THE PROCESSING OF MORPHOLOGY
IN ADULT SECOND LANGUAGE ACQUISITION

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DECLARATION OF ORIGINALITY

I, Nesrin Kutlay, certify that

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ABSTRACT

The Processing of Morphology in Adult Second Language Acquisition

This study examines, via two masked priming experiments, the processing of inflectional and derivational morphology to identify whether first language (L1) and second language (L2) speakers of Turkish demonstrate comparable processing patterns (e.g., decomposition, full listing or a dual route) in these two types of morphological processes. The target verbs were the same and the primes were presented in four prime conditions in both experiments: i) Identity (*ver,* 'give' – *VER*, 'give'); (ii) Inflected Test (*verdi*, 'give' + past tense suffix' – *VER,* 'give'); Derived Test (*vergi,*'tax': 'give' + noun-forming derivational suffix'– *VER*, 'give'; (iii) Orthographically-related (*verem*, 'tuberculosis'–*VER*, 'give'), and (iv) Unrelated (*bak*,'look' – *VER* 'give'). The items were matched in terms of frequency and length. High and low frequency primes were matched with high and low frequency bare target roots in four conditions (HL, HH, LH and LL). The reaction times (RTs) for each prime condition were compared and the effects of root and surface frequency were analyzed across L1 and L2 groups. The findings revealed that L1 speakers employed decompositional pattern in processing inflectional morphology but not derivational morphology. L2 speakers, on the other hand, did not display any facilitation effects either with inflected or derived primes. No clear frequency effects were observed in either group. Findings suggest that L2 learners diverge from L1 speakers in processing inflectional morphology but not derivational morphology. In addition, the processing difference between inflectional and derivational morphemes implies L1 speakers' access to dual routes in Turkish.

ÖZET

Biçimbirimlerin Yetişkin Yaşta Öğrenilen İkinci Dilde İşlemlenmesi

Bu çalışmada iki ayrı maskelenmiş çağrıştırma deneyi aracılıyla Türkçeyi ileri yaşta ikinci dil (D2) olarak öğrenenler ile ana dili (D1) konuşucularının çekim ve yapım eki almış çok ekli sözcükleri nasıl işlemledikleri incelenmiştir. İki deneyde de aynı hedef fiiller ve dört ayrı çağrıştırma sözcüğü mevcuttur: i) Özdeş (*ver– VER*); (ii) Çekim eki test (*verdi– VER*); Yapım eki test (*vergi–VER);* (iii) Yazımsal olarak ilişkili (*verem–VER*); (iv) İlgisiz (*bak –VER*). Çağrıştırıcılar ve hedef sözcükler sıklık sayımları, uzunluk bakımından eşleştirilmiş ve çağrıştırıcılar sıklık düzeylerine göre hedef sözcüklerle çaprazlanarak dört ayrı sıklık kategorisi oluşturulmuştur: (Y)üksek sıklığı olan çok ekli sözcük – (D)üşük sıklığı olan kök (YD), YY, DY, DD. Bulgular, D2 grubunun, D1 konuşucularından farklı bir işlemleme yöntemi kullandıklarını göstermektedir. D1 konuşanları çekim ekli sözcükleri biçimbirimsel ayrıştırma yöntemiyle işlemlerken, yapım ekli sözcükleri bütünsel listeleme yöntemiyle işlemlemektedir. D2 konuşucuları ise hem çekim ekli hem yapım ekli sözcükleri zihinsel sözlükte bütünsel listeleme yöntemiyle işlemlemektedir. Tüm sözcük ve kök sıklığının, bulgulanan işlemleme yöntemleri üzerinde önemli bir fark yaratmadığı göstermiştir. Sonuç olarak bu çalışmada, D1 ve D2 konuşucularının çekim ekli sözcükleri işlemlerken farklılıklar gösterdiklerini ancak bu farkların yapım eki almış sözcüklerin işlemlenmesinde görülmediği anlaşılmıştır. Ayrıca, D1 konuşucularının çekim eki ve yapım eki almış sözcüklerin işlemlenmesinde gösterdikleri farklar, ikili işlemlemeye kanıt olarak kabul edilebilir.

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To my son, Kaan…

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ABBREVIATIONS

ABL	ablative case
CAUS	causative
CL	clitic
DAT	dative case
DER	derivational suffix
EV.COP	evidential copula
GM	generalizing modality
IMPF	imperfective
PASS	passive
PL	plural
POSS	possessive
PSB	possibility
SG	singular
SUB	subordinator
1	first person
2	second person singular

CHAPTER 1

INTRODUCTION

1.1 Background

Acquisition of morphology is one of the most difficult domains in second language (L2) acquisition/learning. Particularly late L2 learners (those whose first L2 exposure begins after 7 or around puberty) appear to have much difficulty in attaining native-like accuracy and fluency in the use of L2 morphemes. This is a widely observed phenomenon that has been reported for decades (Bailey, Madden, & Krashen, 1974; Lardiere, 1998a,b; McCarthy, 2008; Prévost & White, 2000; White, 2003a,b;). This phenomenon is often referred to as morphological variability (or variable use of morphology) as L2 learners either omit or substitute the target morpheme in obligatory contexts (Haznedar & Schwartz, 1997; Prévost & White, 2000; White, 2003). The fact that the variability problem particularly in the domain of inflectional morphology persists even in the end state L2 grammar, has triggered considerable theoretical debate as to the potential causes of such variability (Lardiere, 2009; White, 2003). While some researchers assume that the variability problem is mostly a production problem (Goad, White, Steele, 2003; Haznedar & Schwartz, 1997; Lardiere, 1998a; Prévost & White, 2000), others argue that it is also observed in language comprehension (McCarthy, 2008).

Recently, it has been suggested that morphological variability may be linked to the way multimorphemic words are represented in the mental lexicon (Clahsen, Felser, Neubauer, Sato, & Silva, 2010; Gürel & Uygun, 2013). More specifically, the pattern of lexical representation and access may be responsible for how morphologically complex words are used in the L2. As will be discussed in detail in the subsequent chapters, the two main morphological processing patterns, namely the decompositional pattern (i.e., computation) and full access (i.e. storage) may account for commonly observed variable use of morphology. Thus, the variability issue and native-nonnative speaker differences in morphology have been addressed in recent psycholinguistic research that is based on various online techniques such as computer-based timed lexical decision, word-monitoring, self-paced reading/listening, cross-modal priming, eye-tracking, event related potential (ERPs) (see Marinis, 2010; Roberts, 2012 for a review). These online experimental paradigms are used in L2 research as they are believed to tap unconscious knowledge that learners come to acquire regarding morpho-syntactic and other linguistic properties of the L2. In a sense, psycholinguistic experiments complement the traditional off-line techniques that have been used for years to test L2 morpho-syntax because the psycholinguistic research paradigm enables researchers to explore whether or not late L2 learners' morpho-syntactic problems can also be defined in reference to processing mechanisms they adopt.

Thus, the thesis aims to contribute to this discussion by providing processing data from late L2 learners of Turkish in comparison to native Turkish speaker data. The processing data from inflectional and derivational morphology presented in the current study will also provide grounds for comparison between these two morphological processes. Thus, it will be possible to identify whether there are any differences in the processing of inflected and derived words in the L2.

The role of morphological structure in the processing of inflectional and derivational morphology was first investigated in first language (L1) speakers (i.e., native speakers) of different languages, particularly in L1 English speakers. While some researchers found a decompositional processing route in both inflection and derivational morphology (e.g., Kırkıcı & Clahsen, 2013), some others reported a dissociation between the two morphological processes. More specifically, while inflected complex words are decomposed; derived words appear to be represented in whole-word forms (e.g. Stanners, Neiser, Hernon, & Hall, 1979). A similar dual route has also been reported in the context of past tense processing (Marslen-Wilson, 1998; Marslen-Wilson & Tyler, 2007; Prasada, Pinker & Synder, 1990). It has been suggested that while regularly inflected forms are accessed via linguistic computation (i.e., decomposition), irregular words are represented via direct access route (i.e., full form storage). Dissociation between regular and irregular morphology in terms of processing has led to the formulation of the dual mechanism models that can apply to any linguistic dichotomies such as inflection and derivation. The dual system basically allows the use of both decompositional as well as full listing patterns in the same language (Clahsen, 1999; Pinker & Ullman, 2002; Ullman, 2001). Various factors have been implicated in the extent of adoption of either decomposition or full listing, among which we can count factors such as the type of morphology, productivity, frequency, familiarity. The single system models, on the other hand, do not assume that both routes are available (Butterworth, 1983; Manelis & Tharp, 1977; Rumelhart & McClelland, 1986; Taft & Forster, 1975). They assume either decompositional processing or full listing taking place invariably in lexical access.

The discussions about processing of inflectional and derivational morphology in L1 studies have been applied to L2 learners/speakers processing patterns. Based on the assumptions of the single and dual processing models, inflectional and derivation processing and access mechanisms employed by L2 speakers have been investigated by a number of psycholinguistic studies (e.g. Clahsen, Balkhair, Schutter & Cunnings, 2013; Coughlin & Trembley, 2015Neubauer & Clahsen, 2009; Silva & Clahsen, 2008). The concern in L2 research has been to identify possible similarities and differences between L1 speakers and L2 speakers in terms of mechanisms employed for processing morphologically complex words. The findings, however, have not been conclusive so far.

