and derivational affixes in a word. According to Blevins (2001), inflectional morphemes usually appear on the periphery of a morphologically complex word, while derivation occurs closer to the root. This assumption also feeds the Split Morphology Hypothesis (J. R. Anderson, 1982; Perlmutter, 1988), which claims that unlike derivation, all inflection occurs postsyntactically and hinders further derivation of words (e.g. *relation-ship-s, *relation-s-ship*).

Although some generalizations have been put forward regarding the differences between inflectional and derivational morphology as mentioned above, a consensus has not been reached yet with respect to the controversy between them. These distinctive generalizations have been challenged by various scholars based on crosslinguistic evidences at certain points. Especially in recent decades, the theoretical discussion on the distinction between inflection and derivation has moved toward the processing differences between them, which have been investigated in several psycholinguistic studies. As the processing of inflection and derivation also constitutes the focal point of the present study, the following sections will provide a descriptive overview of the morphological systems of Turkish and English.

2.2 The Morphological Characteristics of Turkish

Turkish is an agglutinating language with a rich variety of affixes available for both derivational and inflectional processes. As opposed to many Indo-European languages, Turkish is characterized by the productiveness of its morphology (Kırkıcı & Clahsen, 2013), in which the word formation process is mainly achieved through suffixation. Therefore, most morphologically complex words in Turkish are created through attaching inflectional and derivational morphemes right to the roots and stems. The Turkish suffixation system is so productive that it is possible to inflect a verb with about 2000 affixes (Hankamer, 1989). See the following example offered by Ketrez (2012) for one of the longest Turkish words:

(1) Avrupa-lı-laş-tır-a-ma-dık-lar-ımız-dan mı-sınız?

Europe-der-der-caus-neg-sub-pl-2plposs-abl cl-2pl?

‘Are you one of those whom we cannot make European?’

Despite illustrating a word in Turkish, (1) can only be expressed as a clause or a sentence in a non-agglutinative language like English or German. Additionally, iteration is another source of productivity in Turkish, which enables the formation of extremely long words (Durgunoğlu, 2006). Iterative loops in Turkish are illustrated by Kirkici & Clahsen (2013) with the following example:

(2) temiz “clean”

temiz-lik “cleanness/cleanup”

temiz-lik-çi “cleaner”

temiz-lik-çi-lik “the occupation of a cleaner”

temiz-lik-çi-lik-çi “a lobbyist for cleaners”

temiz-lik-çi-lik-çi-lik “the occupation of being a lobbyist for cleaners”

As shown in (1) and (2), in Turkish, morphologically complex stems may serve as a basis for further affixation in a productive way (Hankamer, 1989). Nevertheless, such affixation does not alter the stem or the root orthographically and phonologically (Aksu-Koç, Ketrez, Laalo, & Pfeiler, 2007). This makes it possible to determine the root or the stem regardless of the length of the word. Yet, despite the productive nature of the Turkish affixation structure, derivational and inflectional items are not attached to roots and stems arbitrarily. In most cases, excluding clitics, derivational suffixes precede inflectional suffixes (Kutlay, 2017).

Turkish morphology is also characterized by certain rules which govern the phonological structure of simple and complex word forms. According to external vowel harmony rules, which applies to suffixes, the vowels in most suffixes are determined by the last vowel of the word they follow (Kutlay, 2017). The first type of vowel harmony rule requires the vowel of a suffix to be in harmony with the frontness or backness of the preceding vowel.

(3) *masa-lar* ‘tables’

hediye-ler ‘gifts’

As illustrated above, the Turkish plural suffix has two forms (*-lar* and *-ler*) as a result of the vowel harmony in Turkish. The other type of external vowel harmony, also called I-type vowel harmony, is related to frontness and roundness and it concerns the suffixes with a high vowel. When this kind of suffix is attached to a word form, the vowel in the suffix is altered as ‘i’, ‘ı’, ‘ü’ or ‘u’ in accordance with the preceding vowel (Göksel & Kerslake, 2005, p. 22-23).

In addition to vowel harmony, Turkish also features consonant harmony which requires the final consonant of a stem and the initial consonant of a suffix to agree in voicing (Kutlay, 2017). As illustrated in (4), the first consonant of the Turkish past tense suffix -DI is determined according to whether the last consonant of the stem is voiced or voiceless. Because of vowel harmony and consonant harmony in Turkish, the past tense suffix has a total of eight forms (–dı, -di,-du, -dü, -tı, -ti, -tu, -tü).

(4) *aç-tı* (opened)

sev-di (loved)

Additionally, the phonological structure of Turkish does not allow vowels to appear side by side (Göksel & Kerslake, 2005, p. 44). For this reason, attaching a vowel-initial suffix to a vowel-final stem requires either to remove the initial vowel of the suffix (e.g. *kapı* ‘door’ - *kapı-m* ‘door-POSS’: the first person possessive suffix *-(I)m* loses its first initial) or to attach the buffer ‘–y’ to the stem (e.g. *kapı* ‘door’ - *kapı-(y)-I* ‘door-ACC’: the buffer is inserted when the accusative suffix *-I* is attached).

Inflection in Turkish occurs in nominal and verbal forms. Nominal forms are inflected with number, possession and case suffixes respectively as illustrated in (5). According to Kornfilt (1997), the most productive bound suffixes in Turkish are case morphemes which express the syntactic functions of noun phrases. There are five case suffixes in Turkish: accusative, dative, locative, ablative, and genitive.

(5) araba-lar-ı-nı

car-pl-2sg.poss-acc

Turkish verbs, on the other hand, are divided into finite and non-finite verbs. Whereas it is obligatory to mark finite verbs with a person, there is no overt marker for third person singular. Therefore, third person singular is indicated by the lack of a person marker on the verb in Turkish. Although it is possible to inflect both finite and non-finite verbs with voice suffixes, the negative marker, and tense/aspect/modality markers, the two types of verbs differ in one respect. Finite verbs can also occur with copular markers, person markers etc. while non-finite verbs have to be marked with a subordinating suffix (subordinator) and can occur with nominal inflectional suffixes (Göksel & Kerslake, 2005, p. 69).

There is a wealth of derivational morphology in Turkish. According to Aksan (1987), there are presumably over 100 derivational morphemes with different functions and meanings in Turkish. Apart from reduplicative prefixes, Turkish derivational morphology is mainly comprised of suffixes. While some derivational suffixes change the class of roots or stems, others preserve the grammatical category of the word that they are attached to. Also, the meaning of derived word forms may remain related to that of the stem (Göksel & Kerslake, 2005). In addition, unlike some derivational suffixes which are very productive such as *-lI* which can be attached to all place names (e.g. *Mersin-li* 'from Mersin', several others are quite unproductive and therefore are no longer used to create new words.

The focus of this study is both on derivation and inflection. Yet, the present study also aims to investigate the potential differences between nominal and verbal inflection as well as nominal and verbal derivation. Therefore, four morphemes are examined in line with the purposes of this study. The first morpheme investigated is a nominal inflectional suffix: *-(y)I*. This suffix marks the accusative case on nominal forms and it is one of the most productive bound morphemes. Because this accusative suffix is subject to I-type vowel harmony, it has four allomorphs: *–(y)ı, -(y)i, -(y)u, -(y)ü*. The appropriate allomorph is determined according to the frontness and roundness features of the vowel preceding this suffix. Another aspect of the accusative suffix is that it requires the buffer *'-y'* when it is attached to a vowel-final stem. Besides vowel harmony, the accusative suffix also requires consonant harmony. Therefore, when it is attached to a stem that ends in a voiceless consonant ('p', 't', 'k' or 'ç'), that consonant is altered into its voiced counterpart ('b', 'd', 'g/ğ' or 'c' respectively) (e.g. *kitap* 'book' - *kitab-ı* 'book-ACC').

(6) sinema-y-ı

elbise-y-i

tiyatro-y-u

örgü-y-ü

The second morpheme that is examined in this study is the conditional modal: *-sA*. This bound suffix is used to inflect verbs. Due to vowel harmony rules, it has two allomorphs: *-sa, -se*. When it is attached to a verb stem without any personal marker, 3rd person singular meaning is expressed.

(7) koş -sa -□

Run COND 3SG

'If he runs'

Since it is among the goals of this study to compare the inflectional and derivational processes, two derivational suffixes have been incorporated into the experiment. The first derivational morpheme investigated in this study is *-Im* (e.g. seç – seçim, "choose" – "choice"), which is attached to verbs. This deverbal nominalization morpheme has four allomorphs determined according to the frontness and roundness features of the preceding vowel: *-ım, -im, -um, -üm*. The other derivative morpheme included in this study is *-cI* (e.g. diş – dişçi, "tooth" – "dentist"), a derivational morpheme which is attached to nominal roots and stems. This morpheme has eight allomorphs due to I-type vowel harmony and consonant harmony: *-cı, -ci, -cu, -cü, -çı, -çi, -çu, -çü*.

Several reasons exist for selecting the suffixes which are to be examined in this study. The selection of Turkish conditional affix stems from the fact that it functions as a modal and the literature on the morphological processing of verbs inflected with a modal is unavailable to the best of our knowledge. The research on this affix may help to broaden the perspective on the morphological processing of verbal inflection. The accusative case marker, on the other hand, have been chosen because the processing of this suffix has previously been examined in very few studies. More importantly, studies investigating the acquisition and production of nominal case markers in L2 speakers have mainly reported variability in the use of

accusative suffix, and this may be well rooted in the way this structure is represented in L2. Therefore, this study may help to explain the psycholinguistic factors behind the variability observed in L2 speakers' use of this case marker. Finally, the reasons for choosing the derivational morphemes *-Im* and *-cI* are their productivity and the unavailability of previous literature on the processing of these suffixes. In addition, examining these derivative suffixes will provide an opportunity to compare inflection and derivation in verbs and nouns in L1 and L2 speakers.

2.3 The Morphological Characteristics of English

Although this study has been carried out in Turkish as L1 and L2, it is essential to provide a brief overview of the morphological characteristics of English, which is the native language of the L2 group, in order to obtain a deeper understanding of the underlying factors that characterize how English-speaking learners of Turkish process morphologically complex words. English is considered as a derivationally rich but inflectionally limited language. Whereas inflection occurs through suffixation, there are two common ways of deriving new word forms: suffixation and prefixation. In contrast with derivational morphology, inflectional morphology does not alter the grammatical category of the words, nor does it create new lexemes. English inflectional morphology is comprised of eight bound morphemes attached to nouns (plural *–s* and possessive *–s*), adjectives (comparative *–er* and superlative *–est*) and verbs (the progressive *–ing*, third-person singular present tense marker *–s*, past participle *–ed/-en* and past tense marker *–ed*). English also exhibits irregular inflection, especially in relation to plural nouns, past tense and past participle verb forms, and several comparative and superlative adjectives (Blevins, 2006).

The English language displays a rich and productive derivational morphology compared to its inflectional morphology. Whereas Turkish derivational morphology is largely dependent on suffixation with very limited instances of prefixation, prefixation is as prevalent as suffixation for deriving nouns, adjectives, verbs and adverbs in English. Additionally, English derivational morphology is characterized by a classification of suffixes: neutral and non-neutral. Neutral suffixes such as -ful and -ly (e.g. *success-successful*) are attached to free morphemes and the semantic relatedness between the derived word form and the base is maintained. On the other

hand, non-neutral suffixes such as -ion and -ive (e.g. *attentive*) are generally attached to bound morphemes and the meaning of these suffixes are not transparent. Furthermore, neutral suffixes do not affect the phonological qualities of the base to which they are attached, whereas non-neutral suffixes generally cause morphophonological changes such as stress shifts and resyllabification in the base (Plag & Baayen, 2009). Finally, neutral suffixes are more productive than non-neutral suffixes.

As explained above, English has a more limited inflectional morphology than Turkish, and its derivational morphology differs from that of Turkish in terms of the common types of affixation used. The next chapter will present the main models and theories available for morphological processing in native and nonnative language.

3 THEORETICAL BACKGROUND

The question of how human brain processes countless words every day has led to the emergence of several morphological processing models in the field of psycholinguistics. Two competing accounts of lexical access have been prevalent for explaining the computation of morphologically complex words: single- and dual-mechanism models. This chapter will provide a comprehensive overview of these models with an eye to laying the theoretical foundations for this study.

3.1 Models of Morphological Processing in L1

Previous studies on the morphological processing of complex word forms in native speakers have given rise to two basic accounts of lexical access: single- and dual-mechanism models. Single-mechanism models have tried to explain the representation and processing of complex word forms with a uniform mechanism. At the one end of the single-mechanism spectrum is the full-listing model, which posits that all morphologically complex words are stored as single units (Butterworth, 1983; Manelis & Tharp, 1977). At the opposite end of the spectrum lies the decomposition model, which assumes that complex word forms are parsed into their morphological units for storage (Taft & Forster, 1975).

Yet, the inadequacy of the single-mechanism models to account for the variability observed in morphological processing have led to the emergence of dual-route (hybrid) models (e.g. Pinker, 1991; Ullman, 2001, 2016). The dual-route approach postulates two distinct processing mechanisms: a mental lexicon, which stores the full-form representations of irregular word forms, and a mental grammar, which controls the parsing of regular forms. The dual-route approach has been lent support by a number of researchers who have investigated the representation of irregular and regular forms and found decomposition for regular forms and full-listing for irregular ones (e.g. Allen & Badecker, 2002; Clahsen, 1999). Nevertheless, their findings cannot be considered conclusive since there are also several studies which have found decomposition for irregular word forms (e.g. Meunier & Marslen-

Wilson, 2000). The following sections will provide a more detailed look to the models of morphological processing.

3.1.1 Single-mechanism models

Single-mechanism models propose a single mechanism for representing, processing, accessing and retrieving morphologically complex word forms without any distinction between different domains of the language, i.e. lexicon and grammar. One main variant of the single-mechanism models is the decomposition (rule-based) model which assumes that all morphologically-complex word forms go through a process in which they are parsed/decomposed into their constituents. One of the oldest morpheme-based models is the Obligatory Decomposition Model (Taft & Forster, 1975), which suggests that for accessing the lexical representation of a complex word such as *unlucky*, this word must be stripped off its affixes *un-* and *-y* first. This means that the recognition of a complex word form depends upon an earlier morphological analysis of the word. This pre-lexical affix stripping process provides storage economy in the mental lexicon. Taft & Forster (1975) offered evidence for this hypothesis by comparing response times (RTs) to pseudowords composed of real morphemes (e.g. *dejuvenate*) and pseudowords with nonexistent morphemes (e.g. *depertoire*) through a lexical decision task. According to their results, RTs to pseudowords composed of real morphemes were slower, which is claimed to point to a morphological analysis of words prior to lexical access.

The Obligatory Decomposition Model was later revised by Taft (1994, 2004) with the incorporation of the lemma level between the form (orthography-phonology) and the function (semantic-syntactic) levels. This model postulates a hierarchical order of activation among these levels. Therefore, a morphologically complex word is not parsed into its constituents prior to lexical access. Rather, its morphemes are activated at the form level, a process which then extends to the lemma and function levels. Also, this revised model posits that accessing words with inflectional suffixes and accessing prefixed words occurs identically; however, the parsing of a derived word is from left to right and its stem is represented as a unit, which does not require the affix-stripping process before lexical access (Kempley & Morton, 1982; Taft, 1994; Taft & Zhu, 1995).

The evidence for the rule-based approach comes from a number of studies based on various experimental paradigms such as the masked priming method or the lexical decision paradigm. For example, Rastle, Davis & New (2004) investigated the role of morphological and semantic relationships in accessing various word forms through a visual lexical decision task. The experimental items were presented to native speakers of English under three conditions: a condition in which the target and the prime share a morphological relationship which is also semantically obvious/transparent (e.g., cleaner–CLEAN), a condition where the target has a clear morphological relationship with the prime but does not share any semantic connection (e.g., corner–CORN), and a condition in which the target and the prime are similar to each other in form without a morphological relationship (e.g., brothel–BROTH) (Rastle et al., 2004). They found substantial and similar priming effects in the two morphological conditions, which differed from the priming in the nonmorphological condition. Based on these findings, Rastle, Davis & New (2004) suggested that words that appear to be complex are decomposed according to their morpho-orthographic at a certain level of representation.

Another study whose findings lend support to the decomposition model was carried out by Stockall & Marantz (2006). They conducted two unmasked priming lexical decision tasks during which they used magnetoencephalography (MEG). The study was concentrated upon the M350 factor, which assumably indicates lexical root activation. The study aimed to investigate whether regularly- and irregularly-inflected past tense verbs are processed similarly by native English speakers. The two tasks consisted of prime-target pairs in three conditions: a condition in which the target and the prime were identical (e.g., boil-boil), a condition in which the target and the prime shared an orthographical relationship (e.g., curt-cart), or a condition where the target and the prime share a morphological relationship. The morphological condition included regularly-inflected verbs (e.g., jump-jumped), irregularly-inflected verbs that have a substantial orthographic similarity (e.g., gave-give), or irregularly inflected verbs that share a low level of orthographic similarity (e.g., taught-teach). Both experiments resulted in equivalent M350 effects for the target words whose primes were identical or morphologically-related, and the M350 effects were the same for regularly and irregularly inflected forms. Based on these results, Stockall & Marantz (2006) suggested that regularly- and irregularly-inflected

word forms are processed similarly, and both forms activate the morphological stem in the mental lexicon and are processed through a rule-governed route.

In a similar vein, the processing of Fruchter, Stockall & Marantz (2013) looked into how English regular and irregular past tense word forms are processed via a masked priming lexical decision experiment using MEG. However, this study addressed the M170 component, which is claimed to show the onset of morphological decomposition for the stimuli that are presented visually. They found the same amount of priming effects for identical and morphologically-related prime words (both regularly- and irregularly-inflected word forms). Their findings were viewed by the authors as further evidence that lexical access is not affected by the morphological regularity and all words including irregular forms are accessed via a decompositional route.

Whereas the decomposition model has been especially proposed for languages that have a rich morphology such as Turkish on the grounds that it could burden the memory to store each morphological variant of a word (Hankamer, 1989), this approach was later challenged by the full-listing (direct-access) models because evidence of storage was found for highly frequent complex words in languages such as Finnish (Soveri, Lehtonen, & Laine, 2007) and Turkish (Ayse Gürel, 1999). The full-listing approach assumes that all morphologically complex word forms are stored and accessed as a single unit and not parsed into their constituents. Therefore, every variant of a base or root is represented as a new lexical entry in the mind. In other words, morphological structure of a complex word does not affect language recognition, comprehension or production. The proponents of this approach claim that although full-listing of complex word forms requires a considerable storage space, there are fewer linguistic computations, which provides processing economy (Butterworth, 1983; Frauenfelder & Schreuder, 1992; Henderson, 1984; Rubin, Becker, & Freeman, 1979).

The full-listing model shares several similarities with the connectionist (associative) approaches, which generally suggest that every word is stored and accessed in the associative memory regardless of its morphological structure. Accordingly, there are links which associate words with their variants, and certain factors such as frequency of occurrence and orthographic, phonological and semantic similarity determine how strong these links are. Accessing words, which have

distributed representations in the memory, takes place through a direct mapping procedure, which refers to the relation built between input and output representations of words (MacWhinney & Leinbach, 1991). Bybee (1991) summarized the full-listing account as a model which involves the same processes for all morphological pattern. These processes include storing the items, creating connections between the items, and forming patterns for the relevant connections (Bybee, 1991).

Rumelhart & McClelland's (1986) Parallel Distributed Processing (PDP) model, which was developed to simulate children's acquisition of the past tense, has been one of the most prominent connectionist models. This model consists of a simple associator, which learns the relationship between the base form and the past tense form of a verb in English, and a pattern associator, which includes an input unit for the root form of the verb and an output unit for the pattern generated by the model. The model also has a decoding network to generate a phonological representation for the past tense form of the input. Both regular and irregular past tense forms are processed through the same mechanism, and inflected words are stored and represented as full forms (McClelland & Patterson, 2002). The learning process depends on how firmly the input and output forms are connected.

Whereas it has been suggested that the PDP model validates the absence of any morphological processing for accessing morphologically complex word forms (Seidenberg & McClelland, 1989), the model was also criticized based on some generalization issues. It has been noted that the verb formation process developed in this model does not apply to other regular verbs that the model has not been trained on. Also, it has been brought to attention that this model is chiefly focused on inflected forms and thus fails to account for the morphological processing of other complex word forms such as derivational forms (Pinker & Ullman, 2002; Ramscar & Gitcho, 2007).

However, the findings of several other studies have supported the assumption of connectionist models that there are connections between the form of a word (orthography and phonology) and its semantic meaning and the basic unit of representation in the lexicon are not distinct morphemes. For example, in a series of cross-modal lexical decision experiments, where the prime is presented auditorily and the target is presented visually, Gonnerman, Seidenberg & Andersen (2007)

investigated the role of semantic overlap between prime and target pairs on the amount of priming effect. The experimental stimuli contained prime-target pairs in Low Semantic condition (e.g., hardly-hard), Moderate Semantic condition (e.g., lately-late), and High Semantic condition (e.g., boldly-bold). In addition to these conditions, one Form Only prime-target set (e.g., spinach-spin) and one Semantic Only prime-target set (e.g., idea-notion) were included. According to the results, the fastest reaction times were obtained for prime-target pairs with a high amount of semantic overlap. This was respectively followed by the prime-target pairs in the Moderate Semantic and Semantic Only conditions. The Form Only or Low Semantic conditions did not yield any priming effects. Gonnerman et al. (2007) presented the graded effect of semantic similarity on target recognition as support for the connectionist argument that the degree of form-meaning overlap affects the connections of items in the lexicon.

Gonnerman et al. (2007) conducted another cross-modal priming lexical decision experiment with prime-target pairs which shared various degrees of phonological similarity to test the hypothesis that the degree of phonological overlap regulates the priming effects for highly semantically related words. The stimuli were presented in four phonological similarity conditions: 1) No Change (e.g., *acceptable-accept*), 2) Consonant Change (e.g., *absorption-absorb*), 3) Vowel Change (e.g., *criminal-crime*), and 4) Consonant Plus Vowel Change (e.g., *introduction-introduce*). These prime target pairs also had a high amount of semantic similarity. Additionally, word pairs with no semantical similarity were introduced into the experiment in a Low Semantic set (e.g., *accordion-accord*) and synonyms with no phonological overlap (e.g., *porpoise-dolphin*) were used in a Semantic Only set. The results showed that whereas primes that overlapped only in phonology did not facilitate priming, pairs with a consonant change produced the highest facilitation. Also, a graded impact of phonological overlap was found in the availability of semantic similarity. These results were interpreted by the authors as evidence for the connectionist assumption that the mental lexicon does not have a morphological structure, but that whole-word forms are connected in a network according to their degree of form-meaning overlap.

As reviewed above, the rule-based and full-listing models posit a single processing route for morphologically complex word forms. Whereas the rule-based

models assume that all complex words are decomposed for lexical access, the full-listing models posit that all complex forms are accessed as whole-forms. Yet, the fact that these models fail to offer a complete picture of morphological processing for all types of complex words has led to the development of dual route models, which will be reviewed in the following section.

3.1.2 Dual route models

Single-mechanism models present several shortcomings in accounting for the morphological processing of all types of complex words. For example, the decomposition-based models fail to explain the processing of irregular forms, whereas the full-listing models have turned out to be insufficient in offering a satisfactory picture of how regular forms are processed. Such deficiencies of the single-mechanism models have paved the way for the development of dual route (hybrid) models, which propose a combination of full listing and decomposition for morphologically complex words depending on a variety of factors such as regularity and transparency. One of the most well-known dual route models is the dual-mechanism account originally proposed by Pinker (1991, 1999). As a mix of connectionist and rule-based accounts, this model incorporates two different systems which operate together. To explain, the dual-mechanism model fundamentally includes a mental lexicon, also referred to as the associative memory, for full-form storage, and a mental grammar, also called the rule-formation system, which consists of productive and combinatorial rules for forming complex words, phrases and sentences in real time. Regarding the morphological processing and storage, this account postulates decomposition of regular forms within the mental grammar, as opposed to full-form storage of irregular forms in the mental lexicon (Pinker & Ullman, 2002). This is illustrated in Figure 3.1.

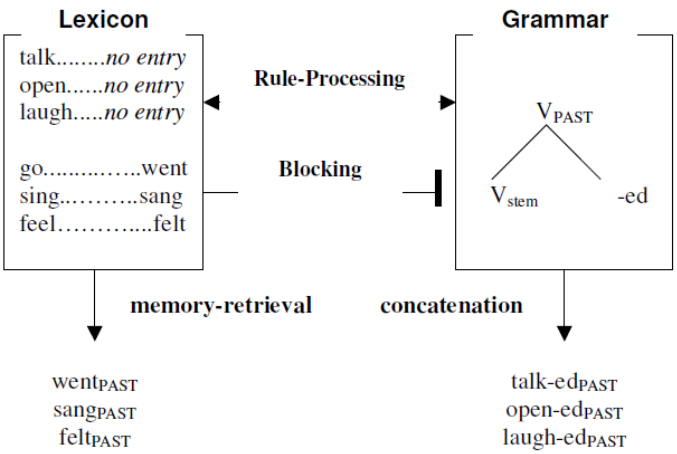

Figure 3.1 A simplified illustration of the dual-mechanism model (taken from Kırkıcı, 2005)

Despite the distinction between the processing of regular forms and the processing of irregular forms, the dual-mechanism model does not disregard the role of certain factors such as frequency or the presence of an alternative irregular form in accessing regular word forms. Indeed, it posits that some regular forms may be stored in the associative memory if they have higher frequency (Bertram, Schreuder, & Baayen, 2000; Neubauer & Clahsen, 2009; Pinker & Ullman, 2002). To illustrate, Alegre & Gordon (1999) found that English regular words which have a frequency higher than 6 per million are more likely to be stored as full forms in the mental lexicon. This finding is claimed by the authors to still be consistent with the dual-route approach, which postulates that decomposition and storage systems compete with each other during the processing of morphologically complex words and the winning system is determined by word frequency. In a similar vein, Berent, Pinker and Shimron (1999) reported that regular words with alternative irregular forms (e.g. smell-smelled/smelt) may be stored as full forms because the existence of an irregular alternative form might hinder the activation of the rule-formation system.

This dichotomy between storage and decomposition is defined by different factors in other hybrid models. For example, despite being a variant of the dual-mechanism model, the Augmented Addressed Morphology model (AAM) posits that word familiarity is the key factor in determining the main processing route (Caramazza, Laudanna, & Romani, 1988) for morphologically complex words. This model suggests that all known words are recognized through whole-word access whereas the parsing route is basically employed for novel morphologically regular

word forms. The Morphological Race Model (Frauenfelder & Schreuder, 1992), on the other hand, posits that both the direct mapping route and the parsing route are activated during word recognition, but only one of these routes is taken depending on a variety of factors which compete against each other such as lemma and surface-form frequency, semantic transparency, neighborhood size and morpho-phonological transparency.

An influential dual-route model which suggests a distinctive account of morphological processing is Ullman's Declarative/Procedural model (2001b, 2016). Although this model is not confined to describing morphology, only its predictions related to the morphological processing of complex words will be reported here for the purposes of the current study. In a similar vein with Pinker's dual-mechanism model (1991, 1999), Ullman's model proposes a combination of decomposition and storage for processing different components of language. Yet the Declarative/Procedural model differs from Pinker's dual-mechanism model by suggesting two separate memory systems employed for these operations. Relying on different neurobiological systems, Ullman's model proposes that the declarative memory, an associative system which is claimed to be responsible for the memorization of facts and episodic information as well as arbitrary and idiosyncratic items, is also employed for storing irregular word forms, whether inflectional or derivational, as full-form. On the other hand, the procedural memory system is utilized for systematic and combinatorial operations and offers a rule-governed mechanism for composing and decomposing regularly inflected word forms. The double dissociation of declarative and procedural memories assumed by this model has been lent evidence by neurocognitive studies conducted on brain damaged patients or patients with neurodegenerative disorders (e.g. Marslen-Wilson & Tyler, 1997; Ullman et al., 1997).

An important neurocognitive study was conducted by Marslen-Wilson and Tyler (1997), who examined the processing of regular and irregular forms of the English past tense by brain-damaged aphasic patients. They performed an auditory priming task in which the participants are asked to make a timed lexical response (a word or a nonword) to an auditorily presented target word which follows a spoken prime word. The experiment included two groups of aphasic patients who had neurological damage in different parts of the brain. The results showed that one

group of patients only had difficulty in processing irregular past forms, whereas only the processing of regular past forms was challenging for the other group. This was interpreted as a sign of two distinct mechanisms governing English past tense morphology.

The Declarative/Procedural model's assumption that regular and irregular word forms are processed via different mechanisms was also probed by Sonnenstuhl, Eisenbeiss and Clahsen (1999) in a cross-modal priming paradigm. They investigated how native speakers of German process regular and irregular past participles and noun plurals. The response data analysis pointed to priming differences between regularly and irregularly inflected forms. To explain, regular inflections (-t participles and -s plurals) elicited full priming effects whereas irregular inflections (-n participles and -er plurals) resulted in partial priming effects. These results have been considered as further evidence of a dual mechanism system in a language other than English. Yet, the partial priming effects should not be merely interpreted as suggestive of full-form storage, but as of a lower degree of reliance on combinatorial operations (Silva & Clahsen, 2008).

The distinction between irregular and regular inflection has been also investigated in more recent studies. Morris and Stockall (2012) conducted a visual masked priming experiment in combination with EEG to track the time course of the processing of English regular and irregular past tense forms. They aimed to use the ERP recordings to offer an explanation for the inconsistencies previously found in the masked morphological priming studies. The masked priming data obtained from 20 native speakers of English revealed shorter reaction times to targets following an identical prime or a regularly inflected prime than to targets following an unrelated prime. Whereas the same amount of facilitation observed for identical and regularly inflected prime-target pairs points to a full priming effect, a partial priming effect was obtained for irregularly inflected prime-target pairs. On the other hand, the time courses of priming effects for regular and irregular inflections were not different according to the ERP data.

In a similar vein, Rastle, Lavric, Elchlepp and Crepaldi (2015) examined the processing of regularly inflected third-person singular present tense forms and irregularly inflected past tense forms via the visual masked priming paradigm and

ERP recordings. Their behavioral data showed significant priming effects for both regularly and irregularly inflected words, although regular inflections facilitated greater priming effects. As for the ERP data, results suggestive of different time courses for regular and irregular inflections were obtained. Priming for regular forms started in a time window reflecting processing up to 250 ms post target onset while priming effects for irregular forms did not emerge until a 400-600 ms post target onset. When considered together, the findings of Morris and Stockall (2012) and Rastle, Lavric, Elchlepp and Crepaldi (2015) indicate a dissociation between regular and irregular inflections based on the different priming effects obtained for regular and irregular inflections.

Whereas most of the studies exploring the storage/decomposition distinction have addressed the issue within the framework of regular/irregular inflectional morphology, the distinction regarding the processing of regular/irregular inflections has been also claimed to stem from their difference in productivity (Yang, 2005). This debate has further expanded to the derivational morphology with the question of whether the processing route for derived word forms differs based on their productivity.

This question was addressed by Marslen-Wilson et al. (1996) in a cross-modal priming experiment with native English speakers. They investigated the processing of derivational prefixes and suffixes with regard to productivity. The experimental stimuli included morphologically related prime-target pairs with the same derivational affix in four conditions: productive suffix (e.g., *darkness-toughness*), unproductive suffix (e.g., *development-government*), productive prefix (e.g., *rearrange-rethink*), and unproductive prefix (e.g., *enslave-encircle*). The behavioral data indicated greater priming effects for productive suffixes and prefixes than unproductive suffixes and prefixes. The strong facilitation observed for productive affixes can be taken as evidence for a decompositional processing route for productive derivations. On the contrary, the relatively lower facilitation effects obtained for unproductive affixes may suggest lower dependence on combinatorial operations.

The finding of distinct processing patterns for productive and unproductive derivations is strengthened by Hagiwara, Sugioko, Ito, Kawamura and Shiota (1999), who investigated the processing of deadjectival nominal suffixes *-sa* and *-mi* in L1

Japanese with brain-damaged aphasic patients. While the suffix *-sa* can apply to a large number of adjectives with a predictable meaning, the suffix *-mi* is only applicable to thirty adjectives and can create words with unpredictable meanings. The results revealed that the Broca's aphasic patients only had difficulty with *-sa* derivations, whereas the patients who had a lesion in the left middle and inferior temporal areas experienced difficulty with *-mi* suffixations. Considering that Broca's area is in charge of rule-governed processing, it can be inferred that the productive suffix *-sa* leads to a combinatorial processing pattern. On the contrary, the data obtained for the suffix *-mi*, which is not as productive, is suggestive of an associative processing route, considering that the left middle and inferior temporal areas control the representation of lexical-semantic information in the associative memory.

Yet, these findings are contradicted by Clahsen and Ikemoto (2012), who examined the same derivational suffixes (i.e. *-sa* and *-mi*) in native Japanese via an eye-movement reading experiment, a lexical decision task and a masked priming paradigm. The eye-movement experiment, which helped to investigate the processing of the relevant suffixes on a sentence level, revealed longer reading times for *-mi* forms than for *-sa* forms, which indicates an additional processing cost resulting from the unpredictable meaning of *-mi* suffixations. The lexical decision task, on the other hand, demonstrated the presence of frequency effects for both *-sa* and *-mi* suffixations. Likewise, equivalent priming effects were found in the masked priming experiment for the two forms. Whereas the findings of eye-movement reading task suggest productivity differences at the meaning level, the lexical decision and masked priming tasks point to the identical representation of derived forms at the word-form level regardless of their productivity. These findings suggest that the regular/irregular dissociation in inflectional morphology cannot be compared to the productive/unproductive dichotomy in derivational morphology since both productive and unproductive derivations can be stored as full-form representations and accessed through rule-based operations at the same time, pointing to a significant difference in derivational and inflectional processes.

This distinction between derivational and inflectional morphology has been also affirmed by the findings of Clahsen, Sonnenstuhl and Blevins (2003). They conducted a cross-modal priming task and a visual lexical decision task to investigate the processing of deverbal *-ung* nominalizations and *-chen* diminutives, highly

productive suffixes, in native speakers of German. The results revealed full-priming effects both *-ung* and *-chen* suffixations, which indicates decomposition. This suggests that productive derived words are processed similarly with regularly inflected words yet differently from irregularly inflected words, which facilitate partial priming effects. Also, both derivational suffixes demonstrated frequency effects, which might be an indication of full-form representation. This implies that productive derivation is comparable with irregular inflection rather than with regular inflection. Based on these findings, the authors conclude that derivation and inflection are linguistically distinctive processes, which entails the incorporation of three distinct elements, i.e. irregular, derived, and productively inflected forms, into the dual mechanism model.

In addition to the findings coming from studies on derivational morphology, the assumptions of the dual-route account have been also opposed by researchers who view morphological regularity as graded rather than categorical. For example, Kielar, Joanisse and Hare (2008) showed via masked and cross-modal priming experiments at different SOAs (0-500 ms) that not only regular verbs but also semi-regular verbs (e.g., slept-SLEEP) can facilitate priming. The results revealed priming effects for both regular and irregular verbs, whereas the lowest priming was detected in vowel change irregular verbs (e.g. sang-SING). However, with increasing SOA, priming effects were observed in all morphologically related words. Besides, these priming effects could not be interpreted as merely semantic or phonological in nature because semantically related or pseudo-irregular past forms (phonologically related primes) did not produce any priming. While the amount of priming was greater in regular and semi-regular verbs, this might result from the higher degree of overlap between the prime and the target. Therefore, the authors conclude that priming varies as a function of orthographic, phonological and semantic overlap, which is particularly evident in morphologically related words.

An alternative account regarding regular/irregular distinction has been offered by Crepaldi, Rastle, Coltheart, & Nickels (2010), who utilized the masked priming paradigm to determine whether the priming effects observed for irregular verbs are orthographical or morphological in nature. The results of three masked priming experiments show that irregularly inflected words (e.g., *fell*) facilitate their base forms (e.g., *fall*) and this priming effect cannot be considered orthographical

since unrelated prime-target pairs with the same orthographic patterns (e.g. *tell-tall*) do not yield any priming. The authors take these results as evidence that the priming produced by irregular verbs takes place at an intermediate (lemma) level between the morpho-orthographic and semantic representations and thus both regular and irregular verbs can activate their lemmas before the morphological processing. Similar findings were also offered by an ensuing ERP study (Rastle et al., 2015). Moreover, equivalent amount of priming for regular and irregular verbs has been also found in other languages such as French (Meunier & Marslen-Wilson, 2004) and German (Smolka, Zwitserlood, & Rösler, 2007).