There are two main views on L2 processing of morphology that have emerged from previous research. The first view is generally referred to as the convergence view as it assumes that L1 and L2 processing are essentially similar and the differences are only quantitative. L2 processing is slower than L1 processing due to factors such as working memory, speed of processing and L1 influence. Nevertheless, the processing pattern is predicted to be the same in both native and non-native processing. Potential quantitative differences are predicted to disappear with the proficiency (Babcock, Stowe, Maloof, Brovetto & Ullman, 2012; Basnight-Brown, Chen, Maloof, Brovetto & Ullman, 2012; Bowden, Gelfand, Sanz & Ullman, 2010; Coughlin & Trembley, 2015; Feldman, Kostic, Basnight-Brown, Durevic & Patizzo, 2010; Gor & Jackson, 2013; Foote, 2015; Ullman, 2005). In this view, L2 learners can achieve native-like processing since implicit computational mechanisms are available to them (Gor & Jackson, 2013; Uygun & Gürel, 2016).

The supporters of the divergence view, on the other hand, claim that L1 and L2 processing are fundamentally different. The differences are not only quantitative but also qualitative (Clahsen, Felser, Neubauer, Sato & Silva, 2010; Jacob, Fleischhauer & Clahsen, 2013; Neubauer & Clahsen, 2009; Silva & Clahsen, 2008). It is assumed that L2 speakers are less sensitive to the internal structure of morphologically complex words because they do not have access to implicit computational mechanisms that L1 speakers have. Therefore, L2 processing is devoid of native-like parsing mechanisms (Neubauer & Clahsen 2009; Ullman, 2004). Both the shallow structure hypothesis (SSH) (Clahsen & Felser, 2006) and Declarative/Procedural model (Ullman, 2005) hold the divergence view as they assert that L2 processing is different from L1 processing in terms of mental representations and processing routes. For example, the SSH proposes that even if L2 speakers' L1 has a similar morphological system, L1 processing mechanisms do not transfer, in a facilitative fashion, to L2 processing. The Declarative/Procedural model (Ullman, 2004) claims that due to maturational constraints, late L2 cannot implement rule-based computations so they rely on storage of both regular and irregular forms as a function of excessive declarative memory use. Nevertheless, in Ullman's (2005) model, is the possibility that L2 learners may achieve native-like processing as the proficiency level increases has not been completely ruled out.

1.2 The current study

Against this background, this study aims to contribute to mental lexicon research by examining native and non-native speakers' processing patterns of morphologically complex inflected and derived words in Turkish. The processing patterns of L2 speakers will be compared to those of L1 speakers in order to identify the similarities and differences between L1 and L2 processing. More specifically, the study aims to investigate whether L1 and L2 Turkish speakers employ differential or similar processing mechanisms (decomposition or full listing) for morphologically complex verb forms and whether or not L2 proficiency plays a role in this. The study also aims to contribute to the discussion regarding the dichotomy between inflectional and derivational morphology and the role of root and surface frequency in the processing of these two types of morphology

1.3 Overview of the dissertation

Chapter 2 will discuss various linguistic issues regarding the differences between derivational and inflectional morphology. Chapter 3 will review the psycholinguistic models of the mental lexicon and previous L1 studies testing these models. Following this, in Chapter 4, L2 studies examining the processing of inflectional and derivational morphology will be discussed. Chapter 5 will present the methodology used in the study along with the description of the tasks and items employed. The results and their interpretation in reference to previous research findings will be presented in Chapter 6. The implications of the findings and suggestions for further research will be included in Chapter 7.

1.4 Definition of key terms

Cross modal priming: A paradigm which involves an auditory stimulus as a prime followed by a target word that is presented visually on a computer screen.

Decomposition: Processing or representation of a morphologically complex word-based on its morphemic unit(s).

Full listing: Storage or processing of morphologically complex words as a whole (also referred to as the direct access route).

Lexical decision task: A procedure in which participants decide whether a given stimulus is a real word or not in a given language.

Masked priming: A paradigm developed by Forster & Davis (1984) in which a prime is presented for a very short time between a mask and a target word. It is assumed to tap into implicit processes since the prime is not consciously visible to the participant.

The mental lexicon: An abstract mental dictionary which contains semantic, phonological, orthographic and morphological characteristics of words.

Repetition priming: The change in a response to a stimulus when being exposed to same stimulus more than once.

Root (stem-cluster, base) frequency: Frequency count of the root or the frequency of all variants of the root.

Surface (whole word frequency): The frequency of morphologically complex form of a word.

CHAPTER 2

LINGUISTIC BACKGROUND

As noted in the introduction section, this thesis investigates whether native speakers and late L2 learners of Turkish will demonstrate a differential pattern in processing inflectional and derivational morphology. Therefore, it is necessary to look at the theoretical views and assumptions regarding the differences between inflectional and derivational morphology. As can be seen in the discussion below inflectional and derivational morphology are traditionally distinguished on the basis of several properties that are inherent in each morphological process.

As it will be summarized below, theoretical models of morphology do not converge on the question of whether inflectional and derivational processes need to be treated as unified or separate phenomena. It is important to note, at this point, that the current study does not aim to provide linguistic analyses to support or to refute these theoretical models. Rather it aims to contribute, indirectly, to this theoretical discussion by providing processing data to show whether theoretical distinctions assumed between inflectional and derivational morphology have a psycholinguistic basis.

2.1 Distinctions between inflectional and derivational morphology

In traditional linguistic descriptions, a distinction has been drawn between inflection and derivation. The following characteristics are generally accepted as the main features that distinguish inflectional and derivational processes:

Inflectional morphology is part of syntax while derivational morphology is part of lexis (Anderson, 1992; Perlmutter, 1988). Inflectional morphology entails inflectional affix attachment to a stem and it marks the syntactic feature of the word. Among the typical inflectional morphemes are tense, aspect, gender and case. Inflectional processes change neither the semantic properties nor the grammatical category of the stem. Additionally, inflection is context-sensitive, that is; it is dependent on the grammatical context in which they appear (Anderson, 1992). In other words, the grammatical context determines the type of inflection required.

Derivational morphology, on the other hand, involves formation of new words or new lexemes (Matthews, 1991). These newly formed lexemes carry meanings and represent syntactic categories different from the stem to which they are attached. Unlike inflected words, derived word forms may undergo further inflectional operations or subsequent compounding.

The general distinguishing properties of inflectional and derivational morphology are listed by Blevins (2001, p.213/214) as follows:

a. Inflection is monotonic, adding but not changing morphosyntactic features.
b. Inflection is paradigmatic, defining new inflected forms of existing lexemes.
c. Inflection is relevant for syntagmatic dependencies (see also Anderson, 1982)
d. Inflection tends to be fully productive and semantically transparent.
e. Inflectional exponents tend to occur on the periphery of a complex word.

As listed below, general properties of derivation differ from those of inflection:

a. Derivation may be destructive, changing as well as adding features.
b. Derivation may create new lexemes, which may have their own inflectional paradigm.
c. The input to a derivational process is not usually syntagmatically relevant.
d. Derivational processes may be idiosyncratic or apply within sub-lexicons.

e. Derivational exponents tend to occur close to the root, forming a derived stem.

Despite these general distinctions between inflectional and derivational morphology, there is no consensus among theoretical linguists as to whether inflection and derivation should be treated similar or different.

For example, in line with the above classification based on the differences between inflectional derivational morphology, the theory of Split Morphology has been proposed (Perlmutter, 1988; Anderson 1982). This so-called “Split Morphology” account is based on the assumption that inflectional and derivational morphology are separate parts of the grammar (Anderson, 1992; Perlmutter, 1988; Scalise, 1984, 1988); that is, while inflectional morphology is part of syntax, derivational morphology is a part of lexis (e.g., Bauer, 2003, 2004). Anderson’s (1992) A-Morphus Morphology drawing on Aronoff’s (1976) analyses also argues for a distinction between the two types of morphological processes. Anderson (1992) postulates that inflectional and derivational processes are distinct in that derivation is a pre-syntactic component of the grammar, whereas inflection is post-syntactic. Derived lexemes are created on the basis of their stem forms by the pre-syntactic component and those lexemes are integrated in syntactic structures that are generated by the syntactic component.

An earlier variant of the Split Morphology account assumes a level ordering of morphological rules for English (Kiparsky, 1985). According to this approach, all morphology is pre-syntactic. Morphological rules are ordered in two or more levels. For instance, inflectional rules are at the last level of the lexical component of grammar and derivation comes before inflection. Therefore, inflection is predicted to be peripheral to derivation. However, the irregularly inflected forms are exceptions to the rule as they can feed word formation in some cases like in compounds.

Kiparsky's Lexical Phonology place both inflectional and derivational processes on a single system although they treat inflection and derivation on different levels in the level ordering component of the model. The Lexical Phonology model proposed by Kiparsky (1982, 1985) is a theory about the organization of grammar. It is concerned with the relationship among phonology, morphology and the lexicon. It assumes that all morphological processes and many phonological processes are performed in the lexicon. Therefore, it is assumed to be a stronger version of the so-called the Lexicalist Hypothesis. The basic assumption of the model is that lexical phonological rules may have to apply to both derived and inflected words. The lexicon is assumed to have a layered structure. Since morphology and part of phonology are carried out in the lexicon, there should be an interface between those two components (see also Booij, 1981).