As discussed above, previous studies have given rise to contrasting views on the morphological processing of morphologically complex words by native speakers. Whereas some researchers have attempted to explain the native morphological processing via single-mechanism models, i.e. full-listing (e.g. Butterworth, 1983; Gonnerman et al., 2007; MacWhinney & Leinbach, 1991; Rumelhart & McClelland, 1986) vs. decomposition (e.g. Fruchter et al., 2013; Rastle et al., 2004; Stockall & Marantz, 2006; Taft & Forster, 1975), others have explained the same processing with a dual-route approach (e.g. Pinker, 1991, 1999; Pinker & Ullman, 2002; Ullman, 2001a, 2001b, 2016). Yet, despite the experimental data that support these various accounts of morphological processing, they have been also opposed by other studies which have come up with contradictory results. For example, despite being mainly based on the regular/irregular distinction in the inflectional morphology, hence the productive/unproductive dichotomy when applied to the derivational morphology as mentioned previously, the assumptions of the dual-route accounts are challenged by those researchers who view morphological regularity as being graded rather than categorical (e.g. Crepaldi et al., 2010; Kielar et al., 2008) as well as by the studies which have found diverging results for derivation and inflection (e.g. Clahsen & Ikemoto, 2012; Clahsen et al., 2003). Considering the relevant findings and discussions in L1 morphological processing, the next chapter will present and discuss the findings of a number of studies conducted on L2 morphological processing in line with the purposes of this study.

4 LITERATURE REVIEW

Pursuant to a number of studies investigating morphological processing in L1, researchers have turned their attention to discovering the nature of non-native morphological processing in recent years. The question regarding the main processing route employed by L2 speakers, i.e., full-listing, decomposition, or dual-route, has been explored in several studies, which yielded controversial results.

In this respect, this chapter will focus specifically on studies investigating the processing of inflectional and derivational morphological structure in non-native language, following a brief introduction to the approaches of non-native morphological processing. With particular focus on the studies which have employed priming as a method of investigation, an overview of various studies conducted in different languages will be presented, and the last section of this chapter will address the findings of studies conducted on morphological processing of Turkish as L1 and L2 in line with the purposes of this study.

4.1 Approaches to Morphological Processing in L2

In recent years, morphological processing and representation of complex words in second language learners have started to receive a growing interest in the field of psycholinguistics. Researchers have started to investigate the phenomenon of non-native language processing through a variety of online psycholinguistic experiments with an eye to discovering how non-native learners retrieve morphologically complex words from the mental lexicon and whether they employ the same mechanisms as native speakers. Although a relatively limited number of studies have been carried out on L2 morphological processing in comparison with L1 researches, two main views have arisen regarding the similarities or differences between L1 processing and L2 processing.

The first view argues that native and non-native speakers basically rely on the same mechanisms and neural systems for morphological processing (Abutalebi, 2008; Indefrey, 2006; McDonald, 2006; Perani et al., 1998), but L2 processing can

be more burdensome due to several variables such as L1 transfer effects, age of onset of acquisition (AoA) and reduced automaticity. Therefore, the differences observed between L1 processing and L2 processing are claimed to be only quantitative rather than qualitative. Green (2003) further claims that any quantitative difference that may emerge between native and nonnative processing will disappear with increasing proficiency. Therefore, it is also assumed that late L2 learners can employ native-like parsing with increased proficiency and exposure to L2 (e.g. Coughlin & Tremblay, 2015; Diependaele, Duñabeitia, Morris, & Keuleers, 2011; Portin et al., 2008; Soveri et al., 2007; Uygun & Gürel, 2016).

The second view posits that L1 processing and L2 processing diverge in fundamental ways. This view can be associated with the shallow structure hypothesis (SSH) proposed by Clahsen and Felser (2006) and Ullman's Declarative/Procedural model (Ullman, 2001b, 2005, 2016) since they suggest that grammatical processing of late L2 learners significantly differ from L1 grammatical processing, especially with respect to processing inflectional forms. Regarding L2 processing, Ullman's Procedural/Declarative model predicts that non-native speakers predominantly depend on the declarative memory system because of the attenuation of the procedural system and the improvement of the declarative system as a result of maturational constraints. In other words, it is claimed that L2 learners cannot employ the computational mechanisms which are available to native speakers for morphological decomposition, and therefore, they largely rely on declarative storage. Yet, Ullman also points out that the procedural system may be utilized by L2 learners with increased practice with L2 and higher proficiency level. In a similar vein with the Declarative/Procedural model, Clahsen and Felser (2006a) underline the overreliance of adult L2 learners on lexical and semantic cues rather than morphological cues. They argue that because of their diminished morphological sensitivity, late L2 learners have difficulty in decomposing complex word forms.

Following this brief overview of various theories regarding L1 and L2 morphological processing, the next section will discuss the findings of L1 and L2 studies that investigated the processing of inflected and derived word forms.

4.2 Previous Studies on Morphological Processing of Inflected Forms in L2

In recent decades, there have been many studies investigating the nonnative processing of inflectional morphology through a variety of methods and techniques such as lexical decision, self-paced reading, masked/unmasked priming and ERP. A significant number of such studies have revealed that second language learners experience difficulty particularly with processing inflected word forms since they demonstrate a reduced sensitivity to the inflectional paradigm.

A study which documented differences between native and non-native processing was carried out by Silva & Clahsen (2008), who compared the morphological processing of inflection and derivation in L1 and L2 speakers through a masked priming paradigm. They investigated regular past-tense forms as well as deadjectival nominalizations with *–ness* and *–ity* in adult native and non-native speakers of English and found significant differences between the two groups. According to their results, the native speakers showed efficient priming for both inflected and derived word forms, whereas the nonnative group displayed no priming for inflected and reduced priming for derived word forms. For this reason, the authors claimed that non-native speakers have a certain degree of sensitivity to the morphological structure of derived words (though less than native speakers), but not to the morphological structure of inflected word forms.

The findings of Silva & Clahsen (2008) have also been lent support by other studies which examined the relevant paradigm with different language pairs and came up with replicable findings. For example, Clahsen, Balkhair, Schutter and Cunnings (2013) investigated via two separate studies the time course of morphological processing by advanced adult learners of English in comparison to adult native English controls. The first study looked into the processing of *-ed* forms by advanced Arabic L2 learners of English through the masked priming paradigm and did not find morphological priming effects for L2 learners despite providing extra time for processing masked *-ed* forms. Yet, native English speakers demonstrated priming effects which were morphological in nature. The second study, on the other hand, employed the eye-tracking technique and an acceptability judgment test to explore the timing of constraints against the derived forms containing plural and singular base nouns with proficient Dutch L2 learners of English. Although the L2 speakers showed native-like acceptability judgments in the

offline task, they did not show any sensitivity to Category and Morphological Structure constraints during the online eye-movement monitoring experiment. The authors take these results as evidence that L2 processing differs from L1 processing in that it is both slower and makes less use of real-time analysis of morphological information.

The processing of inflectional paradigm in L2 has also been investigated with respect to the regular/irregular dichotomy in a study by Neubauer and Clahsen (2009). They examined the processing of regular and irregular German participles with advanced adult Polish-speaking learners of German in comparison to a control group of native speakers through a variety of experimental methods including acceptability judgment, lexical decision and masked priming. For irregular participles, a partial priming effect was detected in the masked priming task in not only the L1 group but also the L2 group. This was interpreted by the authors as evidence that the L2 group demonstrated native-like performance when processing irregular inflection. In contrast, only the L1 group showed a full-priming effect for regular participles in the masked priming experiment. Based on these results, the authors interpret regularity as a factor distinguishing non-native from native processing and as an indication of L2 speakers' reliance on lexical storage of inflected words.

Findings of the above-mentioned studies have led Clahsen and colleagues to predict that the interlanguage grammar does not exhibit adequate instantiation of inflectional morphology and this causes decreased sensitivity to morphological structure in inflected word forms as compared to native language processing (e.g., Clahsen, Felser, Neubauer, Sato, & Silva, 2010). However, these predictions have been contradicted by other researchers. Ullman's Declarative/Procedural model (2005), for example, predicts that with increasing proficiency, non-native speakers can access to procedural mechanisms and demonstrate native-like morphological decomposition for regular forms. This prediction was strengthened by Basnight-Brown et al. (2007) in a cross-modal priming lexical decision task. The study aimed to find out whether late learners of English whose native languages were Serbian and Mandarin were able to show a native-like processing for regular and irregular past-tense verbs of English. By testing native speakers of these two languages, the researchers also aimed to see if the inflectional properties of the native language

would affect the processing capacity in a second language since unlike Mandarin, which lacks verbal inflection, Serbian is a richly inflected language. According to the results, the native English speakers' processing did not rely on the regularity of complex forms as they showed priming effects for both the regular and the irregular past-tense forms, a result which also contradicts the findings of Neubauer and Clahsen (2009). Moreover, the native Serbian speakers displayed native-like processing for regular and irregular forms while the native Mandarin speakers' processing was only native-like for regular forms.

The findings of Basnight-Brown et al. were complemented by Feldman et al. (2010), who carried out a cross-modal priming task and a masked-priming lexical decision task to investigate the processing of English past tense verbs with Serbian learners of English. In both tests, native and non-native groups showed facilitation in target recognition for morphologically-related prime-target pairs, and native-like effects were only detected in the highly proficient participants. Both the Basnight-Brown et al. (2007) and the Feldman et al. (2010) studies found evidence of morphological processing in L2 learners. This finding was further reinforced by Coughlin & Tremblay (2015) who conducted a masked priming word-naming task. They investigated morphological decomposition in late English learners of French. The results showed that both native and non-native groups named the target word equally fast in identity and morphological conditions, which means that both L1 and L2 French speakers displayed full priming effects, an indication of morphological decomposition of complex words into stem and affix. The authors also found that the priming effect grows with increasing proficiency of the non-native speakers, which supports Ullman's (2005) prediction.

While the studies mentioned above have failed to end the ever-growing debate regarding the morphological processing of inflectional paradigm, several studies, though quite limited in number, have also looked into the processing of inflection in nominal forms and further expanded the controversy surrounding the issue. For example, Baayen, Dijkstra & Schreuder (1997) carried out a lexical decision study with native speakers of Dutch to investigate the role of storage and parsing in the visual domain for the productive Dutch plural suffix *-en*, which is also predominantly used as a verbal ending. The study consisted of three experiments, the last of which aimed to compare the processing of nouns and verbs. The first two

experiments showed that storage occurs for high-frequency noun plurals. Baayen et al. (1997) suggested that this result stems from the ambiguity of the suffix *-en*, which causes parsing for noun plurals to be a time-costly process. In the third experiment, which compared nouns and verbs, the researchers found no effect of surface frequency for verbs, but a strong effect for nouns. They concluded that noun plurals are mostly stored due to the time-costly resolution of the subcategorization conflict which emerges when the *-en* suffix is attached to nouns. The distinction between nominal and verbal inflectional processing was also explored in a visual priming study which manipulated the prime duration (SOAs of 35 and 150 ms) (Tsapkini et al., 2002). In this study, the researchers investigated the relationship between morphological regularity and form during lexical processing in L1 Greek and found that morphological regularity affects nouns and verbs differentially.

In another study, VanWagenen & Pertsova (2014) investigated inflectional priming in Russian, a richly inflectional language, with an eye to finding out whether nominal and verbal inflection leads to priming effects analogous to those previously found for derivational morphemes. They found quite robust inflectional priming effects in verbs, but not in nominal inflection, which calls into question whether the unavailability of priming effects in nominal inflection implies a difference between the lexical organization of verbal and nominal inflection.

Nominal inflection has also been investigated in isolation by New et al. (2004). The researchers aimed to examine the effect of surface and base frequency of singular and plural word forms on lexical decision times. They carried out four experiments in English and French and compared their results to those of a previous study on Dutch nouns (Baayen et al., 1997). They found that in English and French, as in Dutch, lexical decision times to singular nouns are affected by the frequencies of the plural forms. They also argue that lexical decision times to plural nouns should be considered as a result of a decomposition into the singular and the plural suffix, rather than the surface frequency of the plural forms. The authors conclude that the processing of morphologically complex words relies on a combination of whole word recognition and decomposition.

The morphological processing of nominal inflection has also been examined in a small number of crosslinguistic studies. An example of this comes from Ahn et

al. (2014) who investigated the processing of Korean nominal marker -ka in native speakers and advanced Chinese L2 learners of Korean. They implemented both masked and cross-modal priming experiments to be able to identify any possible differences between the early stages of form-level access and the central level of lexical entries. Partial priming effects were found for L1, and full priming effects for L2, which shows that native speakers of Korean depend on morphological decomposition during the processing of the nominal marker less than L2 speakers of Korean. These results contradict with many earlier studies which have found full priming effects for inflection in L1 and no priming effects in L2 (Jacob, Heyer, & Veríssimo, 2018; Kırkıcı & Clahsen, 2013; Silva & Clahsen, 2008). Yet, it is crucial to note that these earlier studies usually investigated the processing of inflection in verbs.

Another study which examined the morphological processing of case inflection was carried out in L2 Finnish with native Russian and Chinese speakers (Vainio et al., 2014). Unlike Chinese, Russian and Finnish are both case-inflecting languages. The authors aimed to investigate L1 effects on L2 processing of morphological complexity and morphophonological transparency by choosing these L2 groups. The materials contained simple nouns, transparently inflected nouns, and semi-transparently inflected nouns. According to the results, Finns and Russians showed longer RTs for morphologically complex nouns, which indicates that they rely on the decomposition route in word recognition. However, RTs for Chinese participants were not influenced by morphological complexity, which means that they depend on full-form representations during word recognition. Based on the different findings for the two L2 groups, the authors suggest that the non-native processing of morphological structure may be influenced by the typological differences between speakers' L1 and L2.

In a similar vein, Portin et al. (2008) investigated recognition of inflected nouns in L2 Swedish via a visual lexical decision experiment. The Hungarian (a highly inflected agglutinative language with 17 cases) and Chinese (an isolating language with no case morphology) participant groups were proficient speakers of Swedish. The experiment contained morphologically complex and simple nouns in three frequency ranges (high, medium, and low). According to the results, the Hungarian participants' RTs were slower for morphologically complex nouns than

for simple nouns in medium- and low-frequency ranges but not at the high-frequency level, which suggests that they decomposed L2 Swedish words if the words were not highly frequent. On the other hand, the Chinese participants displayed no processing difference between simple and complex word forms throughout the whole frequency range, which indicates full-form representation for both morphologically simple and complex nouns. In parallel with Vainio et. al (2014), Portin et al.'s conclusion was that L1 features influence L2 processing.

Another study which focused on the processing of inflected nouns was carried out by Lehtonen & Laine (2003) in monolingual Finnish speakers and Finnish-Swedish bilinguals. They conducted a visual lexical decision task in three different frequency ranges and found differential results for monolinguals and bilinguals. Accordingly, monolingual Finns processed low- and medium-frequency inflected nouns mainly through morpheme-based recognition but high frequency inflected nouns through full-form representations. On the other hand, bilinguals displayed a processing delay for all inflections in all frequency ranges, which suggests decomposition for all inflected target forms. The authors argue that this may be due to different amounts of exposure to the word forms in the two groups. They hypothesize that frequently encountered inflected words will lead to full-form representations in order to save processing time. However, the lower rates of exposure seen in bilingual individuals hinder full-form representations from developing.

As the overview in this section suggests, there are controversial findings regarding the morphological processing of inflection both in L1 and L2. The studies carried out on verbal inflection have generally yielded results suggestive of decomposition in native speakers, yet contradictory results were obtained for non-native speakers. To explain briefly, several studies found full-form storage for non-native speakers (e.g. Neubauer & Clahsen, 2009; Silva & Clahsen, 2008), whereas some suggested that non-native speakers may follow a rule-based route depending on various factors such as proficiency (e.g. Basnight-Brown et al., 2007; M. Feldman, Anastasiu, & Bernstein, 2018; Ullman, 2005).

The controversy surrounding the native and non-native processing of inflection has grown even more with the expansion of the issue into the nominal

inflectional paradigm. The studies which investigated the nominal inflection with native speakers has found differences between the processing of inflected nouns and inflected verbs, i.e. storage for nouns, decomposition for verbs, or a combination of these (Baayen et al., 1997; New et al., 2004; Tsapkini et al., 2002; VanWagenen & Pertsova, 2014). The L2 studies, on the other hand, have produced results contradicting those of earlier studies which focused on verbal inflection. In contrast with the studies which suggested storage of inflected verbs in L2 speakers, some researchers showed that full priming effects can be obtained for the processing of inflected nouns by L2 speakers (Ahn et al., 2014). Also, several other researchers have suggested that frequency of words and learners' L1 can be influential factors in the processing of inflected nouns (Lehtonen & Laine, 2003; Portin et al., 2008; Vainio et al., 2014). Though limited, the literature on the processing of inflected nouns shows that the findings obtained for the processing of inflected verbs cannot be generalized to the whole inflectional paradigm and more research is needed on other aspects of inflection both in L1 and in L2.

Following this literature review of the inflectional paradigm, the next section will focus on the derivational paradigm and present the findings of several studies relevant to the purposes of this study.

4.3 Previous Studies on Morphological Processing of Derived Forms in L2

Previous studies on L1 and L2 morphological processing have also probed into the derivational paradigm to determine whether they are similar. While several studies investigated the derivational phenomenon in isolation, a few focused on comparing the inflectional and derivational paradigms. Yet, although there are a number of studies as well as several theories with regard to both native and non-native inflectional processing, derivational processing has been an area that is not thoroughly explored and the relevant studies are only limited to several languages such as German and English. Whereas some of these studies reported native-like processing for L2 learners, different processing patterns were reported by others based on a selection of perspectives such as L1 influence, surface and base frequency, and proficiency level of L2 speakers.

One study which included derivational morphology to investigate the relationship between L1 and the morphological awareness of L2 speakers was carried

out by Silva and Clahsen (2008). They conducted a masked priming experiment to investigate the processing of regular past tense forms, and deadjectival nominalizations *–ness* and *–ity*, which differ in terms of productivity and transparency (i.e. *–ness* is more productive and transparent than *–ity*). The study included native speakers and proficient German and Chinese users of English. According to the results, native speakers showed full priming effects for both inflected forms and the two derived word forms, while the L2 group showed no priming effects for inflected forms (as reported in the previous section of this study) and partial priming effects for derived forms, providing evidence for the claim about L2 learners' higher reliance on lexical storage of morphologically complex words compared to native speakers. Also, a comparison of the results on inflected and derived forms (partial vs. no priming) shows that derivational processing and inflectional processing are not the same in L2, which was explained by the authors in line with the assumption of the realization-based models that derived and inflected forms are represented differently on the morpholexical level. Additionally, the same priming effects detected for both derivational forms is a finding which supports the prediction of Clahsen and Ikemato (2012) that there is no difference between productive and unproductive derivations in terms of their representation at the word-form level.

Silva and Clahsen (2008) also found that the non-native groups performed similarly, indicating the absence of any L1 effect. This confirms the finding of Koda (2000), who also reported similar findings with respect to the lack of L1 impact on L2 morphological processing in a timed separability judgment study which included Chinese and Korean learners of L2 English. Yet, Rehak and Juffs (2011) challenged this assertion in a masked priming study which replicated Silva and Clahsen (2008) with a different group of L2 speakers whose L1 was Spanish, in addition to native speakers and L1 Mandarin Chinese speakers of English. They examined the processing of inflectional *–ed* and derivational *–ness, -ity, -un,* and *–re* suffixes. Although there was no significant difference between the two L2 groups in processing the suffix *–ness*, significant differences were observed between the L2 groups for processing the suffix *–ity*, which is interpreted by the authors as an indication of L1 transfer in the Spanish group since the Spanish suffix *-idad* is similar to *-ity* (e.g. fatalidad – fatality).

The results of Silva and Clahsen (2008) also contradict with those of Clahsen and Neubauer (2010), who carried out a visual lexical decision experiment and a masked priming experiment to investigate how native and Polish non-native speakers of German process nouns derived with the nominalizing suffix *–ung*. Clahsen and Neubauer (2010) found efficient priming in L1 speakers and no priming effects in L2 learners, which was considered to be as indicative of full-form storage. Despite supporting Ullman's Declarative/Procedural model, this finding is in contrast with that of Silva and Clahsen (2008), who detected reduced priming in L2 speakers. However, the finding of whole-word processing by Clahsen and Neubauer (2010) is challenged by a masked priming study conducted by Diependaele et al. (2011), who attempted to investigate L1-L2 differences in processing morphology with Spanish and Dutch learners of English. The experiment consisted of transparent suffixed (viewer-view), opaque suffixed or pseudo suffixed- (corner- corn) and form control (freeze- free) prime target pairs. According to the results, the transparent condition produced the highest priming, whereas the form condition yielded the lowest facilitation and the opaque condition produced an intermediate level of priming. Diependaele et al. (2011) found no qualitative or quantitative differences in the processing of suffixed derivations between L1 and L2 speakers, a finding contradicting with the argument of full-listing in L2 (Clahsen et al., 2010; Ullman, 2001b, 2005), though the authors admit that these differences might be observed at earlier stages of L2 acquisition.

Native-like processing of morphology found in several studies has been sometimes challenged on the grounds that the observed priming effects could be due to orthographic (form) similarity rather than morphological relatedness. To investigate the effects of orthographic overlap between primes and targets, Heyer and Clahsen (2015) carried out a masked priming experiment with proficient German speakers of English. Orthographically related prime-target pairs (e.g., scandal - SCAN) and derived forms (e.g., darkness -DARK) with the same number of letters were compared. For the L2 group, the analyses revealed no significant difference between the facilitation of the orthographically related primes and the facilitation of morphologically related primes. This led the authors to conclude that the priming effects that non-native speakers demonstrate for derived forms may actually be orthographical in nature, rather than morphological.

In a more recent study, Jacob et al. (2018) investigated how advanced Russian learners and native speakers of L2 German process inflectional and derivational morphology. They designed a masked priming task which included the same target words for inflected and derived primes with the purpose of a more accurate comparison of these two morphological forms. The morphological condition had 28 infinitival targets following either a derived nominal form with the *–ung* suffix (ÄNDERUNG '(the) change'- ändern 'to change'), a past participle as an inflected prime (GEÄNDERT 'changed' - ändern), an identity prime or an unrelated prime. In addition, the experiment also contained 24 orthographically related and 24 semantically related prime target pairs to be able to determine whether any priming effects to be obtained would be purely morphological in nature. While the same amount of facilitation was found for derived and inflected primes in the L1 group, the L2 group showed robust priming effects only for derived forms, which hints morpheme-based processing of derived word forms. Neither the L1 group nor the L2 group showed any facilitation effects for the semantically or orthographically related prime-target pairs, which was interpreted by the authors as evidence that the priming effects were morphological in nature. It was concluded that L2 speakers process derivational and inflectional forms in a different way, which supports the assertion that inflection and derivation are distinctive morphological processes.

Several studies have also been conducted in typologically different languages to be able to generalize the available findings regarding the real-time processing of derived words. For example, Vannest, Bertram, Järvikivi & Niemi (2002) offered a crosslinguistic comparison via a series of lexical decision tasks scrutinizing the processing of derived words with some Finnish and English suffixes. Although it was expected that morphological processing of derivational word forms would function more effectively in Finnish than in English because Finnish is a morphologically richer language than English, the opposite was found. Finnish derived words were found to be fully listed, whereas the results showed that English derived words are processed through decomposition.

The processing of derivational morphology was also investigated in L2 Italian by Dal Maso & Giraudo (2014) through a masked priming study which included 22 advanced speakers of Italian from different L1 backgrounds and 22 Italian native speakers. They examined the processing of the affixes *-ità*, and *-ezza* (*-ezza* is not as frequent and productive and has a lower numerosity than *-ità*) in three

control conditions (i.e., identity, unrelated and orthographically related). The results showed that prime type and prime frequency were significant factors for the L2 group, which demonstrated morphological priming effects for high frequency primes with the suffix *–ità*. On the other hand, for the native group, not only prime frequency and prime type but also the suffix type interacted with each other. In contrast with the L2 participants who showed priming effects at least for processing of the high-frequency derived words, the results of native speakers revealed significant priming effects not only for high but also for low frequency word forms and in both of the suffixes. Therefore, the authors' conclusion was that L2 speakers show sensitivity to morphological structure of words with high frequency and a productive sufficiency and the L1/L2 processing differences may stem from language proficiency, not from different processing systems.

An overview of previous literature on the non-native processing of derivational morphology shows that the number of relevant studies is quite limited. Further research is required to be able to come up with conclusive data on how the processing of native language and the processing of non-native language are different or similar. Also, the overview above hints a lack of studies comparing derivational and inflectional morphology as well as of research in typologically different languages. One of these languages is Turkish, which has not received much attention although it provides a good ground to investigate both derivational and inflectional phenomena due to its rich and productive morphological qualities. The following section will focus on the studies which have been conducted on the processing Turkish morphology since this language also constitutes the focal point of this study.

4.4 Psycholinguistic Studies on Morphological Processing in Turkish

Hankamer (1989) claimed that morphologically complex words are processed through a decomposition-based route in agglutinative languages such as Turkish to save storage space. However, it is noted by Frauenfelder & Schreuder (1992) that frequency can be a determining factor for the most efficient route for lexical access. They assume that the direct-route can be more appealing with the increasing frequency of morphologically complex words.

Gürel (1999) investigated these assumptions by conducting the first study on the processing of Turkish multimorphemic words. She attempted to find out via RT

measures whether morphologically simple and complex Turkish words are processed by native speakers via combinatorial processes, as previously claimed to be the case for agglutinative languages (Hankamer, 1989), or full-listing through a visual lexical decision task. The study revealed that decomposition does not apply to all multimorphemic words in Turkish and the preferred processing route basically depends on the frequency of the suffix. To explain, words which include more frequent suffixes such as the plural suffix *-ler* (e.g. emirler, 'orders') were accessed via the direct route, whereas less frequent suffixes such as the ablative suffix *-den* (e.g. depremden, 'from the earthquake') resulted in the parsing of the complex words that they are attached to. It was concluded that morphologically complex words in Turkish, especially those with frequent suffixes, are recognized through the direct route to provide processing economy.

The experimental items of Gürel (1999) were later utilized in an unprimed lexical decision study by Gürel & Uygun (2013) to test the processing of morphologically simple and complex words with nonnative speakers of Turkish in addition to a control group of Turkish native speakers. The study included both intermediate and advanced nonnative speakers of Turkish with the aim of investigating the possible effects of proficiency level on the processing route. The results of the native group revealed the use of a direct access route for recognizing multimorphemic, pseudomorphemic and monomorphemic words. In addition, similar results were obtained for advanced L2 speakers of Turkish as no significant difference was observed between the native and the nonnative groups for processing the words with the ablative suffix and the locative suffix. On the other hand, the results of the intermediate L2 speakers revealed that their recognition of the words with ablative or locative was slower than that of words with plural, which suggested that learners with a lower level of proficiency showed a tendency to decompose morphologically complex word forms more than proficient L2 speakers and native speakers of Turkish. It was proposed by the authors that L2 speakers of languages with complex morphology such as Turkish are likely to employ decomposition less and the direct route more with increasing proficiency as a consequence of proceduralization. They also concluded that the unprimed lexical decision task, which is assumed to provide access to later stages of word recognition, implies that

native speakers of Turkish are likely to employ full listing in a later stage of word recognition.

Uygun & Gürel (2016) replicated this study by adding another nonnative group whose native language was Russian, a language with a rich inflectional morphology. Thus, the study included L1-English (a language with relatively simple inflectional morphology) and L1-Russian (an inflectionally-rich language) learners of Turkish. The authors aimed to explore via an unprimed lexical decision task whether L2 learners' processing route is guided by the morphological structure of their native language or L2. Their experimental stimuli included both monomorphemic and multimorphemic items. The multimorphemic words were inflected with plural, locative and ablative suffixes, which differed in frequency. The most frequent suffix among them is the plural suffix, and the least frequent one is the ablative according to Pierce (1960). According to the results, the native group relied on full-listing to access multimorphemic words, even in lower-frequency inflected forms. Moreover, English-speaking L2 participants demonstrated native-like full-listing, while Russian-speaking L2 group relied on decomposition. Yet, the results also revealed that proficiency was a determining factor in transition from decomposition to full-listing. On the basis of these results, the authors argue that native-like processing can be acquired even by late L2 learners. They also suggest that the difference observed in the two L2 groups might stem from the extent of their exposure to Turkish rather than an L1 effect since the exposure length of L1 Russian group to Turkish was overall lower than that of the L1 English group.

The native and nonnative processing of Turkish morphology was further investigated by Kırkıcı and Clahsen (2013) with a particular focus on the distinction between inflection and derivation. They examined the processing of deadjectival nouns derived with the *–lIk* suffix and verbs inflected with the Aorist suffix via a series of masked priming experiments with native speakers and advanced non-native users of Turkish from different L1 backgrounds. They found evidence that derivational and inflectional forms are represented in different ways morpholexically. The Aorist resulted in significant priming effects for the native group, which suggests decomposition, yet no facilitation for the L2 group. Unlike inflectional suffixes, the derivational suffixes led to significant priming effects in

both groups, causing the authors to conclude that Turkish derived forms are processed in a similar fashion by native and non-native speakers of Turkish.

The processing of Turkish derivational forms was also examined in Gacan's (2014) masked priming study with native speakers of Turkish. She examined the processing of the attributive suffix *-lI* and the privative suffix *-sIz*, both of which are frequent, transparent and very productive. The results revealed significant priming effects for both suffixes. It was concluded that morphological properties of complex words impact early visual word recognition during L1 processing of Turkish.

This chapter provided an overview of the previous literature on the morphological processing of native and nonnative language and revealed that there is still an ongoing debate regarding the differences or similarities between their underlying mechanisms. Additionally, it was observed that there is a serious lack of studies carried out in typologically different languages. In this sense, a separate section was dedicated to the studies conducted in Turkish since it is a typologically different language with a rich inflectional and derivational morphology which can be used as a valuable testing ground for the relevant issues. To this end, the current study has been conducted in Turkish with an eye to offering a more comprehensive understanding of L2 morphological processing. However, in addition to working on an underinvestigated language, this study is also unique since it compares the inflectional and derivational phenomena not only in verbs, but only in nouns. Besides, this study attempts to offer deeper insights into morphological priming since the same verb stems are used for six different conditions both in the verb list and the noun list, which allows a more direct comparison between the different types of primes. These will be explained in detail in the following chapter, which will elaborate upon the methodology of this study.

5 METHODOLOGY

The objective of this study is to investigate how native and non-native speakers process morphologically complex words via a masked priming experiment. More specifically, the goal is to find out whether there are any similarities and/or differences between native speakers and L1-English learners of Turkish when they process multimorphemic words. The study also aims to explore whether different morphological operations (i.e. inflection vs. derivation) and different word categories (i.e. verbs vs. nouns) are determining factors for native and non-native processing patterns (i.e. decomposition, full-listing, or dual-route).

5.1 Research Questions and Predictions

The present study will attempt to answer the following questions:

1. Do native speakers of Turkish process inflected and derived words through a decomposition-based route or as full-forms?
    a. Does the word category of the target items (verb vs. noun in the present study) play a role in the processing of inflected words in L1 Turkish?
    b. Does the word category of the target items (verb vs. noun in the present study) play a role in the processing of derived words in L1 Turkish?

Regarding the processing of inflectional morphology in L1, it is expected that native speakers of Turkish will rely on different processing routes for inflected nouns and verbs. Previous studies in different native languages, including Turkish (Kirkici & Clahsen, 2013), have generally found full-priming effects for regularly-inflected verbal forms, which suggests that L1 speakers access these forms in a morphologically decomposed fashion. Yet, a full-listing pattern has been observed for the recognition of inflected nominal forms in other studies (Baayen et al., 1997; Gürel, 1999; Uygun & Gürel, 2016; VanWagenen & Pertsova, 2014). Therefore, in alignment with previous findings, native speakers of Turkish are predicted to process

nominal and verbal inflectional paradigms differently. More specifically, we expect inflected verbs to be decomposed and inflected nouns to be accessed as full-forms by the native speakers of Turkish.

As for the derivational processing in L1, it is expected in consideration of earlier findings that native speakers of Turkish will demonstrate a decomposed processing pattern for derived forms, regardless of the word category of the targets. The reason behind this prediction is the productive and agglutinating nature of Turkish derivational morphology, which makes full-listing a non-economical option for morphologically complex words since this would lead to too much storage and a heavy load on the memory (Frauenfelder & Schreuder, 1992). Therefore, we expect derived primes to result in a decomposition-based processing pattern for both nominal and verbal targets in the native speakers of Turkish.

2. Do L1 English speakers of L2 Turkish differ from L1 speakers of Turkish when they process inflected and derived words during early word recognition?
    a. Does the word category of the target items (verb vs. noun in the present study) affect the processing of inflected words in L2 Turkish?
    b. Does the word category of the target items (verb vs. noun in the present study) affect the processing of derived words in L2 Turkish?

L2 speakers of Turkish are expected to differ from L1 speakers of Turkish in their processing patterns. The Shallow Structure Hypothesis (Neubauer & Clahsen, 2009) proposes that L2 online processing lacks the use of abstract syntactic structures and therefore L2 interpretation is largely dependent upon surface cues such as lexical and semantic cues and associative patterns. Based on this assumption, it is predicted for the present study that the L2 processing will be slower and less automatized than L1 processing. Regarding the non-native morphological processing of inflection, previous literature provides inconclusive findings. A number of earlier studies have assumed a high degree of reliance on full-listing for L2 speakers (Clahsen et al., 2010; Neubauer & Clahsen, 2009; Silva & Clahsen, 2008). Yet it is crucial to note that most of those studies focused on verbal inflection. Their findings have been contrasted by several studies focusing on nominal inflection. They have suggested that both full-form representation and a morphologically structured

processing pattern are possible for L2 learners' processing of nominal inflections depending on a variety of factors such as L1 effects, frequency of the structures and proficiency level of L2 speakers. (Basnight-Brown et al., 2007; Portin et al., 2008; Uygun & Gürel, 2016). In consideration of the assumptions of the Shallow Structure Hypothesis (Neubauer & Clahsen, 2009) and the findings of earlier studies, non-native speakers of Turkish are expected to fully-list inflected verbal forms but show sensitivity to the morphological structure of inflected nominal forms at least to some degree.

On the other hand, L2 speakers of Turkish are predicted to show some similarities to native speakers in terms of the processing mechanisms they rely on for derivation. The non-native group is expected to show either partial or full priming effects for derived forms in light of previous findings (e.g. Kırkıcı & Clahsen, 2013; Silva & Clahsen, 2008). It is expected that some difference may occur in the degree of priming between the processing of derived nominal forms and derived verbal forms.

5.2 Participants

The study consisted of eight non-native speakers of Turkish (mean age: 43.1, SD: 11.69, range: 27-60, five females). All of them reported to have grown up in households where English was the only spoken language. All participants were at least graduates of the Bachelor's Degree. Their average age of first exposure to Turkish was 21. Except for two participants, all participants reported to have been exposed to Turkish in Turkey. Since it was not possible for us to give the non-native participants a proficiency test, we had to rely on the participants' own statements to determine their proficiency level in Turkish. Four participants described their overall competence in Turkish as intermediate, three participants as advanced and one participant as beginner. Except for one participant, all non-native participants were right-handed. All participants reported to have normal or corrected-to-normal vision.

The study also included 24 native speakers of Turkish (mean age: 29.70, SD: 2.71, range: 26-34, 6 females). All native participants reported that they started acquiring Turkish from birth. 15 native speakers reported that they could speak at least some English as a foreign language.

Both the native and the non-native group consisted of university graduates who were healthy right-handed individuals with normal sight. The participants were found via the convenient sampling technique. All participants took part in the experiment voluntarily. Neither the native group nor the non-native group were aware of the purpose of the study.

5.3 Instruments

The instruments that are utilized to collect the required data in the present study are listed in the following sections.