The concept of Level Ordering has been developed by Wiese (2000), who classifies affixes as class I and class II affixes, which attach to the roots and to the stems, respectively. Three lexical levels in the lexicon have been proposed in this view. The properties of class I morphology are associated with the first level in the lexicon. Those affixes may carry stress or affect the stress of their base. Class II affixes, on the other hand, do not carry word stress and belong to the second level in the lexicon. Regular inflectional rules exist in the third and the last level of the lexicon whereas the irregular inflectional rules are located at level one. In other words, word formation takes place in levels one and two, preceding regular inflection, which means regular inflection is expected to be peripheral to derivation.

In this version of Lexical Phonology/Morphology model, level I is associated with root, level II with stems, and level III with words. This means, derivational processes are performed on roots (level I) and stems (level II) while regular inflectional processes are applied in level III which results in inflected words.

To sum up, the Lexical Phonology/Morphology model treats both morphological processes as parts of a single system even though inflection and derivation are placed at different levels of the model's level ordering component. In other words, inflectional and derivational morphology are located in the same subcomponent of the grammar.

Theoretical accounts that treat inflectional and derivational morphology separately such the Split Morphology model have been challenged on the grounds that there is no need to draw a clear distinction between inflection and derivation. The main argument against a dichotomy between inflection and derivation is that inflectional and derivational rules operate in a single domain of word formation. The skeptical approach, Distributed morphology (DM), claims that all word formation is syntactic (Embick 1998; Marantz 1997; Halle & Marantz 1993; Travis 1999). Proponents of DM challenge the existence of a lexicon and claim that there is no specific component of word formation or a morphological component as syntax operates all the way down to morphemes. That is, the syntactic structure determines the properties of both phrases and morphemes. Thus, the properties of morphemes are derived from the grammatical configuration and their relative positions.

Despite the lack of convergence among the theoretical models of morphology as to whether or inflection and derivation should be treated separately, differences between inflection and derivation have still been largely acknowledged and led to considerable debates in the literature.

The debate has basically centered on the criteria to be used in order to distinguish the morphological processes of inflection and derivation. Among the criteria discussed in this context include obligatoriness, syntactic relevance, syntactic category change, productivity, semantic transparency.

With respect to the first criterion, it was suggested that unlike derivation, inflection is an obligatory process. For instance, in English each noun has to be marked as either singular or plural. Even though there is no overt marking for singular nouns and abstract nouns, they need a singular verb agreement. Similarly, in languages with a case system, nouns need to be marked with a specific case. On the other hand, derivation is not an obligatory process as it is made for semantic reasons (Booij, 2006). To exemplify, the use of the word, *doer* as an agent form of the verb *do*, which is created by the suffix *–er* is considered to be a choice made by the speaker but not as an obligatory process.

A second criterion used to distinguish inflection and derivation is the syntactic relevance. For example, Anderson (1992) argues that syntax is engaged in the interrelations between words within larger structures (e.g., phrases, clauses) while morphology is concerned with the internal structures of the words. Anderson (1982, p.587) also asserts that inflection is part of morphology which is relevant to syntax. Given that a property is assigned to words in order to make an essential reference to bigger syntactic structures, this property is syntactic. Therefore, an agreement rule which causes an item to agree with another item in a larger syntactic structure is inflectional. Similarly, configurational properties such as case are inflectional since they are clearly assigned to larger structures in which they appear.

However, the syntactic relevance criterion has been challenged by examples from different languages in which the distinction between inflection and derivation is not transparent. For example, there are languages in which inflection is not guided by syntax. In Latin, for instance, the accusative form of the word *Roma* is *Romam* and it can either function as the direct object of a word or an adverbial phrase (Booij, 2005, pp. 105-106). In the second case, the accusative form is not required by the syntactic case but by the semantic case. On the other hand, some derivation may prove to be relevant to syntax. Booij (2005) accounts for this by defending that since derivation includes a syntactic category change, it is already relevant to syntax. Booij (2005) supports the relevance of derivational processes to syntax with an example of derivation of causative verbs that require the obligatory presence of direct object. Therefore, derivation of causative verbs has syntactic relevance.

Another problem with syntactic relevance is that the same category may be inflectional in some languages but derivational in others (Anderson 1982).

A third controversial issue in the distinction of inflection and derivation is concerned with the syntactic category change of derived forms. Scalise (1988, p. 564) argues that derivational processes always change the syntactic category of the base forms. However, many have argued that the fact that derivation creates new lexemes does not necessitate that all derivation must be lexeme-creating or that all inflection must be lexeme-preserving. Stump (1998, p. 15) claims that a derived form which has a different meaning does not necessarily entails a change in the part of speech. The form *reread* derived from *read* has a different lexical meaning but the category of the stem has not changed by the derivational process. Therefore, some derivation can be category-preserving. Similarly, some inflectional processes such as participle formation leads to a change in the syntactic class as participles are considered adjectival in many languages.

In order to account for the category change controversy, Booij (1994) defines two types of inflection, namely inherent inflection and contextual inflection. Inherent inflection includes the category number of nouns, comparative and superlative degree of adjectives, tense and aspect for verbs, infinitives and participles. This type of inflection may have syntactic relevance. Contextual inflection, on the other hand, is dictated by syntax and includes person and number markers on verbs which establish the agreement with subjects and/or objects, agreement markers for adjectives and structural case markers on nouns. Inherent inflection, such as gender of noun or tense of verbs, is similar to derivation and it feeds word formation whereas contextual inflection cannot feed derivation and is peripheral to derivation.

A further separation between inflection and derivation is that inflection is considered to be more productive compared to derivation (Stump, 1998: 16). This generalization is based on the assertion that inflections can be added to every word given that they are from the same grammatical category. In addition, inflectional processes can be applied to novel words to create inflected forms. Derivation, on the other hand, is assumed to have limited productivity. However, it is possible to find fully productive derivational affixes in different languages. The productivity-based distinction between inflection and derivation has also been challenged by Booij (2006) that exemplifies one case from English plurals. English plural nouns are formed by the productive suffixation with one of the allomorphs of the suffix /z/ but some Greek-origin words like *prolegomenon/prolegomena* are created by adding the suffix *–on*. Similarly English irregular past tense forms do not apply to the general productivity assumption.

Semantic transparency is yet another aspect discussed among linguists with respect to the differences between inflection and derivation. A complex word can be considered semantically transparent if its meaning is a transparent combination of the meanings of its constituents. A semantically opaque complex word, on the other hand, can be defined as the one whose meaning cannot be combined out of the meanings of its constituents. Applied to inflection and derivation processes, it is argued that inflection does not change the semantics of the stem. Therefore, the meanings of the inflected forms are predictable. In contrast, derivational processes change the meaning of the stem they are attached to and thus unpredictable (Bybee, 1985).

Another distinction between inflection and derivation is drawn on the basis of lexicalization. Derivational processes may create new words of which the meaning cannot be deduced from the sum of its parts. On the other hand, inflection creates compositional forms; that is, the meaning of the complex word can be predicted on the basis of the meanings of its parts. For instance, the affix '-ion' in English may derive lexicalized items such as 'transmission' which requires effort to understand the compositional meaning (Lieber, 2016).

The last property in the inflection/derivation distinction is that inflection is expected to be peripheral to derivation (De Groot, 1966). This assumption is in line with Greenberg's Universal 28, which states that "*if both the derivation and the inflection follow the root, or they both precede the root, the derivation is always between the root and the inflection*" (Greenberg, 1963:93).

This generalization has been challenged on the basis of cross linguistic evidence by Booji (1994, 1996), who argues that in various languages inflection feeds derivation. To illustrate, in English, participles that have both verbal and adjectival properties can function as stems for de-adjectival forms such as *excitedness*. Comparative forms are classified as inflectional forms but in Dutch, the comparative forms of adjectives can feed derived verb forms. *Erg* is the adjective which means *bad* and the comparative form *erg-er* functions as the stem for the verb *ver-ger-er* (to worsen). Similarly, Dutch plural nouns may be used as stems for derivation as in *held-en-dom* (*heroism*). In this example, *held* 'hero' is followed by the plural inflection *–en* which is further followed by *–dom* that is the collective suffix, forming the morphological structure root-plural-collective. Evidence against split morphology appears in compounding. In Italian, plural nouns are used to form compound nouns although the final meaning can be singular. In order to derive the compound *dishwasher* the verbal stem *lava* 'to wash' and the plural noun *piatta* 'dishes' are combined (Booij, 2006).

In the light of the above arguments Blevins (2001:216/217) redefines some of the properties of derivation.

Derivational properties (revisited):

a. Only derivation is destructive, but not all derivation is destructive.
b. Only derivation may create new lexemes, but not all derivation creates new lexemes.
c. The input to a derivational rule is not syntactically relevant, but the output may be.
d. Derivational processes may be, but need not be, idiosyncratic or restricted.
e. Derivation occurs inside inflection, but not all peripheral exponents are inflectional.

As the discussion above suggests, the controversy regarding inflectional and derivational morphology has not been resolved. Nevertheless, these theoretical discussions are also relevant to psycholinguistic studies testing inflected and derived word processing. Any processing differences between inflectional and derivational processes may be considered supporting evidence for the theoretically-driven distinction between these morphological processes. Therefore, several psycholinguistic studies have been conducted to understand how different types of complex words are represented in the mental lexicon and how they are processed.