5.3.1 Participant background questionnaire and consent form

A background questionnaire was given to both native speakers and non-native learners with the purpose of collecting information about the participants' demographic and education background. In addition to completing the questionnaire, all participants were asked to sign a consent form before starting the experiment.

5.3.2 Linguistic background questionnaire

The non-native participants were given a linguistic background questionnaire for the purpose of gathering information about their former experience with the Turkish language. The questionnaire included specific questions related to the participants' language learning experience such as the age of first acquisition, the length and place of exposure and other relevant information.

5.3.3 Vocabulary knowledge test

A vocabulary knowledge test was administered to the non-native participants after the masked priming task had been completed. With this test, we aimed to find out whether the experimental stimuli (i.e., the target words) were familiar to the non-native speakers of Turkish. Overall, the L2 participants were found to be unfamiliar with 5.5% of the nominal targets and 13% of the verbal stimuli.

5.3.4 Masked priming task

The experimental technique used in this study was the masked priming paradigm. This experimental paradigm works through the presentation of a prime word on the screen for a very brief time (e.g., 50 ms) following a forward mask which consists of a string of symbols (e.g. ######). It is important to note that the

presentation of a forward mask prevents most, if not all, participants from being aware of the prime word. The prime word is immediately replaced by the target word, on which participants are asked to make a quick lexical decision regarding whether it is a word or non-word.

The masked priming paradigm ensures the imperceptibility of primes at a conscious level for almost all participants by utilizing a forward mask and a very short "stimulus onset asynchrony (SOA)" (usually between 30-80 ms), which refers to the time between the onset of the prime and that of the target. Thus, this technique is claimed to tap into very early processing stages in word recognition due to the extremely brief period of time the primes remain on the screen (Forster & Davis, 1984). The short SOA also prevents participants from developing any strategies that can be linked to the realization of the prime words. In addition, the prime words and the target words appear on the screen in different cases (i.e., lowercase letters for the prime words, uppercase letters for the target words), which contributes to minimizing visual priming due to orthographic overlap.

Since the primes are not visible to participants in a masked priming experiment, it is possible to manipulate the relations between the primes and the targets (e.g., morphologically-related, orthographically-related, semantically-related) and thus examine the impact of different prime-target relations while the participants think that they are just reacting to the targets. The reaction time is the main data of interest in masked priming experiments. Priming is assumed to occur if a certain type of prime word facilitates the processing/recognition of the target word; that is, if it makes the reaction time shorter.

The masked priming experiments generally consist of three conditions: Identity (e.g., walk – WALK), Test/Related (e.g. walk – WALKED), and Unrelated (e.g. paint – WALK). The prime-target relation in the Test condition can be orthographic, semantic and/or morphological, whereas the primes and targets in the Unrelated condition do not share any morphological, semantic or orthographic relation. The facilitation obtained when the Identity prime results in shorter response times than the Unrelated prime is called "repetition priming". If the Related primes yield shorter response times than the Unrelated primes and there is no statistically significant difference between the response times in the Test and Identity conditions,

"full priming" is obtained. "Partial priming", on the other hand, indicates that the participant's reaction to a Related prime takes shorter than to an Unrelated prime but longer than to an Identity prime. No significant difference between the reaction times to a Test and Unrelated prime suggests "no priming".

The masked priming task used in the current study consisted of six experimental lists constructed with morphologically, semantically and orthographically related prime-target pairs. Each list involved 72 experimental items. Since examining any possible effect of word category on the processing of derivational and inflectional forms was one of the purposes of this study, the critical items included both noun targets and verb targets. To this end, two item sets were prepared. In both item sets, the same verb or noun targets were used for different types of primes; thus, it was possible to make a direct comparison between different conditions. Both noun targets and verb targets followed six different types of primes: identity, derivational, inflectional, orthographically-related, semantically-related, and unrelated. The primes in the identity condition were the same as the target words. The unrelated primes, on the other hand, did not have any morphological, orthographical or semantic relation with the target words. Additionally, it was important that the unrelated primes and the targets did not share any letters in the same position.

36 infinitival verb stems were incorporated into the study as targets (see Appendix C). Instead of bare forms (*e.g., AL, "take"*), the infinitive forms of the verbs (*e.g., ALMAK, "to take"*) were used for a few reasons. First of all, dictionaries include the infinitive forms as the standardized citation forms of the verbs. Also, the infinitival marker has no semantic load or person-marking (Şafak, 2015). Most importantly, the bare forms of the verbs had very low frequencies and there are some studies which already used the infinitive verb forms as targets (Clahsen et al., 2003; Neubauer & Clahsen, 2009; Şafak, 2015).

The morphologically-related primes for the verb targets were complex words marked with the conditional suffix –SA (*e.g., yapsa-YAPMAK*) in the inflectional condition, and with the deverbal nominalization -IM (*e.g., yapım-YAPMAK*) in the derivational condition. The length of the targets and the primes were measured in terms of the number of letters. The verbs had a mean root length of 2.8 letters (range:

2-3 letters). However, since the verbs were presented with the infinitive marker -MAK, the targets were between five and six letters long (mean stem length: 5.8 letters). The length of inflected and derived primes was slightly shorter than the target words (mean length: 4.8) due to the two-letter suffixes used. It was not possible to manipulate frequency in the present study due to the difficulty of finding primes in different conditions for the same target. The frequency details for the verbal stimuli are presented in Table 5.2.

Table 5.1 A sample set of verbal stimuli

	Prime Type					
Target	Identity	Inflection (-SA)	Derivation (-IM)	Orthography	Semantic	Unrelated
BAKMAK ***'to look'***	bakmak *'to look'*	baksa *'if he/she looked'*	bakım *'care'*	bakkal *'grocery store'*	gör *'see'*	tüket *'consume'*
SATMAK ***'to sell'***	satmak *'to sell'*	satsa *'if he/she sold'*	satım *'sale'*	saten *'satin'*	ödemek *'to pay'*	çevir *'turn'*

Table 5.2 Mean frequency of the verbal stimuli

	Identity	Inflection	Derivation	Orthography	Semantic	Unrelated
Mean Frequency	25.479	1.226	31.927	68.129	22.969	4.720
SD	52.524	1.748	46.910	171.058	55.792	15.643
Range	0.6 - 232.76	0 - 6.93	0.16 - 211.64	0.28 - 915.85	0 - 301.26	0 - 91.05

Besides the verbs, the experiment also included 36 noun targets. The morphologically-related primes for the noun targets consisted of complex forms marked with the accusative marker –(y)I *(e.g. büyüyü—BÜYÜ)* in the inflectional condition, and with the derivational -CI *(e.g. büyücü-BÜYÜ)* in the derivational condition. The targets were unmarked bare forms of the complex prime words. The targets were between two and four letters long (mean length: 3.27 letters). The

primes inflected with the accusative marker had a mean length of 4.58 (range: 3-6 letters). On the other hand, the primes derived with -CI were between four and six letters and had a mean length of 5.27. Just as in the verbal stimuli, frequency of the nominal stimuli could not be controlled in the current study because of the challenge of finding primes in different conditions for the same target. The frequency details for the nominal stimuli are presented in Table 5.4.

Table 5.3 A sample set of nominal stimuli

	Prime Type					
Target	Identity	Inflection -(y)I	Derivation (-CI)	Orthography	Semantic	Unrelated
BÜYÜ ***'spell'***	büyü *'spell'*	büyüyü *'spell-ACC'*	büyücü *'wizard'*	büyük *'big'*	sihir *'magic'*	şeker *'sugar'*
KİRA ***'rent'***	kira *'rent'*	kirayı *'rent-ACC'*	kiracı *'tenant'*	kiraz *'cherry'*	ev *'home'*	duygu *'emotion'*

Table 5.4 Mean frequency of the nominal stimuli

	Identity	Inflection	Derivation	Orthography	Semantic	Unrelated
Mean Frequency	84.976	26.134	8.524	87.803	39.015	62.408
SD	141.579	46.955	30.128	307.031	45.362	114.934
Range	3.1 - 672.48	0.24 - 222.84	0 - 180.59	0.22 - 1760.95	1.11 - 234.29	1.91 - 608.41

Because the inflectional and derivational primes had not only a morphological but also an orthographical and semantic relation with the target words, orthographically- and semantically-related primes were also incorporated into the study in order to determine the real source of priming. In other words, orthographic and semantic targets were utilized for the purpose of finding out whether any priming effects to be detected in the morphological items can be attributed to the orthographic overlap or the semantic relation between the prime-target pairs. The orthographically-related primes contained the entire verb/noun root but did not bear any morphological or semantic relation with the target. This ensured a more reliable experimental design compared to other studies that included a separate orthographic item set with different target words. The prime-target pairs in the semantic condition were associatively or semantically related but orthographically and morphologically unrelated words. The semantically-related

primes for the noun targets were nouns in bare forms. Likewise, the semantically-related primes for verb targets were verbs in bare forms. The reason for presenting these verb primes as bare forms (*e.g. tut* 'hold') rather than with the infinitival marker -MEK (e.g. *tutmak* 'to hold') was to avoid generating an orthographic similarity between the prime and the target.

Table 5.5 Distribution of the Items

	Version 1 (n)	Version 2 (n)	Version 3 (n)	Version 4 (n)	Version 5 (n)	Version 6 (n)
Practice items	10	10	10	10	10	10
Experimental items (verbs)	36	36	36	36	36	36
Experimental items (nouns)	36	36	36	36	36	36
Fillers (word-word)	80	80	80	80	80	80
Fillers (word-nonword)	80	80	80	80	80	80
Fillers (nonword-nonword)	20	20	20	20	20	20
TOTAL	262	262	262	262	262	262

Additionally, 80 word-word, 80 word-nonword, and 20 nonword-nonword pairs were included into the experiment as fillers. The nonwords were constructed by changing two letters of existing Turkish words and forming orthographically possible but unreal words in Turkish. Therefore, the nonwords could be legally pronounced and syllabified in Turkish. Also, the experiment incorporated 10 practice items with 5 real and 5 unreal target words. A Latin square design was used to group all prime-target pairs into six experimental lists so that each target word shows up only once and follows a different prime in each list.

5.4 Procedure

L1 Speakers

The researcher tested the participants individually in a quiet and dimly-lit room. As the first step of this study, a consent form and a background information questionnaire were given to the participants (Appendix X). After that, the

participants were seated in front of the laptop and were kindly requested to read the instructions on the screen. After the participants finished reading, the researcher made a brief explanation to ensure that everything was understood correctly. The participants were instructed to press the "Yes" or "No" buttons highlighted on the keyboard in order to decide whether the string of letters they see on the screen are real Turkish words. In addition, the participants were informed that their response should be as fast and correct as possible. Before the experiment, a trial session was carried out with 10 items. This was meant to familiarize the participants with the process.

The experimental task used in this study was a forward masked priming experiment which was first developed by Forster & Davis (1984). Response times were recorded via E-Prime software version 2.0 (Schneider, Eschman, & Zuccolotto, 2002). As shown in Figure 5.1, the experiment started with a forward mask which remained on the screen as a fixation point for 500 ms. The forward mask, which consisted of hashmarks (######), was immediately followed by the prime word, which was presented in lowercase letters on the screen for 50 ms. The purpose of setting the SOA to 50 ms in the present experiment was to tap into implicit processing by preventing participants from consciously identifying the primes and thus developing any strategies.

The target word appeared on the screen right after the prime word since the interstimulus interval, which refers to the duration of time between the offset of the prime word and the onset of the target word, was set to 0 ms. The target word was presented in the same position as the prime word, but in uppercase letters. This was meant to prevent visual priming by minimizing any orthographic overlap. The target word remained on the screen for 5000 ms, during which the participants were supposed to press 'yes' or 'no' buttons which were designated with green and red colors respectively on the keyboard to indicate whether the target word was a word or a non-word. After the participants pressed the 'yes' or 'no' button or when the presentation duration of 5000 ms was over, another forward mask appeared on the screen followed by a new pair of prime and target. Both the primes and the targets were presented in black letters (Verdana 40 points) against a white background on a 14-inch laptop. Each participant was asked whether they realized anything unusual

on the screen. No participants reported having seen the prime words. The experiment lasted for about 7 minutes for each participant.

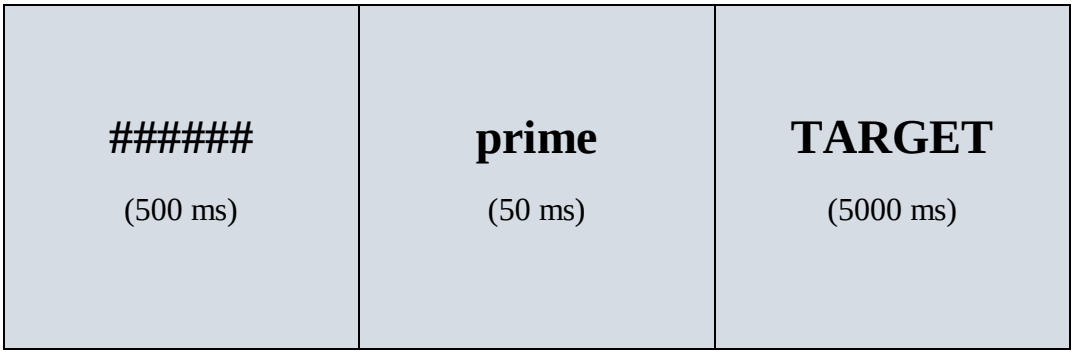

Figure 5.1 The presentation of the stimuli

L2 Speakers

L2 speakers of Turkish were tested differently from the L1 speakers. The L2 processing data had to be collected online due to the outbreak of Covid-19 pandemic. The experiment which was implemented on the L1 speakers was recreated in the online environment. HTML, CSS and JavaScript were used for preparing the interface of the experiment. A software was developed via PHP and MySQL to record the data generated during the testing of L2 participants. The design of the online experiment was the same as the experiment implemented on the L1 speakers.

The L2 participants were first sent a link to the experiment and the background information questionnaire via email. In this email, the participants were briefly informed about the experiment and requested to do the experiment on a computer screen. They were also told to contact the researcher if they had any concerns or questions. When the participants clicked on the experiment link, they were first presented with the necessary instructions on the screen. They were instructed to indicate as fast and as correctly as possible whether the words they see on the screen are existing Turkish words or non-words by pressing 9 for ‘word’ or 0 for ‘non-word’. In the same way as the L1 experiment, they were respectively presented with a series of hashmarks for 500 ms, a lowercase prime word for 50 ms, and an uppercase target word for 5000 ms. The experiment included 10 practice items and took around 7 minutes for each participant.

5.5 Analysis

The analysis only included the participants' responses to the experimental stimuli both for the L1 group and for the L2 group. In other words, the responses to fillers and practice items were excluded from the analysis. There were two dependent variables in this masked priming experiment: accuracy and response time (RT). Before the data analysis was performed, all responses to the experimental items were analyzed in terms of accuracy, and the incorrect answers (i.e. all non-word responses to the target words) were excluded from the analysis. The erroneous answers constituted 4.2% of the L1 data and 3.5% of the L2 data. There were no participants excluded from the analysis due to a substantial error rate. Additionally, the response times were checked to detect and clean any outliers prior to the data analysis. To this end, mean reaction time of each participant was calculated and the response times that were three standard deviations below or above the mean score of each participant were excluded from further analysis (1.39% of the L1 data and 1.25% of the L2 data). Overall, these exclusions accounted for 5.59% of the L1 data and 4.75% of the L2 data.

We conducted a one-way ANOVA for each language group with Condition (identity-noun, identity-verb, derivation-noun, derivation-verb, inflection-noun, inflection-verb, orthography-noun, orthography-verb, semantic-noun, semantic-verb, unrelated-noun, and unrelated-verb) as the within-subjects factor to detect priming effects. Accuracy and response time served as the two dependent variables. Following the analysis, the planned pairwise comparisons were performed to examine how the prime conditions interacted. Mauchly's test of sphericity showed that this assumption was met both for the L1 group (verb stimuli: $\chi2(14) = 22.925$, $p = .063$; noun stimuli: $\chi2(14) = 22.925$, $p = .051$) and for the L2 group (verb stimuli: $\chi2(14) = 20.480$, $p = .141$; noun stimuli: $\chi2(14) = 16.136$, $p = .341$). Finally, a two-way ANOVA was conducted with Language as between-subjects factor and Condition as within-subjects factor.

6 RESULTS

This chapter introduces the results of the masked priming task which was conducted with the native and non-native speakers of Turkish to examine the processing of inflected and derived forms in different word categories. Before starting to present the results, it should be reminded that in this task, different prime words (e.g. derived prime: *topçu* 'footballer', inflected prime: *topu* 'ball-ACC', orthographically-related prime: *toprak* 'dirt') were followed by the same noun or verb root as targets (e.g. *top* 'ball'). This allowed us to make a direct comparison between different prime conditions and thus determine the real source of priming effects.

The results of the native and non-native processing will be presented in different sections. Since it was one of the primary goals of this study to investigate the role of word category on the morphological processing, each section will provide the data pertaining to the verbal items and the nominal items under separate headings. Finally, a comparison of the native and non-native data will be offered.

6.1 The Results of L1 Processing Data

This section will first present the data obtained from the verbal item list and the nominal item list respectively. Then, a comparison will be provided on the results of the verbal and nominal item set.

6.1.1 Verbal item set

The descriptive statistics showed that the participants provided highly accurate responses for the verbal item set in the masked priming task. The accuracy rates ranged between 77.78% and 100% (mean = 97.45%, SD = 0.046). The highest amount of errors was observed in the Semantic condition while the targets following an inflected or orthographically-related prime word yielded the lowest amount of erroneous responses. However, ANOVAs with the factor Prime Type demonstrated no main effect on the error data ($F(5, 115) = 2.265$, $p = 0.053$, partial $\eta 2 = .09$), which suggests the lack of a statistically significant difference among the six conditions in

terms of error rate. On the other hand, the one-way repeated measures ANOVA showed a significant main effect of Prime Type (or Condition) on the Response Time ($F(5, 115) = 13.28$, $p = .0000000003$, partial $\eta 2 = .37$). The targets that followed an Identity prime received a significantly faster response (mean = 631.96; SD = 113.41) than the targets in the Unrelated condition (mean = 710.37, SD = 114.94), suggesting repetition priming. The analysis showed that the orthographically-related prime-target pairs resulted in the longest mean RT in the experiment (mean = 727.90; SD = 95.61), followed by the unrelated primes (mean=710.37, SD=114.94) and the semantically-related primes (mean=709.26, SD=106.07) respectively. However, no significant difference was found between these three conditions in pairwise comparisons ($p > 0.05$).

Table 6.1 Mean RTs, SDs and error rates of the verbal stimuli

	Identity	**Inflection**	**Derivation**	**Orthography**	**Semantic**	**Unrelated**
RTs (SDs)	631.96 (113.41)	658.29 (110.88)	650.29 (124.89)	727.90 (95.61)	709.26 (106.07)	710.37 (114.94)
Error Rate (%)	2.08	0.69	1.39	0.69	5.56	4.86
Priming Effect	78.41	52.08	60.08		1.11	

The lowest response latency detected in the Identity condition was respectively followed by the Derivation condition and the Inflection condition. Although the derived primes resulted in a higher mean RT than the inflected primes, pairwise comparisons revealed no significant difference between them [mean difference = 8.000, $p = 1.000$, 95 percent confidence interval, (-61.306, 45.306)]. Furthermore, the mean RTs yielded by the derived and inflected primes were not significantly different from the mean RT obtained in the Identity condition ($p = 1.000$). On the other hand, Bonferroni post-hoc tests revealed a significant difference both between the Derivation condition and the Unrelated condition [mean difference = -60.088, $p = 0.14$, 95 percent confidence interval, (-111.896, -8.280)], and between

the Inflection and the Unrelated condition [mean difference = -52.088, p = 0.02, 95 percent confidence interval, (-89.945, -14.231)]. In other words, both derived and inflected primes yielded significantly shorter RTs than the unrelated primes. Taken together, these results are suggestive of full priming effects for L1 Turkish speakers both in the inflectional and derivational morphology.

To investigate the real source of priming, the data on the orthographically-related prime-target pairs were analyzed carefully as well. Pairwise comparisons revealed that orthographically-related prime target pairs led to significantly longer mean RT in comparison with the Identity primes [mean difference = 95.938, p = .000, 95 percent confidence interval, (42.089, 149.788)], whereas no statistically significant difference in mean RT was found between the Orthography condition and the Unrelated condition [mean difference = 17.528, p = 1.000, 95 percent confidence interval, (-34.474, 69.529)]. Further analysis on the RT data also revealed a statistically significant difference between the Derivation condition and the Orthography condition [mean difference = -77.616, p = 0.007, 95 percent confidence interval, (-139.887, -15.345)]. Similarly, a pairwise comparison between the Inflection condition and the Orthography condition showed a statistically significant difference in terms of their mean RTs [mean difference = -69.616, p = 0.14, 95 percent confidence interval, (-129.572, -9.660)]. These findings are indicative of the fact that the full-priming effects detected in the Derivation and Inflection conditions cannot be due to an orthographic overlap between the prime-target pairs.

Similar results were also found for the prime-target pairs in the Semantic condition. Semantically-related primes led to a significantly longer mean RT than the Identity primes [mean difference = 77.294, p = .000, 95 percent confidence interval, (48.258, 106.330)]. ANOVA also revealed that there was no significant difference in the mean RTs of the Semantic condition and the Unrelated condition [mean difference = -1.117, p = 1.000, 95 percent confidence interval, (-39.313, 37.079)]. Also, no significant difference was found in the mean RTs between the Semantic and Orthography conditions [mean difference = -18.644, p = 1.000, 95 percent confidence interval, (-74.986, 37.697)]. On the other hand, the ANOVAs on the RT data demonstrated that the participants responded to derived prime-target pairs significantly faster than the semantically-related prime target pairs [mean difference = -58.972, p = 0.43, 95 percent confidence interval, (-116.894, -1.049)]. Similarly,

the inflected prime-target pairs yielded significantly shorter RTs than the pairs in the Semantic condition [mean difference = -50.972, p = .005, 95 percent confidence interval, (-90.475, -11.468)]. These ANOVA results lend support to the fact that the full-priming patters found for the derived and inflected prime-target pairs does not stem from the semantic relationship between these word pairs.

To sum up, the one-way mixed ANOVA and the post-hoc pairwise comparisons revealed a significant interaction between the factor Condition (or Prime Type) and response time. Significant differences found in the L1 speakers of Turkish between the Identity and Unrelated conditions are indicative of repetition priming effects. Furthermore, the absence of a significant difference in the mean RT between the two morphological conditions, i.e. Derivation and Inflection, and the Identity condition suggest a full-priming pattern. On the other hand, the ANOVA showed that the mean RTs obtained in the Orthography and Semantic conditions do not differ significantly from the mean RT in the Unrelated condition, which implies that the orthographically- and semantically-related primes functioned like Unrelated primes. This also supports the fact that the full-priming effects observed in the two morphological condition cannot be due to an orthographic overlap or a semantic relationship between the prime-target pairs.

6.1.2 Nominal item set

In line with the purposes of this study, the masked priming task also included a nominal item set which consisted of prime-target pairs in six conditions in the same vein with the verbal item set. The ANOVA results demonstrated that the nominal item set received highly accurate responses from the participants. In participant-based analysis, the accuracy rates ranged between 94.44% and 100% (mean = 98.26%, SD = 0.021). The semantically-related prime-target pairs yielded the highest amount of errors among the six conditions with 3.47%, whereas no erroneous responses were obtained in the Inflection condition. Yet, the results of the one-way repeated-measures ANOVA with the factor Prime Type revealed that there was no significant main effect of Prime Type (Condition) on the error rates (F(5, 115) = 1.679, p = 0.145, partial $\eta 2$ =.068), suggesting that the error rates did not differ significantly among the six conditions.

Table 6.2 Mean RTs, SDs and error rates of the nominal stimuli

	Identity	**Inflection**	**Derivation**	**Orthography**	**Semantic**	**Unrelated**
RTs (SDs)	605.70 (105.99)	684.65 (102.42)	621.70 (106.28)	716.54 (97.78)	703.48 (98.50)	692.36 (96.56)
Error Rate (%)	0.69	0	2.78	0.69	3.47	2.78
Priming Effect	86.66	17.71	60.66			

On the other hand, the analysis revealed a significant main effect of Prime Type, i.e. Condition, on the Response Time ($F(5, 115) = 19.73$, $p < .05$, partial $\eta 2 = .46$). According to the results, orthographically-related primes yielded the longest mean RT (mean = 716.54, SD = 97.78). The shortest mean RT was obtained in the Identity condition (mean = 605.70, SD =105.99). The mean RT yielded by the Unrelated condition, on the other hand, was 692.36 (SD = 96.56). A post-hoc pairwise comparison demonstrated that the mean RT in the Identity condition was significantly shorter than the mean RT in the Unrelated condition [mean difference = -86.661, $p < .05$, 95 percent confidence interval, (-139.170, -34.152)], suggesting that there was repetition priming. Another Condition which resulted in a long mean RT was the Semantic condition (mean = 703.48, SD = 98.50).

Following the Identity primes, the primes in the Derivation condition yielded the second lowest response latency (mean = 621.70, SD = 106.28). Although the mean RT was lower in the Derivation condition in comparison with the Identity condition, pairwise comparisons showed that there was no significant difference in the mean RT between these two conditions [mean difference = 16.003, $p > .05$, 95 percent confidence interval, (-74.352, 42.345)]. On the other hand, a significant difference was found between the mean RTs of the Derivation and Unrelated conditions [mean difference = -70.658, $p = .002$, 95 percent confidence interval, (-121.782, -19,533)]. Taken together, these results are indicative of full priming effects for the prime-target pairs in the Derivation condition.

The inflected primes, on the other hand, resulted in a mean RT of 684.65 (SD = 102.42). Although the third shortest mean RT was found in the Inflection condition, Bonferroni post-hoc tests revealed a significant difference in the mean RT between the Inflection and Identity conditions [mean difference = 78.948, $p < .05$, 95 percent confidence interval, (-32.629, 125.267)]. Additionally, a significant statistical difference was detected between the Inflection and Derivation conditions in the mean RT [mean difference = 62.944, $p = .012$, 95 percent confidence interval, (-9.306, 116.583)]. On the other hand, pairwise comparisons demonstrated that the Inflection condition did not differ from the Unrelated condition significantly in terms of the mean RT [mean difference = 7.713, $p < .05$, 95 percent confidence interval, (-59.788, 44.362)]. These results suggest the absence of priming effects for the prime-target pairs in the Inflection condition.

In the same vein with the verbal item list, the nominal item list included orthographically- and semantically-related prime-target pairs for us to be able to detect the main source of priming effects. Pairwise comparisons revealed significant differences in the mean RT between the Orthography and Identity conditions. The mean difference between these two conditions was 110.835 [$p < .05$, 95 percent confidence interval, (59.132, 162.539)]. Further analysis on the RT data also revealed a statistically significant difference between the Orthography condition and the Derivation condition [mean difference = -94.832, $p < 0.05$, 95 percent confidence interval, (-44.805, 144.859)]. This finding indicates that the full-priming effects detected in the Derivation condition did not stem from an orthographical overlap between the prime-target pairs.

On the other hand, pairwise post-hoc comparisons demonstrated that the orthographically-related primes did not significantly differ from the inflected, semantically-related, and unrelated primes. The overall mean RTs for these conditions were as follows: Inflection<Unrelated<Semantic<Orthography. The mean difference between the Orthography and Inflection conditions was 31.887 [p = .084, 95 percent confidence interval, (-22.113, 85.888)]. The mean difference between the Orthography and Unrelated conditions was 24.174 [p = .237, 95 percent confidence interval, (-6.203, 54.552)], and finally the mean difference between the Orthography and Semantic conditions was 13.055 [p > .05, 95 percent confidence interval, (-32.257, 58.367)].

Table 6.3 Pairwise Comparisons of RTs

Comparisons	Mean difference	Significance (*p* value)	95 percent confidence interval	
			Lower Bound	Upper Bound
Orthography-Inflection	31.887	.984	-22.113	85.888
Orthography-Semantic	13.055	1.000	-32.257	58.367
Orthography-Unrelated	24.174	.237	-6.203	54.552

Additionally, pairwise comparisons revealed significant differences between the Semantic and Identity conditions [mean difference = 97.781, $p < .05$, 95 percent confidence interval, (56.089, 139.473)]. Similarly, a significant difference in the mean RT was found between the semantically-related prime-target pairs and the derivational prime-target pairs [mean difference = 81.777, $p < .05$, 95 percent confidence interval, (35.431, 128.123)]. This finding suggests that the priming effects yielded by the derived primes is not due to a semantic relationship with the target words; that is, these priming effects are purely morphological in nature.

On the other hand, pairwise comparisons showed that the semantically-related primes did not differ significantly from the inflected, orthographically-related and unrelated primes. The mean RT difference between the Semantic and Inflection conditions was 18.833 [$p > .05$, 95 percent confidence interval, (-18.367, 56.033)]. Also, the mean difference between the semantically-related prime target pairs and orthographically-related prime-target pairs was -13.055 [$p > .05$, 95 percent confidence interval, (-58.367, 32.257)]. Similarly, the mean difference between the Semantic and Unrelated conditions was 11.119 [$p > .05$, 95 percent confidence interval, -24.402, 46.641)].

To sum up, the ANOVA conducted on the nominal item list revealed a significant interaction between the factor Condition and the response time. As a result of pairwise comparisons, we found a significant difference between the Identity and Unrelated conditions, which is suggestive of repetition priming. On the other hand, no statistically significant difference was found between the Derivation and Identity conditions. However, the derivational prime-target pairs differed from the unrelated prime-target pairs significantly. These findings are indicative of full-

priming effects in the Derivation condition. Yet, no priming effects were detected in the other morphological condition, that is, the Inflection condition. To explain, the Inflection condition did not differ from the Unrelated condition significantly, whereas a significant difference was found between the inflectional and identity prime-target pairs. In addition, pairwise comparisons with the Semantic and Orthography conditions revealed a significant difference with the Derivation condition, which indicates that the full-priming effects yielded by the derived primes cannot be due to a semantic relation or orthographical similarity between the primes and the targets.

6.2 The Results of L2 Processing Data

This section will focus on the L2 Turkish data and present the results of the verbal item list and the nominal item list separately. Finally, the results of the verbal and nominal item set will be compared in a separate section.

6.2.1 Verbal item set

According to the descriptive statistics, the verbal item set led to highly accurate responses in the L2 group. The mean accuracy rate of the L2 participants was 98.45% (SD = 0.018, range = 96.29% - 100%). The Semantic and Unrelated conditions led to the highest amount of errors, whereas no error was observed in the Inflection, Derivation and Orthography condition. However, ANOVAs with the factor Prime Type (or Condition) did not show any main effect on the error data (F(5, 40) = 1.303, p = 0.282, P.E.S.=.14), which indicates that the error rate did not differ significantly among the six prime types. However, the one-way repeated measures ANOVA revealed a significant main effect of the factor Prime Type on the Response Time ($F(5, 40) = 17.21$, p = 4.5968E-9, P.E.S.=.68). The targets following an Identity prime resulted in the shortest RT (mean = 694.09; SD = 59.95), whereas the targets following an Unrelated prime led to the longest mean (mean = 823.05; SD = 77.19). Moreover, a significant difference in the mean RT was found between Identity and Unrelated (mean difference = -128.958, p = .000), which suggests repetition priming effects. Likewise, the mean RT in Identity differed from the mean RTs in Orthography (mean difference = -117.916, p = .000) and Semantic (mean difference = -116.836, p = .001). Yet, no significant difference in the mean RT was found among Unrelated, Orthography and Semantic (p = 1.000).

Table 6.4 Mean RTs, SDs and error rates for the verbal stimuli

	Identity	**Inflection**	**Derivation**	**Orthography**	**Semantic**	**Unrelated**
RTs (SDs)	694.09 (59.95)	768.56 (90.38)	750.86 (63.55)	812.00 (61.45)	810.92 (53.27)	823.05 (77.19)
Error Rate (%)	0.018	0	0	0	0.037	0.037
Priming Effect	128.96	54.49	72.19	11.05	12.13	

The prime-target pairs in the Derivation condition led to the second lowest response latency (mean = 750.86; SD = 63.55). Yet, pairwise comparisons revealed a significant difference in the mean RT between Derivation and Identity [mean difference = 56.776, p = .000, 95 percent confidence interval, (29.403, 84.148)] as well as between Derivation and Unrelated [mean difference = -72.182, p = .014, 95 percent confidence interval, (-130.512, -13.851)], suggesting partial priming effects for the derivational prime-target pairs. Likewise, although the prime target pairs in Inflection resulted in the third fastest mean RT (mean = 768.56; SD = 90.38), there was a statistically significant difference between Inflection and Identity [mean difference = 74.471, p = .048, 95 percent confidence interval, (.556, 148.386)], but no statistically significant difference between Inflection and Unrelated [mean difference = -54.487, p = .578, 95 percent confidence interval, (-145.311, 36.338)]. These results indicate that inflected primes failed to prime their targets.

Pairwise comparisons were carried out in order to find out the real source of priming that was obtained for the derivational prime-target pairs. A statistically significant difference was found between Derivation and Orthography [mean difference = -61.140, p = .030, 95 percent confidence interval, (-117.030, -5.250)], suggesting that the priming effects were not resulting from an orthographical overlap between the primes and the targets. Furthermore, the mean RTs in Derivation and Semantic were compared and a statistically significant difference was found between them as well [mean difference = -60.061, p = .010, 95 percent confidence interval, (-106.372, -13.749)]. This means that the priming effects were not brought about by a semantic relationship between the prime and target words. Taken together, these

results demonstrate that the partial priming effects facilitated by the derived primes were solely of a morphological nature.

To sum up, the one-way repeated measures ANOVA and the post-hoc pairwise comparisons pointed to a significant interaction between Prime Type and response time. L2 speakers of Turkish responded to the prime-target pairs in Identity significantly faster than the prime-target pairs in Unrelated, which is indicative of repetition priming effects. Also, a significant difference was found in the mean RT between Derivation and Identity as well as between Derivation and Unrelated, suggesting partial priming effects. No priming effect was found in the Inflection, Orthography and Semantic conditions.

6.2.2 Nominal item set

The results of the descriptive statistics show that a high accuracy rate was achieved in the L2 group for the nominal item set. Their mean accuracy rate was 98.45% (SD = 0.013, range = 96.29% - 100%). The Derivation condition resulted in the highest amount of errors, whereas there was no erroneous response for the prime-target pairs in Identity and Inflection. Yet ANOVAs with the factor Prime Type (or Condition) showed that there was no significant main effect of Prime Type on the error rates ($F(5, 40) = 0.716$, $p = 0.82$, P.E.S.=.082), which means that there was no statistically significant difference in the error rate among the six conditions. On the other hand, it was found that there was a significant main effect of the factor Prime Type on the Response Time ($F(5, 40) = 40.23$, $p = 1.4136E-14$, P.E.S. = .83). The targets that followed an Identity prime generated the shortest mean RT (mean = 690.34; SD = 57.35), which was respectively followed by the derivational prime-target pairs (mean = 707.29, SD = 51.97) and the inflectional prime-target pairs (mean = 742.94, SD = 55.36). On the other hand, the semantically-related primes led to the longest mean RT to the target words (mean = 802.40; SD = 69.40), which was followed by the orthographically-related prime-target pairs (mean = 794.13, SD = 42.71) and the unrelated prime-target pairs (mean = 784.01, SD = 60.24). Yet, pairwise comparisons revealed no statistically significant difference between Semantic and Unrelated (mean difference = 18.389, $p = 1.000$), between Orthography and Unrelated (mean difference = 10.112, $p = 1.000$), or between Semantic and Orthography (mean difference = 8.278, $p = 1.000$).