Having briefly discussed the arguments in morphological theory and traditional distinctions drawn between inflectional and derivational morphology and their relevance to psycholinguistic studies, the next section will be devoted to the morphological structure of English and Turkish. A general descriptive overview of the morphological systems of two languages will be provided in this section. It is important to note that theoretical (psycho) linguistic work on inflectional and derivational morphology is also relevant for (second) language acquisition. L1 and L2 acquisition and processing data might be relevant to test theoretical taxonomies and distinctions.

In the section below a brief overview of English inflectional and derivational morphology is provided. Following that inflectional and derivational morphology in Turkish will be discussed with examples.

2.2 The morphological characteristics of English

The inflectional system of English is not very rich; therefore, English is generally regarded as an inflectionally limited language. Nevertheless, English derivational morphology is richer and more varied (Blevins, 2006). The English morphological system comprises both suffixes and prefixes. While inflected forms are produced through suffixation, derived word forms are produced by either suffixation or prefixation (Plag, 2003). Similar to other languages, inflectional morphology does not change the grammatical class of the words or does not form a new lexeme. Inflectional morphology marks a variety of functions such as number, tense, aspect, gender, case that produces new forms of the same word. Derivational morphology is related to lexis and, unlike inflectional morphology, it does not play a role in realization of morpho-syntactic features (Perlmutter, 1988; Anderson, 1992).

2.2.1 Inflectional morphology in English

The inflectional system of English basically consists of a regular subsystem with some limited irregularities (Blevins, 2006). In English, there are eight bound inflectional morphemes; four are attached to verbs, two are attached to nouns and two attached to adjectives. The third person singular present agreement marker –s is orthographically and phonemically the same as the plural marker –s. Past tense and past participle forms are marked by the morpheme –ed and the progressive is marked by –ing. Possessive –s is attached to nouns like plural marker –s and comparative (–er) and superlative (–est) are attached to adjectives.

With reference to irregular inflection, much of irregularity is observed in nouns and verbs, where the irregularity is limited to plural nouns, past tense verbs and past participles. In the adjectival system irregularity is limited to some comparative and superlative formations such as good–better–best and bad–worse–worst. Progressive –ing and present tense marker –s are regular (Blevins, 2006).

Past tense inflection in English has also been a matter of particular interest in (psycho) linguistic studies due its dual forms. The regular past form entails attachment of –ed suffix to bare verbs (e.g. start-ed, want-ed, talk-ed etc.) while the irregular form requires some form of sound changes in the bare verb form (e.g. sell-sold, keep-kept, teach-taught etc.). The regular past tense suffix –ed has three allomorphs which are dependent on the phonological properties of the stems. The allomorphy of regular past tense is phonologically conditioned and realized as /t/ with verbs which end in a voiceless sound (e.g. picked, talked), as /d/ with verbs ending in a voiced sound (e.g. loved, saved), and as /əd/ with verbs ending in alveolar stops /t/ and /d/ (e.g. wanted, waded).

2.2.2 Derivational morphology in English

Derivational morphology in English is more productive compared to the inflectional system. Derivational affixes are basically divided into two classes: neutral affixes and non-neutral suffixes. Neutral suffixes are attached to free morphemes (i.e. the stems that can stand alone to function as words) and the meaning of the derived word is transparent (Kiparsky, 1982). In other words, the semantic relatedness between the stem and the derived word is preserved. Additionally, this type of derivational process does not alter the stress pattern of the stem or the spelling of the root. Neutral affixes are more productive (e.g. happ(y) + ness = happiness, govern + ment = government.

Non-neutral affixes, on the other hand, are generally attached to bound morphemes (i.e. the stems that cannot stand alone as words) and they usually cause the stress to shift when added to stems (Kiparsky, 1982). They may change phonological segments; and the semantic relatedness between the stem and the derived word usually disappears (e.g. san + ity = sanity, univers + ity = university, virtu(e) + al = virtual). Non-neutral suffixes are limited in usage.

As discussed above English inflectional morphology is more limited compared to the derivational system. The following section briefly highlights the corresponding linguistic features in Turkish.

2.3 The morphological characteristics of Turkish

Turkish is an agglutinative language with a rich morphological system. Due to its productive and rich morphology, it is possible to attach around 2000 inflectional items to a verb (Hankamer, 1989). It is technically possible to produce words with infinite length with iterative loops (Durgunoğlu, 2006). Such an operation may lead to extremely long words that would be expressed in a phrase, clause or sentence in non-agglutinative languages. One of the longest words possible in Turkish is exemplified with the following example (Ketrez, 2012, p.1):

(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?’

In Turkish, the main word formation process is suffixation (i.e. attaching a suffix to the right side of the root). Although it is possible to attach numerous suffixes to a root, the order of attachment is not arbitrary. In Turkish, inflectional and derivational suffixes that are attached to the stem do not change the orthographic and phonological form of the stem and this property makes it possible to detach those affixes (Çotuksöken, 2011). Several suffixes can be attached to a stem. However, in practice two or three suffixes are added to a verbal or nominal stem (Ketrez, 2012). The order of suffixes can be altered. However, the same suffix cannot be attached to a stem consecutively. In majority of cases, except for clitics, derivational suffixes precede inflectional ones Göksel & Kerslake, 2005).

(2) oda-lar-ımız-dan

'room-pl-2plposs-abl'

The above example illustrates the possible order of morphemes that could be attached to the root *oda* (room). The plural suffix *-ler* should precede the possessive suffix *–ımız (2pl possessive*) and the ablative *-dan* needs to follow the possessive marker. Hence, a word like **odamızlardan* is not a possible word in Turkish.

Another aspect of Turkish morphology is related to the phonological structure of a word. The vowels in almost all suffixes depend on the vowels that precede them in accordance with the vowel harmony rules. Table 1 shows the properties of vowels in Turkish.

Table 1. Vowels in Turkish

	Front		Back	
	-round	+ round	-round	+ round
High	i	ü	ı	u
Low	e	ö	a	o

(Adapted from Kornfilt, 2009, p. 522).

In Turkish there are two basic types of vowel harmony. The first one is internal vowel harmony and it applies to the internal structure of a word. External vowel harmony, on the other hand, applies to the suffixes added to a word (Ketrez, 2012, p. 8). According to internal vowel harmony, a Turkish word can have all front vowels or all back vowels. Borrowed words may not follow this rule.

External vowel harmony applies to the suffixes attached to a verbal or nominal stem and it is determined according to the last vowel of the word. There are two different types of external vowel harmony. The first is two-fold vowel harmony which alternates between two vowels, namely "a" and "e". In two-fold vowel harmony (A-type), the vowel of the suffix agrees with the frontness or backness of the preceding vowel. Table 2 below illustrates A-type vowel harmony. For instance, the plural suffix has two forms, *-lar* (as in *araba-lar* 'cars') and *–ler* (as in *ev-ler* 'houses'). Table 2 demonstrates the two-fold vowel harmony in Turkish.

Table 2. A-type or two-fold vowel harmony in Turkish.

Preceding vowel	Suffix	Examples
Front (e, i, ö, ü)	-ler	ev-ler, iş-ler, çiçek-ler
Back (a, ı, o, u)	-lar	araba-lar, oda-lar, sokak-lar

(Adapted from Ketrez, 2012, p. 8)

The second type of external vowel harmony is four-fold or I-type vowel harmony and it applies to suffixes with a high vowel. They get their frontness and roundness features from the preceding vowel. When I-type suffixes are attached to a word, these fronting and rounding harmonies determine whether the vowel of the suffix will be 'i', 'ı', 'ü' or 'u' (Göksel & Kerslake, 2005, p.22-23).

Besides vowel harmony, Turkish also exhibits consonant harmony which ensures that the consonants of the stem and the suffix agree in voicing. If the stem ends in one of the voiceless consonants 'p', 't', 'k' or 'ç' and a suffix beginning with a vowel is attached, they alternate into their voiced counterparts that are 'b', 'd', 'g/ğ' or 'c' respectively. In a similar vein, the initial consonant of a suffix relies on the final consonant in the stem and is subject to alternation. The past tense and perfective suffix *–DI* in Turkish, for instance, has eight different forms *–dı, -di,-du, -dü, -tı, -ti, -tu, -tü* (as in *gel-di* 'came' but *git-ti* 'went') (Görsel & Kerslake, 2005). The voiceless consonant *–l* at the end of the word *gel* 'come' calls for *–dI* whereas the voiced consonant *–t* as in *git* 'go' requires *–tI* as past tense marker. Table 3 demonstrates I-type vowel harmony and consonant harmony together with examples that are relevant with the target inflectional and derivational morphemes (i.e., -DI, and –GI) tested in this study.

Table 3. I-type or four-fold vowel harmony and consonant harmony in Turkish.

Preceding vowel	Suffix	Examples
a or ı	-GI /-DI	bas-kı, bas-tı
u or o	-GI /-DI	sor-gu, sor-du
e or i	-GI /-DI	ser-gi, ser-di
ü or ö	-GI /-DI	ör-gü, ör-dü

In Turkish, vowels cannot occur next to each other. Therefore, when a vowel-initial suffix is attached to a stem ending in vowel, either the initial vowel of the suffix needs to be deleted or the inter-vowel (buffer) '–y' is attached to the stem. As a result, suffixes in Turkish are classified under two groups: the ones that lose their initial vowel and those that can acquire the inter-vowel consonant 'y'. Examples of the first type include 1st person possessive suffix -*(I)m,* the aorist suffix -*(A/I)r* and the adjectival suffix -*(I)mtrak*. Some examples of the second type of suffixes which take the consonant 'y' are the converbial suffix -*(y)IncA*, the dative suffix -*(y)A* and the future marker -(*y)AcAk*. Most inflectional suffixes are of this type (Göksel & Kerslake, 2005, p. 44).

As exemplified above, in Turkish almost all suffixes have variants because they are subject to vowel and/or consonant alternations depending on the consonants or vowels preceding them. Therefore, phonological properties of stems are significant in selecting the appropriate form of a suffix. In the following section inflectional and derivational morphology of Turkish are discussed.

2.3.1 Inflectional morphology in Turkish

Inflectional morphology in Turkish appears in the nominal and verbal domain. Nominal inflection consists of suffixes marking number, possession and case. The order of nominal inflectional suffixes is predictable in Turkish. The only plural suffix is *–lAr* appears first following the stem and is followed by possessive marker that indicates the person of possessor. The case marker appears last in the order of nominal inflection except for some exceptional cases. In other words, the order of nominal inflection is as follows: Stem- number- possession-case

(3) ev-ler-i-ne
home-pl-2sg.poss-dat

(4) The forms of the possessive suffixes attached to pronouns.

1st person singular	*-(I)m*	‘my’
2nd person singular (familiar)	*-(I)n*	‘your’
(formal)	*-(I)nIz*	‘your’
3rd person singular	*-(s)I(n)*	‘his’, ‘her’, ‘its’
1st person plural	*-(I)mIz*	‘our’
2nd person plural	*-(I)nIz*	‘your’
3rd person plural	*-lArI(n)*	‘their’

(5) Possessive markers attached to a noun

ev-im	‘my house’	*araba-m*	‘my car’
ev-in	‘your house’(familiar)	*araba-n*	‘your car’
ev-iniz	‘your house’(formal)	*araba-nız*	‘your car’
ev-i ‘	‘his/her/their house’	*araba-sı*	‘his/her/their car’

ev-imiz	'our house'	*araba-mız*	'our car'
ev-iniz	'your house'	*araba-nız*	'your car'
ev-leri	'their house(s)'	*araba-ları*	'their car(s)'

(Taken from Göksel & Kerslake, 2005:66)

Case morphemes in Turkish are bound suffixes and they are the most productive ones among bound suffixes which mark the syntactic functions of noun phrases (Kornfilt, 1997). Turkish has five case suffixes:

1. Accusative	-(y)I	ev-i, masa-y-ı, kitab-ı
2. Dative	-(y)A	ev-e, masa-y-a, kitab-a
3. Locative	-DA	ev-de, masa-da, kitap-ta
4. Ablative	-DAN	ev-den, masa-dan, kitap-tan
5. Genitive	-(n)In	ev-in, masa-nın, kitab-ın

There are two types of verbs in Turkish: finite and non-finite. The possible inflectional suffixes with finite verbs are as follows:

1. voice suffixes: causative, passive, reflexive and reciprocal suffixes
2. the negative marker
3. tense/aspect/modality markers
4. copular markers: -*(y)DI*, -*(y)mIş*, -*(y)sA*
5. person markers (Göksel & Kerslake, 2005, p. 69).

Finite verbs have to be marked with a person; however, third person singular is not overtly marked in Turkish. The absence of a person marker indicates third person singular in Turkish. The order of suffixes that appear with finite verbs is also predictable:

root-voice-negation-tense/aspect/modality-copular marker-person marker-*dir*

(6) Döğ -üş -tür -t -ül -me -yebil-iyor -muş -sunuz -dur

beat -rec-caus-caus-pass -neg -psb-impf -ev.cop -2pl –gm

‘It is presumably the case that you sometimes were not made to fight.’

(Göksel & Kerslake, 2005, p. 70)

Non-finite verbs may appear with the following suffixes:

I. voice suffixes
II. the negative marker
III. tense/aspect/modality markers
IV. subordinating suffixes
V. nominal inflectional suffixes

(Göksel & Kerslake, 2005, p.70).

Non-finite verbs are obligatorily marked with a subordinating suffix (subordinator).

root-voice-negation-subordinating suffix-nominal- inflectional markers (Göksel & Kerslake, 2005, p. 70).

(7) bak -tır -ma -dığ -ın -dan
check -caus -neg -sub -2sg.poss –abl

‘because you haven’t had [it] checked’, ‘from the one you didn’t have checked’

2.3.2 Derivational morphology in Turkish

Turkish is rich in derivational morphology. Aksan (1987) estimates that Turkish has more than 100 derivational morphemes and each derivational morpheme has multiple functions and meanings. Due to processes like vowel harmony and (de)voicing rule, allomorphy is limited to phonologically predictable alterations (Kornfilt, 1997). The majority of derivation is achieved by suffixation, though there are instances in which prefixation is used for reduplication. Those words are only a few loan words. Compounding is another type of derivation possible in Turkish.

Some derivational suffixes change the class of the word they are attached to such as *–GI* (e.g., sev, 'love' (verb); *sev-gi* 'love' (noun) whereas others create words of the same class as the stem to which they are attached. For instance the suffix *–CI* derives nouns from nouns as in *diş-çi* ('tooth'- 'dentist'). When a derivational suffix is attached to a word, the meaning of the derived word may stay related to the meaning of the stem (Göksel & Kerslake, 2005).

The particular derivational suffix that a word can take cannot be anticipated. For instance, the suffixes *–lA*, *-lAş, -(A)l* and *–(A)r* create verbs from adjectives but the adjectives that they are attached to cannot be predicted on the basis of a grammatical rule as can be observed in the following examples (Göksel & Kerslake, 2005, p.52).

(8)	Temiz 'clean'	temiz-le 'to clean'
	Dar 'narrow'	dar-laş 'to become narrow'
	Kısa 'short'	kısa-l 'to become short'
	Kaba 'puffy'	kaba-r 'to swell'

Some of the derivational suffixes in Turkish are unproductive (Göksel & Kerslake, 2005). Some of those suffixes are found in words that are presently in use but they are no longer identified as usable in the creation of new words by the speakers. For instance the derivational suffix *–gAç* as in *süz-geç* 'filter' is an example of such suffixes. According to Göksel & Kerslake (2005), productivity of derivational suffixes is determined by the consistent meanings of suffixes and the way they are freely used with a particular type of stem. The suffix *–lI* is attached to all place names and the derived forms acquire the meaning that the person is from a place or is native of the place specified:

(9) Londra-lı Londoner

İzmir-li from İzmir

Similarly, the target suffixes –DI and –GI included in this study are considered productive as they have a consistent meaning and can be attached to a particular stem freely. For instance, past tense maker –DI can be attached to any verbs and the meaning implies that the action was done in the past. –GI derives nouns from verbs and can be attached to majority of the verbs.

Turkish allows for iterative loops in derivational process (Durgunoğlu, 2006). There is no specific rule regarding combination of derivational suffixes. However, two cases seem to apply to majority of cases. Firstly, unproductive suffixes are not likely to co-occur. Secondly, productive suffixes tend to follow the unproductive ones. For example the unproductive suffix *–An* precedes the productive suffix *–lIk* in the derived word *bak-an-lık* (bak 'look', bak-an 'minister', bakanlık 'ministry') (Göksel & Kerslake, 2005, p. 63).

In line with the aims of this study, the verbal inflection morpheme (*-DI*), which marks past tense, and the derivational morpheme (*-GI)*, which derives nouns from verbs, will be discussed in the following section. The morphemes –DI and –GI are chosen in this study because the aim is to compare the processing of complex words (derived and inflected) that share the same root. For example, the items included inflected forms (e.g., *sevdi* (sev + di), 'love'-past tense suffix, 'loved' and derived forms (e.g., *sevgi* (sev + gi), 'love-noun.') that share the same root, *sev*, ‘love’. Furthermore, based on the individual morpheme frequency counts (e.g., Pierce, 1960), both morphemes have a high frequency count.

As noted above, the suffix – DI is the past tense marker in Turkish. Yavaş (1980) describes –DI as the only verbal inflection that has an unmarked meaning of tense. The allomorphs are *–dı*, *-di*, *-du*, *-dü*, *-tı*, *-ti*, *-tu*, *-tü*. As noted earlier, when it is attached to a verb the appropriate allomorph is attached depending on consonant and vowel harmony. A verb inflected with –DI implies that the speaker has direct experience or involvement of the event (Erguvanlı Taylan, 2015). Without any personal marker, -DI attached to a verb stem conveys 3rd person singular meaning.

(10) al-dı ‘took’
gel-di ‘came’
bul-du ‘found’
gör-dü ‘saw’
at-tı ‘threw’
git-ti ‘went’
tut-tu ‘held’
öp-tü ‘kissed’

The derivational suffix, -*GI* forms nouns from verbs, mostly denoting concrete objects. The allomorphs are *–gı, -gi, -gu, -gü, -kı, -ki, -ku, -kü.*

(11) say-gı ‘respect’
sil-gi ‘eras-er’
kur-gu ‘fiction’
sür-gü ‘bolt’

bas-kı ‘pressure’

tep-ki ‘reaction’

coş-ku ‘enthusiasm’

bil-gi ‘knowledge’

sev-gi ‘love’.