Table 6.5 Mean RTs, SDs and error rates for the nominal stimuli

	Identity	**Inflection**	**Derivation**	**Orthography**	**Semantic**	**Unrelated**
RTs (SDs)	690.34 (57.35)	742.94 (55.36)	707.29 (51.97)	794.13 (42.71)	802.40 (69.40)	784.01 (60.24)
Error Rate (%)	0	0	0.037	0.018	0.018	0.018
Priming Effect	93.67	41.07	76.72			

In pairwise comparisons, a significant difference in the mean RT was found between Identity and Unrelated [mean difference = -93.678, p = .000, 95 percent confidence interval, (-131.491, -55.865)], which suggests that the Identity primes resulted in repetition priming effects. Similarly, there was a significant difference in the mean RT between Derivation and Unrelated [mean difference = -76.721, p = 0.012, 95 percent confidence interval, (-137.655, -15.787)], whereas the mean RT of derivational prime-target pairs was not significantly different from the mean RT of the prime-target pairs in Identity [mean difference = 16.957, p = 1.000, 95 percent confidence interval, (-22.719, 56.633)]. These results are suggestive of full-priming effects for the derivational prime-target pairs. The inflectional prime-target pairs, on the other hand, produced fairly different results in pairwise comparisons. In contrast to Derivation, the mean RT of Inflection differed significantly from the mean RT of Identity [mean difference = 52.604, p = .000, 95 percent confidence interval, 37.589, 67.618)]. Yet, a significant difference was also found between Inflection and Unrelated [mean difference = -41.075, p = .050, 95 percent confidence interval, -82.104, -.045)]. Taken together, these results suggest partial priming effects for the inflectional prime-target pairs.

Post-hoc pairwise comparisons were conducted with the goal of finding out whether the full and partial priming effects obtained for the inflectional and derivational items resulted from any orthographical or semantic relationship between the primes and targets. The mean RT of derivational items was found to be significantly different from the mean RT of orthographically-related prime-target pairs [mean difference = -86.833, p = .000, 95 percent confidence interval, -127.896,

-45.770)] and from the mean RT of semantically-related prime-target pairs [mean difference = -95.110, p = .002, 95 percent confidence interval, -154.230, -35.991)]. Similarly, the mean RT of inflectional prime-target pairs differed significantly from the mean RTs of orthographical items [mean difference = -51.186, p = .002, 95 percent confidence interval, -81.131, -21.242)] and semantical items [mean difference = -59.464, p = .002, 95 percent confidence interval, -94.368, -24.560)]. These results show that the priming effects produced by the derivational and inflectional primes were not resulting from orthographical overlaps or semantic relationships between the primes and the targets.

To sum up, the ANOVA results revealed a significant interaction between Prime Type and Response Time. L2 speakers gave the fastest response to the targets following an Identity prime, which was indicative of repetition priming effects. Furthermore, the derived primes facilitated the processing of their targets in the same way as Identity primes, which can be taken as evidence for full-priming effects. On the other hand, the inflected primes resulted in a mean RT which was significantly different from the mean RTs of both Identity and Unrelated, suggesting partial priming effects. Finally, the finding of significant differences between the two morphological conditions (i.e, Inflection and Derivation) and Orthography and Semantic showed that the priming effects obtained for these two conditions were purely morphological in nature.

6.3 Comparison of L1 and L2 Results

The one-way repeated measures ANOVAs pointed to mean RT differences among conditions in both participant groups. Figure 6.1 and Figure 6.2 show the mean RTs across different conditions and word types in the two groups. It is clear that both groups responded to the prime-target pairs in Identity faster than the other types of prime-target pairs. Also, in both groups, the mean RTs yielded by the orthographically and semantically related primes did not differ from the mean RT of unrelated prime-target pairs significantly. Yet, there were several differences between the two groups with respect to the results for the derivational and inflectional items.

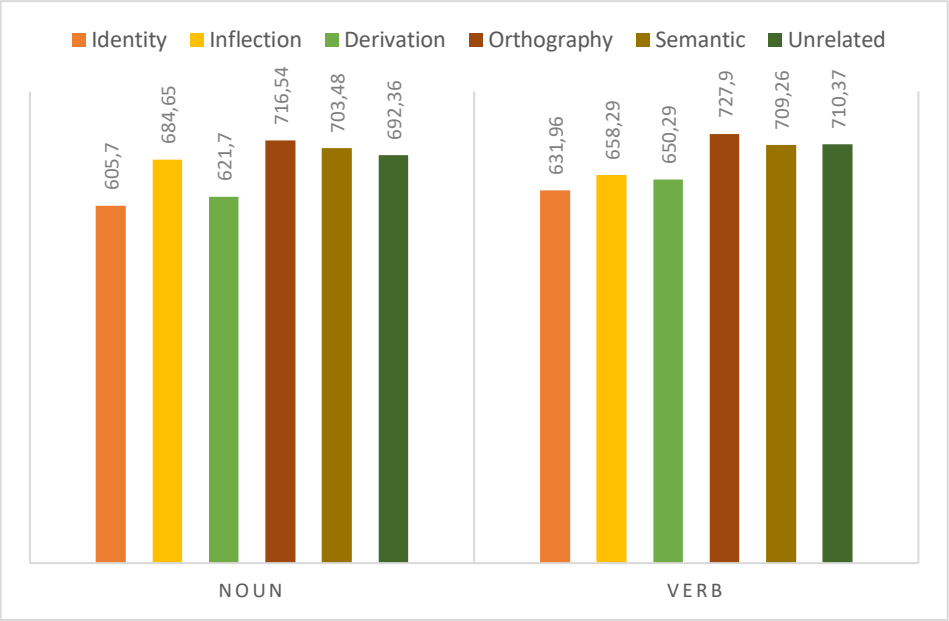

Figure 6.1 Mean RTs for the L1 group

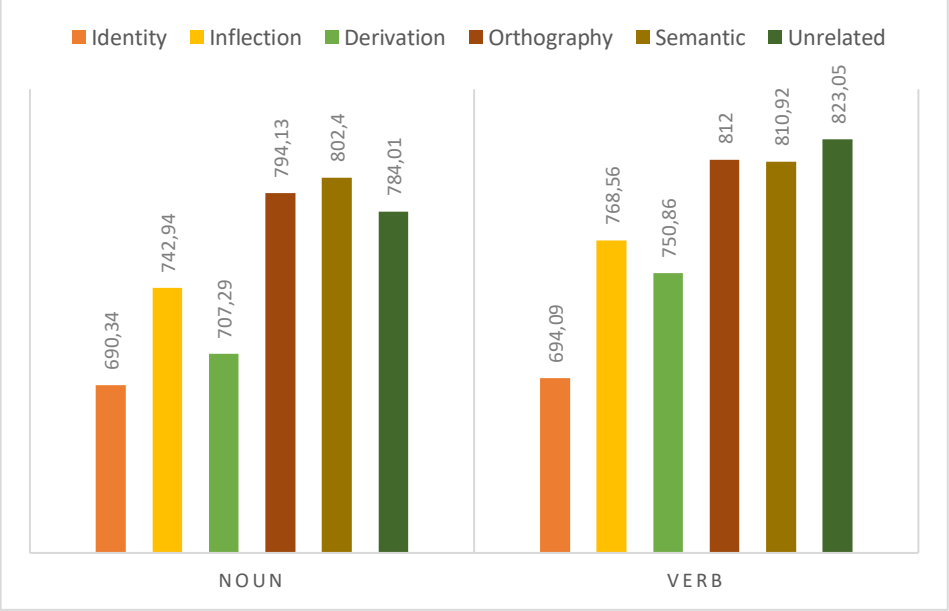

Figure 6.2 Mean RTs for the L2 group

In order to determine any RT differences across conditions and word types, and between the L1 and L2 groups, a three-way repeated measures ANOVA was carried out with group as the between-subjects factor and condition (Identity, Derivation, Inflection, Orthography, Semantic and Unrelated) and word type (noun vs. verb) as the within-subjects factors.

The ANOVA results revealed a significant main effect of Group on the Response Time, $F(1, 372) = 41.489$, $p < .001$, partial $\eta 2 = .100$. Overall, the mean RT of L1 group was faster than the mean RT of L2 group. The figures below provide

a between-group comparison of mean RTs for Identity, Inflection, Derivation and Unrelated in nominal and verbal items.

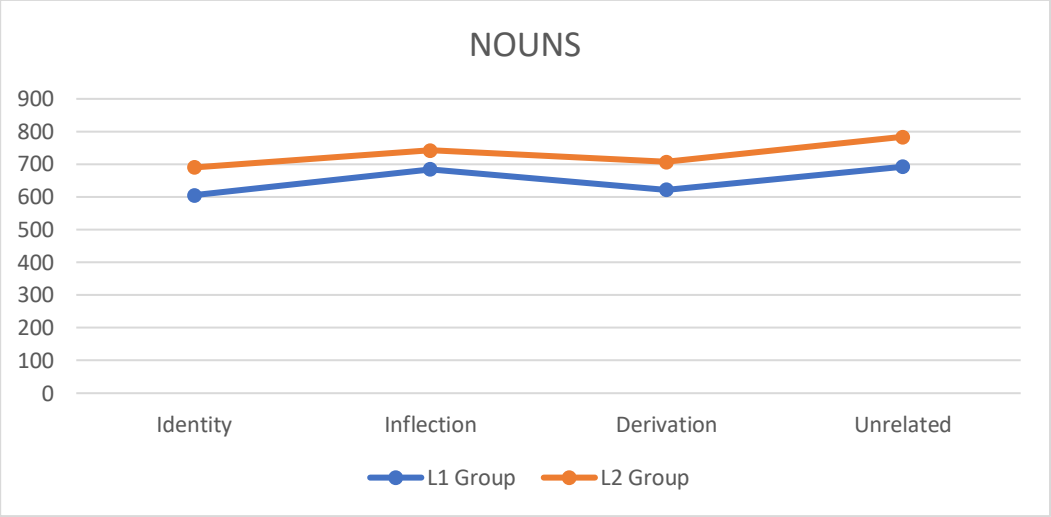

Figure 6.3 Between-group comparison of mean RTs for the nominal items

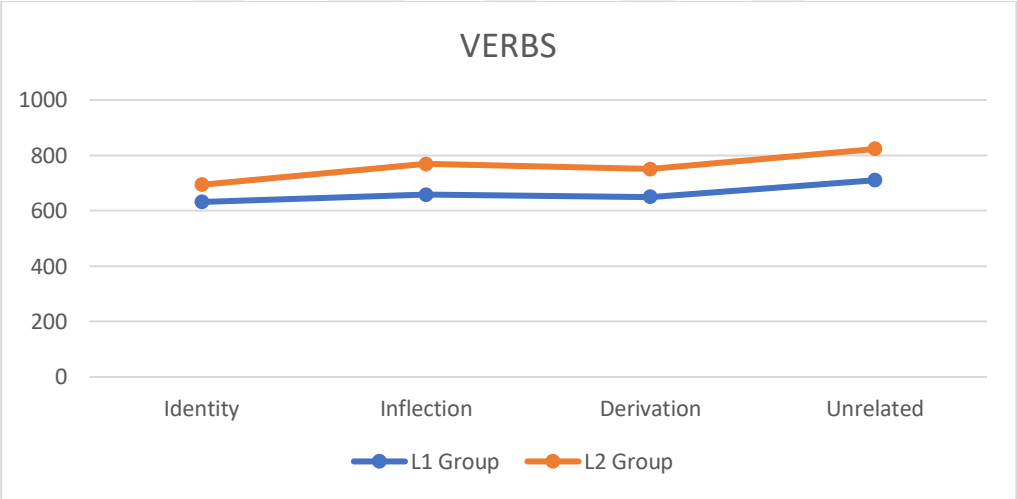

Figure 6.4 Between-group comparison of mean RTs for the verbal items

On the other hand, no significant two-way interaction was found for "group x condition" ($F(5, 372) = .275$, $p = .927$, partial $\eta 2 = .004$), "condition x word type" ($F(5, 372) = .359$, $p = .876$, partial $\eta 2 = .005$), and "group x word type" ($F(1, 372) = .364$, $p = .547$, partial $\eta 2 = .001$). Moreover, the three-way interaction of "group x condition x word type" was not significant either ($F(5, 372) = .269$, $p = .930$, partial $\eta 2 = .004$), which suggests that the two participant groups were similar in terms of their processing patterns (see Fig. 5 and 6).

7 DISCUSSION & CONCLUSION

The present thesis aimed to investigate how L1 and L2 speakers process morphologically-complex words via a masked priming experiment which included both nouns and verbs as target words for different types of prime. The main goal herein was to find out whether the early phases of L1 and L2 visual word recognition is constrained by word category for processing inflectional and derivational word forms, and whether there are any differences between L1 and L2 processing of morphology in this regard. The study also sought to determine whether any priming effects which may be obtained for morphologically related prime-target pairs could be facilitated by an orthographical or semantic similarity between primes and targets.

In this chapter, the first section will discuss the results of the current study with reference to research questions of the study and the findings of previous studies. Following that, the second section will present the conclusions related to the study. Finally, the last two sections will share the limitations of the study and suggestions for further research.

7.1 Discussion

Regarding L1 morphological processing, the present study addressed the questions of whether L1 speakers of Turkish decompose or fully-list inflected and derived word forms and whether word category is a determining factor for the preferred processing route. Results of the L1 study revealed differing priming patterns for nominal and verbal items. We found full-priming effects for accessing inflected verbal forms. This means that L1 Turkish speakers represent and access inflected verbs through decomposition, which is in line with our prediction and supports the previous findings on the processing of verbal inflection in Turkish (Kırkıcı & Clahsen, 2013) and other languages such as English and German (Diependaele et al., 2011; Fruchter et al., 2013; Morris & Stockall, 2012; Neubauer & Clahsen, 2009). The masked priming experiment conducted by Kırkıcı & Clahsen (2013) also revealed full-priming in the morphological processing of verbs inflected with the Aorist suffix *-(V)r*. Our finding is also in line with Hankamer's (1989)

prediction that morphologically complex words are decomposed in morphologically rich, agglutinative languages such as Turkish for storage efficiency.

On the other hand, inflected nouns were not effective primes for their targets in L1 Turkish. No priming effect was found for inflectional prime-target pairs in the nominal stimuli, suggesting that L1 speakers of Turkish accessed these forms as full forms. This predicted finding is comparable to the findings of Gürel (1999) and Uygun & Gürel (2016), who investigated the processing of inflected Turkish nouns via unmasked lexical decision tasks and found a full-listing pattern in L1 speakers of Turkish. The full-listing pattern for morphologically complex nouns was also observed in the study of Lehtonen & Laine (2003), who suggest that morphologically complex words may be stored as full-forms if they consist of frequent suffixes (Lehtonen & Laine, 2003). The fact that the current study found distinctive processing patterns for inflected nouns and inflected verbs in L1 Turkish may be due to differential processing patterns that govern the verbal and nominal paradigms. This is evident in some previous studies which compared the processing of verbal and nominal domains. For example, VanWagenen & Pertsova (2014) detected clear inflectional priming effects in verbs, but not in nouns in L1 Russian. Such difference was also reported in the study of Baayen et. al (1997), who examined the processing of *-en*, which serves both as a verbal ending and as a plural suffix in Dutch, and found storage for noun plurals, but decomposition for verbal forms.

Our L1 results revealed that the prior presentation of derived nouns and verbs facilitated the recognition of target words significantly when compared to unrelated primes. This facilitation did not differ from that of Identity primes, which is indicative of full-priming effects for the derivational items in both nominal and verbal stimuli. As predicted earlier, the finding of identical priming patterns is a strong implication that both derived nouns and derived verbs are represented in the same way in the mental lexicon, i.e., through a decomposition into their constituents. This means that the recognition of the derived words occurred through the isolation of the base stem and the subsequent stem activation (Kırkıcı & Clahsen, 2013). This is consistent with the findings of Kırkıcı & Clahsen (2013), who found decomposition for the Turkish derivational suffix *-lIk*. Also, as well as the findings of some studies in various languages such as German and English (Jacob et al., 2018; Silva & Clahsen, 2008). The full-priming effects observed for derivational forms in

the current study is also in line with the principle of storage economy since in morphologically-rich languages like Turkish, multimorphemic words are expected to be stored as morpheme-based units rather than full-forms in order to reduce the memory load (Frauenfelder & Schreuder, 1992).

Since morphologically-related primes also share a semantic and orthographical relationship with their targets, the current study employed semantically and orthographically related primes as control items. Recall that for a direct comparison across all conditions, the same targets (e.g. bakmak *"to look"*) were used for different kinds of related primes (e.g. Derivation: bakım *"care"*, Inflection: baksa *"if s/he looked"*, Orthography: bakkal *"grocery store"*, Semantic: gör *"see"*). In both nominal and verbal stimuli, orthographically and semantically related primes resulted in as long RTs as Unrelated primes, suggesting no priming effects for these prime-target pairs. This implies that the 50-ms SOA used in this study hindered the activation of orthographical or semantic qualities of primes and thus no facilitation was achieved for the recognition of stems that followed an orthographically or semantically overlapping prime. Moreover, the pairwise comparisons revealed significantly shorter mean RTs in derivational and inflectional conditions than in conditions where primes and targets were semantically or orthographically related. This means that the priming effects observed for inflected verbs, derived nouns and derived verbs were independent from semantic or orthographical effects, which is in line with the findings of some previous studies (Marslen-Wilson, Bozic, & Randall, 2008; Rastle et al., 2004, 2015).

As for the L2 processing of Turkish, the present study aimed to address the question of whether L2 speakers of Turkish process inflected and derived word forms through a rule-based route (i.e., decomposition) or a direct-access route (i.e., full-listing), and whether their processing route is determined by the word category of target words. It was predicted that L2 participants would recognize the inflected nouns in a decomposed fashion and the inflected verbs via the direct-access route. On the other hand, no difference was expected for between processing of derived nouns and derived verbs, and both forms were expected to elicit partial or full priming effects. In the current study, L2 speakers of Turkish demonstrated no priming effects for inflected verbs since they resulted in as long reaction to target stems as Unrelated primes. Therefore, it can be assumed that the inflected verbs are

accessed through the direct-access route, i.e., as full-forms, during the early visual word recognition stage. The high level of reliance on storage for inflected verbs was also observed in the study of Kırkıcı & Clahsen (2013), who reported absence of priming effects for the verbal inflectional suffix -*Vr* in L2 Turkish. This finding is also consistent with Ullman's dual-mechanism prediction that postulates the storage of inflected forms as chucks by L2 speakers due to their lack of linguistic computations. In a similar vein, Silva & Clahsen (2008) explain the absence of morphological priming observed in inflected forms with L2 speakers of English in their own study via two different hypotheses. They propose that L2 learners fail to show priming effects either because functional categories and features are missing in the syntactic representations of L2 grammar or because L2 speakers struggle in realizing the surface morphology (Prévost & White, 2000).