This chapter discussed the basic morphological characteristics of English and Turkish in a descriptive fashion. As noted earlier the target language in this study is Turkish, and the particular morphological forms that are being examined are past tense –DI-inflected complex forms as well as –GI-attached derived words (i.e., nominals derived from verbs). Since both the past tense morpheme and the derivational morpheme can attach to verbs, this would provide grounds to study potential differences between the processing of inflected and derived words sharing the same stem. Although the morphological processing of English inflectional and derivational morphology is not in the scope of this study, the section included a brief note on English because the participants in the study are all native speakers of English and the morphological system in their native language may be relevant in the way they process corresponding morphology in L2 Turkish, even though this is not directly examined in the current study.

The complex word formation through inflection and derivation has raised questions regarding their lexical representations and processing mechanisms. Psycholinguistic studies have been interested in how those complex words are represented in the mental lexicon and how they are produced and comprehended by both L1 and L2 speakers of a particular language. Native language processing of complex words has been investigated by several researchers from various perspectives (Ford, Davis & Marslen-Wilson, 2010; Longtin, Segui and Halle 2003; Rastle, Davis, Marslen-Wilson & Tyler, 2000; Sonnenstuhl, Eisenbeiss & Clahsen , 1999; Clashen, 1997 among many others). Other researchers have examined how those complex word forms are processed by L2 speakers (Silva & Clahsen, 2008; Diependale et al., 2013; Kırkıcı & Clahsen, 2013; Clahsen & Neubauer, 2010 among many others). All those studies have addressed the processing mechanisms within the storage versus decomposition debate. The next chapter will discuss those psycholinguistic studies in detail.

CHAPTER 3

PSYCHOLINGUISTIC MODELS OF THE MENTAL LEXICON

In this chapter, the main morphological processing models will be presented with reference to their views of storage and computation of morphologically complex words. Firstly, single mechanism models will be reviewed briefly. Following this, hybrid (dualistic) models that take an intermediary position between the single mechanism models will be reviewed.

3.1 Models of visual word recognition

The role of morphological structure in language processing has been one of the main concerns in psycholinguistic research. Almost four decades of work on this issue have proposed that the morphological structure of a complex word plays an important role in language decoding. Initial work in this area focused mostly on native language (or first language) processing of inflected and derived words in various languages. Morphological processing research with native speakers has not revealed conclusive findings to support either the single mechanism models or dual mechanism models. Therefore, there has been a considerable debate as to whether word recognition is based on the properties of morphological constituents of a word or on the properties of the whole word (e.g., Forster, 1976; Kempley & Morton, 1982; Manelis & Tharp, 1977; Taft & Forster, 1975). Consequently, two main models of morphological processing have been proposed namely, single mechanism models and dual (hybrid) models.

The single mechanism models share the premise that all morphologically complex words are represented in the same way. Two main variants of these models are the full fisting model and the decomposition model. The full listing hypothesis assumes that the lexicon is a store of full forms and access to lexical representations is not through their individual morphemic units (Butterworth, 1983; Manelis &Tharp, 1977). The decomposition model, on the other hand, asserts that complex words are decomposed into their morphological constituents at the initial stages of word recognition. Any meaningful subpart may be used as the basis of access to words in the mental lexicon. In between those two models of morphological processing, some dual mechanism models have been proposed regarding the representation and access of multi-morphemic words in the mental lexicon (e.g., Schreuder & Baayen, 1995). In the following section all those models will be discussed in more detail.

3.1.1 The full listing model

The full listing models assume that each morphologically complex word is stored as a single unit in the mental lexicon and word recognition involves direct retrieval of this word unit. Accordingly, the morphological structure of a complex word does not play a role in language production and comprehension. It is assumed that even multi-morphemic words are lexemes and hence word primitives. Morphologically complex words are not parsed into morphemes because each morphological variant of a base constitutes a separate lexical entry (Butterworth, 1983; Henderson, Wallis & Knight, 1984; Manelis & Tharp, 1977; Rubin, Becker & Freeman, 1979). Because each affixed variant of a base constitutes a separate entry, full listing models suggest a system that requires a large amount of storage capacity; nevertheless, because each word is recognized as a single unit, there would be saving in linguistic computations.

The full listing models, in a sense, share similar assumptions with Connectionist models, which commonly assume that simple as well as complex words are stored in the associative memory as distributed representations and there are connections between them. In this view, the morphological structure is not explicitly represented in the mental lexicon. Rules are only descriptive entities and morphological relationships can be derived from associations between words. In other words, in the access procedure, the morphological structure of words is not processed. Rather, words are recognized through a direct mapping procedure (MacWhinney & Leinbach, 1991; Rumelhart & McClelland, 1986). High frequency words build stronger connections and semantic, phonological and orthographic similarities determine the strength of connections between words.

One of the most influential models of connectionist approach is Rumelhart & McClelland (1986)'s parallel distributed processing (PDP) model. The model aimed to simulate children's acquisition of past tense. The model proposes two main parts; a simple associator and a decoding network. The simple associator is meant to learn the relationship between the base form of a verb and the past tense of that word in English. The pattern associator consists of two layers called input unit and output unit. The input unit contains the root form of the verb whereas the output unit contains the pattern generated by the model. Both units represent certain phonological features of the input or output, respectively. The decoding network, on the other hand, is responsible for converting the representation of the past tense form of the input into phonological representation. According to the PDP model, the strength of modifiable connections between the input and output units determines the learning process. On a learning trial the model is given the root form of a verb and its correct past tense form. The pattern associator computes an output and compares it to the correct representation of the past tense form. If the computed output matches the past tense form, no adjustment is needed between the connections. However, if the correct form is not generated, the weights between the input and output units are adjusted accordingly (i.e. either increased or reduced). After many trials, the model was found to be successful in generating the correct past tense forms of verbs that it had never seen before. Thus, it is claimed that the model could stimulate the basic three-stage pattern of children's past tense acquisition (i.e. the U-shaped learning). The model is claimed to confirm that no morphological processing is required in the access of morphologically complex words. Morphological structure can emerge as an outcome of strong connections among nodes.

3.1.2 The decomposition model

The decomposition models assume obligatory pre-lexical morphological analysis of complex words. According to this model, morphemes serve as word primitives. They are the smallest forms of a word stored in the lexicon. Access to those words is only possible by stripping away the affixes from the base forms (Kemply & Morton, 1982; MacKay,1978: Taft &Forster, 1975; Taft, 1981). According to those models, stems and affixes have separate entries in the mental lexicon and all morphologically complex words are parsed into their constituents for processing purposes. This process assumes cognitive economy as fewer lexical units are needed to be stored in the mental lexicon while requiring greater capacity for performance (i.e., for computation) (Hankamer, 1989; Taft & Forster, 1975, Taft, 1985).

The decomposition model that was first introduced by Taft & Forster (1975) assumes a prior morphological analysis of a morphologically complex word that requires stripping of prefixes attached to the word before the lexical representation of the stem is accessed. This obligatory process is referred to as prefix stripping or global affix stripping. According to the original formulation of the decomposition model, the lexical access takes place on the basis of the word's stem. Recognition of the complex word is possible after the prefix component is stripped off. In this model, all affixes are stripped off prior to lexical access of the root. With regard to lexical storage, it is claimed that the internal lexicon is organized in such a way that the stem is stored in conjunction with the possible word formation information such as information about prefixes that can combine with the particular stem. In a further study, Taft (1981) contrasted pseudo-prefixed words with prefixed words in a series of lexicon decision and naming experiments. Pseudo-prefixed words took longer to recognize compared to prefixed and non-prefixed words. The results of these experiments are taken as evidence for an obligatory prefix stripping procedure in lexical access as the longer reaction times for those pseudo-prefixed words are supposed to be the sign of a parsing procedure applied. In other words, those words are not accessed as whole words but are mistakenly treated as prefixed words, which brings extra cost to the access. Taft argued that if a prefix-stripping procedure had not applied, pseudo-prefixed words would not have been mistakenly decomposed.

In more recent formulation of the decomposition model, Taft (1994, 2004) revised his account within the framework of interactive-activation model. The obligatory decomposition model suggests that prefixed words are represented in a decomposed form but pre-lexical prefix-stripping is not necessary. Rather, prefix stripping is an integral part of the accessing process, not a discrete stage. Different from the original formulation of the model, there is no need for any specific storage of prefixes as there is no pre-lexical prefix stripping. The revised model postulates that the units of activation are in a hierarchical manner. The activation starts at the grapheme level and goes up to the concept level which is the highest level in the model. For instance for the word *invent*, the activation starts at grapheme nodes *v,e,n,t* and activation reaches the word units representing *invent, vent* and other words including the body unit *vent* at the same time. The unit *in* is also activated through the same grapheme unit activation procedure and it helps to raise word note *invent*. In other words, morphemes are represented as units and are activated when the letter string contains the compatible orthographic information. The activation within the morpheme units is passed to the units that represent the multimorphemic word (Taft, 1994: 281). Through this process, the morphologically complex word is not actively decomposed prior to the lexical access but accessed via activation of its morphemes (Taft, 1991, 1994; Taft & Zhu, 1995). Crucially, in this view, inflected words containing suffix(es) are claimed to be accessed in the same manner as the prefixed words. In the case of derived words, the access is via a left-to-right repetitive parsing procedure and the stem of a derived word is represented as a unit. Therefore, the derivational suffix should not be stripped off prior to the access.