On the other hand, priming effects for inflected verbs, which were reported as missing in several earlier studies (Jacob et al., 2018; Kırkıcı & Clahsen, 2013; Silva & Clahsen, 2008), were actually observed in some L2 studies. For example, Coughlin & Tremblay (2015) reported full-priming effects for *-er* French verbs in both L1 group and L2 group in a masked-priming word-naming task. This could be due to the proficiency level of their L2 participants, since they explain their finding with a quantitative change in L1 learners' competence. Accordingly, as L2 proficiency increases, L2 learners can make use of procedural knowledge faster and more automatically, and thus show higher level of morphological priming (McDonald, 2006). Therefore, it can be speculated that the L2 processing of inflected verbs may depend on the L2 proficiency. Yet, since the present study did not manipulate L2 proficiency, it is not possible to know whether this speculation can be justified herein.

With respect to nominal inflection, the L2 data in the present study revealed that the targets following an inflected noun elicited significantly faster response times when compared to targets following an unrelated prime. However, pairwise comparisons also pointed to a significant difference with the prime-target pairs in Identity. Taken together, these results point to partial priming effects for inflected nouns in the early stages of visual word recognition in L2 Turkish. The partial priming effects can be interpreted as evidence that the L2 group accessed inflected nouns via both a morpheme-based route and an indirect activation of shared lexical

representations of the target words, as implied in the study of Crepaldi et al. (2010) for the partial priming effects found for regular verb roots.

The findings of earlier studies which examined nominal inflectional processing had urged us to predict that L2 speakers would show full-priming effects for inflected nouns (e.g. Ahn et al., 2014; Lehtonen & Laine, 2003; Portin et al., 2008; Vainio et al., 2014). Yet it should be noted that the relevant studies rested on different factors and aimed to test different aspects of morphological processing. For example, the study of Vainio et al. reports both no priming and full priming effects for inflected words depending on the native language of the L2 participants. The present study also partially supports the study of Uygun & Gürel (2013), who, in an unprimed lexical decision experiment with intermediate and advanced learners of Turkish, reported a tendency to decompose nouns inflected with the ablative and locative suffixes for intermediate L2 speakers. A replication of their study (Uygun & Gürel, 2016) with an additional L2 group whose L1 was Russian also revealed that unlike English-speaking L2 learners and L1 speakers of Turkish, Russian learners of Turkish decomposed inflected nouns. Though the present study also tested L1-English participants, it found partial priming effects for inflected nouns in contrast with Uygun & Gürel (2016). This difference could be due to their experimental method, which is claimed to tap into later stages of word recognition, in contrast with the masked priming experiment which taps into earlier phases of word recognition. Also, the reduced priming effects obtained in the present study could be due to L2 speakers' proficiency levels or duration of exposure to the language. With increased exposure or L2 proficiency, the participants may switch to a purely decompositional processing route for inflected nouns.

With respect to the derivational processing, different priming patterns were for nouns and verbs. Derived verbs facilitated partial priming effects for their targets since they resulted in a mean RT longer than identity primes but faster than the unrelated primes. The mean RT of the derivational prime-target pairs was also significantly faster the orthographically and semantically related pairs. This priming pattern was also reported in the study of Silva & Clahsen (2008) for the L2 processing of the English deadjectival nominal suffixes *-ness* and *-ity*. The authors interpret this finding as an indication that L2 learners process derived word forms in a morphologically structured way, although this processing is not as effective as in

L1. On the other hand, we found full priming effects for the L2 processing of derived nouns, suggesting a morphologically-structured processing pattern. Also, the fact that the derived primes differed significantly from orthographically and semantically related primes in terms of the mean RT shows that the full-priming effects relied only on the morphological relationship between the primes and targets. Moreover, when compared to derived verbs, derived nouns facilitated a considerably shorter mean RT (mean difference = 43.57 ms). This difference may be interpreted as a result of the different word categories used in the experimental stimuli. In other words, it can be said that L2 speakers of Turkish process nouns following a derived prime faster than the verbs following a derived prime. This can also imply a difference between the mental organization of nouns and verbs. Additionally, the different priming patterns found for derivational nouns and derivational verbs may further suggest that the different results reported in previous studies for the processing of different word categories in the inflectional domain (e.g. Ahn et al., 2014; Lehtonen & Laine, 2003; Portin et al., 2008; Vainio et al., 2014) also apply to the derivational domain.

7.2 Conclusion

The present study investigated the processing of inflectional and derivational word forms in L1 and L2 Turkish. Specifically, the study incorporated two different lists of stimuli, i.e., a nominal list and a verbal list, in order to discover the potential role of word category in determining the processing route for multimorphemic words. This study has a unique nature in that the same roots were used as targets for six different types of primes including identity, inflection, derivation, orthography, semantic and unrelated, which made it possible to detect the effect of semantic or orthographic relatedness on the obtained priming effects. Overall, this thesis allows for several conclusions to be drawn based on the analysis results. Firstly, L1 speakers of Turkish access inflected verbs and inflected nouns via different routes. Whereas inflected verbs are accessed through a morphologically-structured route, the processing of inflected nouns is characterized by full-listing. Thus, it can be concluded that word category is a determining factor for the processing pattern of inflectional forms in L1 Turkish. Secondly, derivational word forms are accessed via decomposition into their constituents regardless of their word category. This

conclusion is based on the finding that the same morphological full-priming pattern was observed in both nouns and verbs following a derived prime. This means that word category did not influence the processing of derivation in L1 Turkish. With regards to L2 processing of Turkish, it can be stated that word category had a significant role in determining the processing pattern of inflectional word forms. Inflected forms are not effective primes for verbs in L2 Turkish, whereas the processing of inflected nouns relies on a morphologically structured route to a certain degree. Similarly, different priming patterns were detected for targets that followed derivational nouns and derivational verbs, i.e., partial full-priming effects for the former and partial priming effects for the latter. Based on this result, it can be concluded that L2 speakers of Turkish relied on different amounts of decomposition for processing derivational nouns and verbs. Another conclusion that can be drawn from this study is that orthographically or semantically related words failed to prime their targets at an SOA of 50 ms, which led to another conclusion that the priming effects mentioned previously were independent from semantic or orthographic effects. All in all, the study presented in this thesis provides evidence that inflectional and derivational processing can be influenced by word category in both L1 and L2 Turkish.

7.3 Limitations of the Study

The results of the study at hand should be evaluated in consideration of its limitations. One limitation was that it was not possible to match the items used in this study for frequency. This was caused by the difficulty of finding four different types of related primes for the same targets. Therefore, the frequency factor had to be disregarded for the sake of achieving a direct comparison across different types of conditions. Another limitation was related to the collection of the L2 data as well as the profile of the L2 group. Due to the outbreak of Covid-19 pandemic during the data collection process of this study, the L2 experiments had to be conducted online as explained in the Methodology chapter. Although the participants were provided with the necessary instructions for carrying out the experiment, it could not be ensured that the participants did the experiment in an ideal environment (i.e., alone, in a quiet and dimly lit room, on a standardized computer screen.) Moreover, due to the pandemic, only a very limited number of L2 participants could be reached for the

study. Therefore, the participants could not be matched in terms of their proficiency level, and the proficiency level of the participants were determined based on their own statements.

7.4 Suggestions for Further Research

The findings of the current study bring forward a new issue in the psycholinguistic research of word processing. This study shows that inflectional forms can elicit priming effects in L2 speakers depending on their word category. This assumption can be further investigated by integrating different word categories into experiments. Also, since it was not possible to match the items in terms of frequency in this study, future researches may manipulate frequency in the experimental items in order to discover whether there is an interaction between word category and frequency on priming patterns. Moreover, as it is an established assumption that the features of native language can affect the L2 processing, L2 participants from typologically different language backgrounds can be tested in future studies focusing on word category. Additionally, this study found no priming effects for targets following inflected nouns, which is generally not expected in morphologically rich languages as Turkish. Therefore, this study also has significant implications for L1 processing and shows that there are still some aspects of L1 processing that needs to be explored. Following L1 studies can test the assumptions of the present study in different L1 speakers with different word categories.

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APPENDICES

Appendix A: Experimental Verbal Stimuli

Appendix B: Experimental Nominal Stimuli

Appendix C: Consent Form

Appendix D: Linguistic Background Questionnaire

Appendix E: Participant Background Questionnaire

Appendix F: Vocabulary Knowledge Test

APPENDIX A. Experimental Verbal Stimuli

TARGET	ID.	DER.	INF.	ORTH.	SEM.	UNR.
AKMAK	akmak	akım	aksa	akşam	sız	benze
ALMAK	almak	alım	alsa	altın	tut	konuş
BAKMAK	bakmak	bakım	baksa	bakkal	gör	tüket
BASMAK	basmak	basım	bassa	baston	ez	oyna
BİÇMEK	biçmek	biçim	biçse	biçare	kes	havla
BİLMEK	bilmek	bilim	bilse	bilet	öğren	yaşa
BOĞMAK	boğmak	boğum	boğsa	boğa	sık	ayrıl
ÇEKMEK	çekmek	çekim	çekse	çekirge	ger	bunal
ÇİZMEK	çizmek	çizim	çizse	çizme	yaz	güven
DİKMEK	dikmek	dikim	dikse	dikkat	koy	tırmala
DOĞMAK	doğmak	doğum	doğsa	doğru	çık	yakala
DÖKMEK	dökmek	döküm	dökse	dök	akıt	beğen
DOLMAK	dolmak	dolum	dolsa	dolaş	yayıl	yarat
DÜRMEK	dürmek	dürüm	dürse	dürbün	katla	yönet
EĞMEK	eğmek	eğim	eğse	eğer	bük	inan
GİYMEK	giymek	giyim	giyse	giyotin	soyun	utan
KAZMAK	kazmak	kazım	kazsa	kazak	oy	oyala
KESMEK	kesmek	kesim	kesse	kestane	doğra	başar
KISMAK	kısmak	kısım	kıssa	kısmet	azalt	ovala
KIYMAK	kıymak	kıyım	kıysa	kıyafet	parçala	açıkla
KONMAK	konmak	konum	konsa	kontrol	dur	gecik
KURMAK	kurmak	kurum	kursa	kurşun	oluştur	anımsa
ÖLMEK	ölmek	ölüm	ölse	ölçek	yaşa	ayıkla
SALMAK	salmak	salım	salsa	salon	bırak	yoğur
SATMAK	satmak	satım	satsa	saten	öde	çevir
SAYMAK	saymak	sayım	saysa	saydam	hesapla	kurtul
SUNMAK	sunmak	sunum	sunsa	suni	öner	eğit
SÜRMEK	sürmek	sürüm	sürse	sürahi	git	dağıt
TAKMAK	takmak	takım	taksa	taksi	as	alkışla
TUTMAK	tutmak	tutum	tutsa	tutu	kavra	imzala
VERMEK	vermek	verim	verse	verem	ilet	zıpla
YAKMAK	yakmak	yakım	yaksa	yaka	tutuştur	dinlen
YAPMAK	yapmak	yapım	yapsa	yaprak	oluştur	hoşlan
YAYMAK	yaymak	yayım	yaysa	yaya	dağıt	çiğne
YIKMAK	yıkmak	yıkım	yıksa	yıkama	devir	kayna
YORMAK	yormak	yorum	yorsa	yorgan	usandır	tiksin

ID.: identity, DER.: derivation, INF.: inflection, ORTH.: orthography, SEM.: Semantic

APPENDIX B. Experimental Nominal Stimuli

TARGET	ID.	DER.	INF.	ORTH.	SEM.	UNR.
AŞI	aşı	aşıcı	aşıyı	aşık	ilaç	tarak
AV	av	avcı	avı	avuç	tüfek	ızgara
BÜYÜ	büyü	büyücü	büyüyü	büyük	sihir	şeker
CAM	cam	camcı	camı	cambaz	pencere	korku
ÇAY	çay	çaycı	çayı	çayır	kahve	halı
CEP	cep	cepçi	cebi	cephane	pantolon	kabuk
DAVA	dava	davacı	davayı	davar	yargı	mantı
DİŞ	diş	dişçi	dişi	dişil	ağız	küpe
ELMA	elma	elmacı	elmayı	elmas	armut	yılan
FAL	fal	falcı	falı	falan	tarot	radyo
GOL	gol	golcü	golü	golf	spor	duvar
GÖZ	göz	gözcü	gözü	gözleme	kirpik	dünya
HAN	han	hancı	hanı	hançer	otel	yastık
HAVA	hava	havacı	havayı	havale	gökyüzü	zil
İŞ	iş	işçi	işi	işaret	meslek	kablo
İZ	iz	izci	izi	izmarit	leke	maske
KALE	kale	kaleci	kaleyi	kalem	futbol	boya
KALP	kalp	kalpçi	kalbi	kalpazan	yürek	gece
KAMP	kamp	kampçı	kampı	kampüs	doğa	etek
KAPI	kapı	kapıcı	kapıyı	kapışma	kilit	rüya
KASA	kasa	kasacı	kasayı	kasaba	dolap	sözlük
KİRA	kira	kiracı	kirayı	kiraz	ev	duygu
KOL	kol	kolcu	kolu	koltuk	bacak	cam
KUŞ	kuş	kuşçu	kuşu	kuşak	martı	bot
MUZ	muz	muzcu	muzu	muzip	çilek	kaya
ODA	oda	odacı	odayı	odak	mutfak	emir
PLAN	plan	plancı	planı	planet	program	tablo
ŞAKA	şaka	şakacı	şakayı	şakak	espri	keçi
SÜT	süt	sütçü	sütü	sütun	yoğurt	yaprak
TAŞ	taş	taşçı	taşı	taşra	kaya	hediye
TOP	top	topçu	topu	toprak	voleybol	üzüm
TOST	tost	tostçu	tostu	tostoparlak	peynir	çeşit
YAT	yat	yatçı	yatı	yatır	tekne	limon
YEM	yem	yemci	yemi	yemin	hayvan	işaret
YOL	yol	yolcu	yolu	yoluk	cadde	bardak
YÜK	yük	yükçü	yükü	yüksek	eşya	sinir

ID.: identity, DER.: derivation, INF.: inflection, ORTH.:orthography, SEM.: Semantic

APPENDIX C. Consent Form

CONSENT FORM

Bu deneyin yöntemi ve içeriği ile ilgili bilgilendirildikten sonra ben,

……

(Ad ve Soyad)

kendi rızamla Dr. Filiz Çele ve Refika Çimen'in yürütmekte oldukları "Yanıt Süresi Deneyi"nde katılımcı olmayı ve elde edilen verilerin anonim bir biçimde bilimsel amaçlara yönelik kullanılmasını kabul ediyorum.

İstanbul, …… (Tarih)

……

(İmza)

APPENDIX D. Linguistic Background Questionnaire

LINGUISTIC BACKGROUND QUESTIONNAIRE

Bu bölüm, yabancı bir dil olarak Türkçe öğrenme deneyiminizle ilgilidir.

1. Türkçeyi öğrenmeye başladığınız yaş: _____
2. Türkçeyi öğrenmeye başladığınız yer: _____
3. Ne kadar süreyle Türkçe dersleri aldınız?
    a. 1 yıldan az
    b. 1 yıl
    c. 2 yıl
    d. 3 yıl
    e. Diğer: _____
4. En son gittiğiniz Türkçe kursunun seviyesi?
    a. A1
    b. A2
    c. B1
    d. B2
5. Daha önce herhangi bir Türkçe Yeterlilik Sınavına girdiniz mi?
    a. Evet
    b. Hayır

Cevabınız evet ise:

1. Sınava girdiğiniz yer: _____
2. Sınava girdiğini tarih: _____
3. Aldığınız puan: _____

Lütfen Türkçe dilinde aşağıdaki alanlardaki yeterliliğinizi belirtiniz.

	Başlangıç	Orta	İleri	Anadile yakın
Okuma				
Yazma				
Konuşma				
Dinleme				
Genel yeterlilik				

APPENDIX E. Participant Background Questionnaire

PARTICIPANT BACKGROUND QUESTIONNAIRE

1. Ad-soyad: _____
2. Yaş: _____
3. Yazarken hangi elinizi kullanırsınız?
    a. Sağ
    b. Sol
4. En son aldığınız eğitim nedir?
    a. Lise
    b. Ön lisans
    c. Lisans
    d. Yüksek Lisans
    e. Doktora
    f. Diğer: _____

APPENDIX F. Vocabulary Knowledge Test

Lütfen aşağıda verilen her fiil ile ilgili size uygun olan kutucuğu işaretleyin.

	1: Hiçbir fikrim yok.	2: Daha önce duydum ama ne anlama geldiğinden emin değilim.	3: Bu kelimeyi biliyorum.
AKMAK			
ALMAK			
BAKMAK			
BASMAK			
BİÇMEK			
BİLMEK			
BOĞMAK			
ÇEKMEK			
ÇİZMEK			
DİKMEK			
DOĞMAK			
DÖKMEK			
DOLMAK			
DÜRMEK			
EĞMEK			
GİYMEK			
KAZMAK			
KESMEK			
KISMAK			
KIYMAK			
KONMAK			
KURMAK			
ÖLMEK			
SALMAK			
SATMAK			
SAYMAK			
SUNMAK			
SÜRMEK			
TAKMAK			
TUTMAK			
VERMEK			
YAKMAK			
YAPMAK			
YAYMAK			
YIKMAK			
YORMAK			

Lütfen aşağıda verilen her isim ile ilgili size uygun olan kutucuğu işaretleyin.

	1: Hiçbir fikrim yok.	2: Daha önce duydum ama ne anlama geldiğinden emin değilim.	3: Bu kelimeyi biliyorum.
AŞI			
AV			
BÜYÜ			
CAM			
ÇAY			
CEP			
DAVA			
DİŞ			
ELMA			
FAL			
GOL			
GÖZ			
HAN			
HAVA			
İŞ			
İZ			
KALE			
KALP			
KAMP			
KAPI			
KASA			
KİRA			
KOL			
KUŞ			
MUZ			
ODA			
PLAN			
ŞAKA			
SÜT			
TAŞ			
TOP			
TOST			
YAT			
YEM			
YOL			
YÜK			

APPENDIX F. Ethical Approval Form

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