3.1.3 The hybrid (dual) models

The hybrid models are also concerned with the nature of mental representations included in word recognition. They can be described as a combination of the full listing and decomposition models. Those models have emerged as a result of recent investigations of potential differences between different types of complex words including derived and inflected forms as well as regularly and irregularly inflected words. The basic assumption of dual route models is that there are factors that determine the extent of morphological decomposition (or full listing) in lexical access of morphologically complex words. Among the determining factors are familiarity, frequency, regularity, and transparency. Depending on these factors, morphologically complex words can be recognized via two routes, namely the direct access route, which is based on full form representations of morphologically complex words, and the decompositional route, which requires pre-lexical morphological parsing of the visual stimulus. For example, in the context of regular versus irregular morphology, several studies in favor of dualistic accounts have suggested that all irregularly inflected words are stored as full units, while regular inflections are subject to decomposition. In other words, the root and the inflectional morphemes are stored separately in regularly inflected words (Clahsen, Rothweiler, Woest & Marcus 1992; Marcus, Brinkmann, Clahsen, Wiese, Woest, & Pinker 1995; Pinker & Prince 1988, 1994; Prasada & Pinker 1993; Ullman1999).

Different dualistic models have emphasized different dimensions in relation to the interaction of those two routes. For instance, the Augmented Addressed Morphology model (AAM) of Caramazza, Laudanna and Romani (1988) proposed that the mental lexicon contains both whole-word units and morphemic access units for known words. The full listing component works much faster than the full parsing component; and the parsing module is adopted only when a novel word must be recognized (Laudanna, Cermele & Caramazza, 1997). Chialant & Caramazza (1995) also claim that the access route may be determined by word familiarity. More specifically, the known (i.e., familiar) words are accessed as full forms while the novel words and rare regular words are parsed into constituents. A number of other factors are also implicated in these models. These include the frequency of the complex word and/or its constituents, lexical neighborhood size of a word, morpho-phonological and semantic transparency of the complex word, regularity, affix productivity, and the degree of homonymity of an affix (Baayen et al. 2003, Bertram et al. 2000).

Another model that adopts the dual route view is the Morphological Race Model (Baayen &Schreuder, 1999; Baayen, Dijkstra & Schreuder, 1997; Schreuder & Baayen, 1995) and it suggests that the direct access and the parsing routes are two independent access routes that operate in parallel. When a morphologically complex word is encountered, an attempt at parsing is initiated along with an attempt at direct mapping. The word with a high frequency of occurrence is believed to be recognized on the basis of full form representation. The winning route may also be determined by the morpho-phonological and semantic transparency of a word, its surface frequency and the frequencies of other morphologically related complex words.

The above-mentioned models have emerged as a result of accumulated research conducted initially with native speakers, and later developed on the basis of L2 studies that compared native and nonnative processing. It is important to note that the two major experimental paradigms used in this line of research include simple lexical decision and priming tasks. In both types of tasks, the time and accuracy of word recognition are measured as dependent variables. Unlike simple lexical decision task, in the priming paradigm, the target word is preceded by a prime word presented either very briefly (around 30-60 ms) as a masked prime or longer (60-100 ms) as overt prime. Particularly, the priming modality has allowed researchers to gain insights into a set of factors that determine the processing route that is adopted in accessing morphologically complex words.

The following section presents an overview of L1 studies that rely on these lexical decision paradigms to examine the determining factors playing a role in the processing of L1 morphology (inflectional and derivational) and discusses some basic issues in this line of research as they relate to the current thesis study.

3.2 Issues in psycholinguistic research on morphological processing

As noted earlier, in the mental lexicon research so far, a number of factors have been discussed in relation to the morphological processing patterns adopted in accessing multimorphemic words. While a considerable number of L1 studies have focused on the differences in the processing of regular and irregular morphology (Crepaldi, Rastle, Coltheart, and Nickels, 2010; Pinker & Ullman, 2002 among many others; see also Rızaoğlu (2016) for a recent masked priming study examining regular and irregular past tense inflection in L1 Turkish learners of English), relatively few studies have compared the processing of inflectional and derivational morphology in relation to the role of factors such as frequency, affix productivity, transparency in morphological processing (e.g. Raveh, 2002; Stanners et al., 1979)

In line with the scope of the thesis study, the discussion below focuses only on those studies that used lexical decision paradigms to identify some of the central issues that are relevant for the processing of derivational and inflectional morphemes in the L1. Thus, the discussion below will include the factors that are believed to play determining factors in the processing of complex derived or inflected words.

3.2.1 Factors affecting the processing of morphology

One of the issues that has been subject to much scrutiny as a determining factor in morphological processing is frequency. With the spread of the morphemic view, which postulates that morphologically complex words are decomposed into their constituent morphemes, morphemic frequency has become a matter of particular interest. As noted above, in the psycholinguistic literature, it has been well-established that frequency plays a crucial role in the representation and processing of words in the mind. Specifically, the frequency of the word and/or its constituents determines whether morphemes serve as the basic processing units in word recognition (Ford, Davis & Marslen-Wilson, 2010). Faster and more accurate recognition (as well as naming) of words have been found in high frequency words (e.g., Forster & Chambers, 1973). As will be discussed below, to some extent, this generalization seems to hold for both inflectional and derivational morphemes.

In the literature, the frequency of different components of a complex word has been discussed. The frequency of the root, the affix, the root + affix combination (i.e. surface or whole-word frequency), the cumulative stem/base morpheme frequency (i.e., the sum of the frequencies of all affixed forms that share a particular base morpheme)[1] (e.g., Kostič, Marković, & Baucal, 2003) have been the topic of interest in theoretical psycholinguistic studies (see Alegre & Gordon, 1999; Baayen, Dijkstra & Schreuder,1997; Bertram, Laine & Karvinen,1999; Burani & Caramazza, 1987; Ford, Davis & Marslen-Wilson, 2009; Taft 1979 among many others). To illustrate, while the frequency of a root word such as 'like' would be the summed whole-word frequency of 'like', 'likes', 'liking' and 'liked' (Taft, 1979: 267), the frequency of suffixed forms such as 'likes', 'liked' etc. would be the surface/whole-word frequency. From the perspective of processing pattern, what is crucial here is that high surface frequency may trigger whole-word processing rather than morphemic

[1] In standard theoretical morphological literature, the 'root' refers to the smallest form of a word that cannot be further analyzed morphologically. The 'base' refers to the form to which affixes are attached; the 'stem' is the form to which inflectional affixes are added. For example, in a word such as 'untouchables', the root is 'touch', the root 'touch' can also be considered the base for the derivational suffix –able to attach to produce 'touchable'. The form 'touchable' is now also a base so that the prefix –un can attach to it to produce 'untouchable'.the stem is 'untouchable' to which the inflectional morpheme –s can be added. In many publications, unfortunately these forms are sometimes used interchangeably but while a root can sometimes be a base or a stem at the same time; the reverse does not always hold. Also even though all stems are bases, not all bases are stems (Bauer, 1983). Nevertheless, in the thesis, unless a clear distinction is necessary, these forms are used interchangebly.

decomposition (Schreuder & Baayen, 1995). In contrast, the more frequently a stem (e.g., like) is used as an access unit in recognizing any of the other forms it maps onto (likes', 'liking' and 'liked'), the faster the recognition times will be for all those forms, suggesting a decompositional route (Taft, 1979).

Allegre & Gordon (1999) conducted a series of experiments to investigate the effects of whole-word frequency on representation of regularly inflected complex word forms in English. They manipulated surface frequencies of the complex words with constant stem-cluster frequencies over the experiments. The results suggested that in regular inflectional morphology, whole-word frequency effects were obtained up to a threshold of about six per million frequency values. Above six per million, whole-word frequency effects disappeared and those complex words were maintained to be represented as full forms. On the other hand, below the threshold of six per million complex words were found to have composition representations.

Baayen, Dijkstra & Schreuder (1997) examined the effects of surface frequency on processing of Dutch singular and plural nouns using a visual word recognition task. They conducted three experiments and the first two experiments including singular and plural nouns showed differential priming effects. More specifically, the singular nouns when their stem frequency (i.e. the sum of the sum of the frequencies of the singular, plural, and diminutive forms (Baayen et al., 1997, p. 99)) were kept constant, were responded equally fast regardless of their surface frequency. However, the plural nouns with a high surface frequency were responded faster than plurals with low surface frequency. When the surface frequency of singular nouns was kept constant in the second experiment, the response latencies differed depending on the surface frequency of their plural forms. In the third experiment, they compared verbs and they found no surface frequency effects for verbs but for nouns. They concluded that high surface frequency plural nouns were stored as full forms as parsing those forms was not cost-effective due to the ambiguous nature of the plural marker "-en".

The effects of surface frequency on morphological processing have also been investigated to compare L1 and L2 speakers. Lehtonen & Laine (2003) conducted a series of experiments to this aim. L1 and L2 Finnish speakers were tested on inflected nouns and monomorphemic words with a lexical decision task. High, medium and low frequency surface multimorphemic words were matched with monomorphemic words with the corresponding frequency counts. The items were also matched for biagram frequency[2], and family size (the number of derived and compound forms in which a particular stem occurs). As expected, the L1 speakers were primed more with the low and medium frequency inflected words but not with the high frequency ones. L2 speakers, on the other hand, showed a processing delay with all inflected nouns regardless of their frequency. They concluded that L1 speakers differ from L2 speakers in processing morphologically complex words in different frequency ranges. That is, L1 speakers tend to apply full storage for high frequency inflected nouns but a decomposition route for low and medium frequency complex nouns while L2 speakers decompose all the inflected nouns irrespective of their frequency counts.

Surface frequency effects on processing have also been discussed in derivational morphology. Meunier & Segui (1999) conducted two cross modal priming experiments to investigate how derived words and their stems are represented in the mental lexicon. The first experiment investigated whether the derived words primed their stems while in the second experiment they tested whether

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[2] Biagram frequency is defined as the average frequency of all two-letter sequences in a Word (Lehtonen & Laine, 2003, p. 215)

stems primed their high and low frequency derived forms. They found a full priming effect for only low frequency derived words to their stems but not for high frequency derivationally complex words. The second experiment revealed that the stems were not effective primes for their low frequency derived forms as much as they were for their high frequency derived forms. This asymmetrical pattern was accounted for two different lexical representations for high frequency affixed words. They proposed that while low frequency derived words are represented in a decomposed form, the high frequency derived words and their stems are represented both as full forms and as decomposed forms. When a high frequency derived word is encountered, both representations will be activated. Under an unprimed condition, full representation will allow the recognition of the word.

In masked priming experiments, studies have revealed inconclusive results regarding the surface frequency effects with derivational morphology. McCormick, Brysbaert, Rastle (2009) compared higher frequency prime – lower frequency target, lower frequency prime – higher frequency target and a pseudo word prime – real word target conditions in a masked priming study in L1 English. The results suggested that in all three conditions priming effects were significant and comparable. Hence, they suggested morphological decomposition for all complex derived words independent of frequency counts.

Another consideration in frequency studies has been root/stem or base frequency effects on morphological processing.

Clahsen, Eisenbeiss & Sonnenstuhl (1997) in an online lexical decision experiment compared response times to high-frequency and low-frequency *–t* participles of weak forms to high-frequency and low-frequency *–n* participles of strong verbs in German. The results showed strong word form frequency effects for irregular –*n* participles but not for regular –*t* participles. That is, they found strong base frequency effects but no surface frequency effects for regularly inflected word forms. They maintained that in processing regularly inflected words, their base forms are processed and those base forms do not have full form representations. They suggest a distinct processing pattern for irregular inflection (whole-word access) and regular inflection (decomposition).

Taft's (1979) study examined both surface frequency and root frequency effects (also referred to as stem or base frequency) on the processing of inflected and derived prefixed words. When the surface frequency was held constant, base frequency was influential in lexical decision times. However, when the base frequency was controlled and surface frequency was manipulated, lexical decision times were influenced by surface frequency. The results proposed a two-stage model of word recognition in which base frequency and surface frequency affect lexical decision times at two different stages. These findings were confirmed by other researchers providing evidence from different languages.

In another early work, Burani, Salmaso & Caramazza (1984) conducted a study in Italian to investigate whether it was the cumulative root/base frequency or the surface frequency of an inflected word that determines the decision times in a lexical decision task. The results revealed that both root frequency and the surface frequency of a word contributed significantly to lexical decision times. They concluded that although the results confirm the lexical access model proposed by Taft (1979) in respect of representation, they diverge in explaining access patterns to those representations. They claim that access to those morphologically decomposed representations does not require a decomposition route but can be through full forms.

As discussed above, the role of frequency has been one of the important issues widely discussed in derivational and inflectional morpheme processing studies. Another factor that is commonly discussed in relation to frequency is productivity. In the thesis, productivity is not one of the variables that is defined and tested independently because the suffixes explored, namely the past tense morpheme –DI and the noun-deriving (i.e.,, deverbal nominal) derivational morpheme,–GI that forms nouns are among the productive suffixes in Turkish (Kornfilt, 1997: 448). Nevertheless, it is important to note that the role of affix productivity is also relevant for the processing pattern. Anshen & Aronoff (1988) defined productivity as the likelihood that newly created word forms will occur in a language and proposed that words that are formed with productive suffixes are decomposed whereas the ones with less productive suffixes will be represented as full forms in the lexicon. For instance, derived words with highly productive English suffixes such as '-ness' will demonstrate more stem frequency effects than derived words with less productive suffix such as '–ity', which will only show surface frequency effects.

Bertram, Laine and Karvinen (1999) conducted a study on Finnish derived words using visual lexical decision tasks to examine the role of suffix productivity on morphological parsing. Bertram et al. (1999) claimed that derived Finnish words with unambiguous, productive suffixes are subject to both full listing and decomposition whereas derived words with unproductive suffixes are represented only through full forms like monomorphemic words. They concluded that productivity facilitates morphological parsing.

In another study, Bertram, Schreuder and Baayen (2000) investigated, as a follow-up study of Bertram et al. (1999), the role of morphological productivity in storage and computation of derived words in Dutch. They used visual lexical decision experiments (Experiments 2 and 3) to investigate two derivational suffixes. The unproductive suffix *–te*, which derives abstract nouns from adjectives (e.g., warmte, warmth), and the productive suffix *–heid*, which has the same function with the former, (e.g., leegheid, emptiness) were tested. Following Taft (1979), storage and computation were tested by varying the surface and base frequency of the complex words. More specifically, in order to assess storage, they varied surface frequency of the complex word and kept the base form frequency constant as the effects of high surface frequency are expected to emerge in the form of full listing of complex words. To investigate the role of computation, they varied the base form frequency while keeping the surface frequency constant. It is predicted that complex words with high base frequency should be decomposed more than those with low base frequency when the surface frequency is kept constant. The experiments revealed that derived words with the unproductive suffix '–te' are stored as full forms whereas the nouns derived with productive suffix '–heid' are processed both on the basis of their full forms and through the parsing route. They asserted that productivity is a necessary but not a sufficient condition for parsing.

Ford, Davis & Marslen-Wilson (2010) also examined the influence of suffix productivity on word recognition in a lexical decision study involving derivationally complex words in English. The study compared the effects of base morpheme frequency and family size[3] on response times to derived words and investigated the interaction of these variables in relation to suffix productivity. The results showed that base frequency effects were only found with derived words containing productive suffixes. Family size effect was observed regardless of suffix productivity. They suggested that base morpheme frequency effects are dependent

[3] Family size is a type of frequency count which includes the number of complex words of a base word in which the stem appears as a contituent (Schreuder & Baayen, 1997).

on suffix productivity and derived words with productive suffixes are represented as morphemes.

In addition to frequency and productivity, formal and semantic transparency have also been discussed in the processing literature. While the first notion refers to the extent of clarity/identifiability of stem-suffix attachment (i.e., transparent stem-suffix morpheme boundary), semantic transparency refers to the degree which the meaning of a complex word can be inferred from the combined meaning of its parts (or morphemes). This is particularly an issue in the context of derived words and compounds. For example, the English derived words 'unhappy' and 'department' represent the semantically transparent and opaque words, respectively. It has been suggested that the degree of semantic transparency of stem-affix combination in a morphologically complex word may determine to what extent those words are decomposed in processing. Nevertheless, previous studies have not revealed completely converging results.

For example, Marslen-Wilson, Tyler, Waksler & Older (1994) used a cross-modal[4] immediate repetition priming method in a study on morphologically complex words in English. In the study, they carried out a series of experiments to investigate whether the derivationally suffixed and prefixed words are represented in a morphologically structured way and how this relates to the semantic and phonological transparency of the relationship between the stem and the affix. The results showed that semantically transparent derived forms such as 'attractive'

[4]The cross-modal priming paradigm involves an auditory stimuli given as a prime followed by a target word that is presented visually on a computer screen. The aim is to avoid any potential confounding effects of orthographic similarity between the prime and the target. This is different from the masked priming paradigm, where the prime is visually presented very briefly (about 20-60 msec) prior to the visual presentation of a target stimulus. The aim in masked priming is to make sure that the parser does not notice the prime consciously (Forster & Davis, 1984).

primed their base forms (attract), independent of phonological transparency.[5] They further suggested that morphologically complex, semantically opaque forms such as *apartment* were subject to full listing in the mental lexicon as they did not prime their base forms (*apart*). Based on these findings, they argued that semantic transparency plays an important role in the representation and processing of words in the sense that morphologically complex derived forms which are semantically transparent are represented in a decomposed form at the level of the lexical entry whereas semantically opaque derived forms in English are stored as whole units.

It is important to note, at this point that the target inflectional and derivational morphemes (i.e., -DI and –GI) examined in the present study are frequent, highly productive suffixes with formal and semantic transparency. In that sense, both are comparable on these measures. Therefore, any difference between the priming effects observed in the two types of morphemes may not be directly linked to these factors. The question of whether or not inflection or derivation produces stronger priming effects has been examined, albeit rarely, in the literature in reference to semantic transparency effect. Inflectional and derivational morphology have different status in that respect because the meaning relationship between the stem of an inflected form and its morpheme(s) is more direct and clear (e.g., flower versus flowers); whereas the semantic relatedness between a derived form and its constituent affix(es) cannot always be established (e.g. 'bake-baker' versus 'fry-fryer') (Raveh, 2002: 313).

[5] Phonologically transparent forms have the same phonetic shape in its affixed and unaffixed versions For example, the word 'friend' is phonetically identical on isolation and when it is affixed as in the 'friendly' (Marslen-Wilson et al, 1994, p. 5).

3.2.2 Differential priming effects in morphological processing

As discussed above, the role of semantic transparency has been extensively studied in the field particularly in reference to the processing of derived words. The issue of transparency is not only relevant for identifying the extent of decomposition in complex words that have formal transparency and/or semantic transparency but also for exploring whether the faciliatory effect of the prime is based on semantic, morphological, or orthographic relatedness between the prime and the target. Given that a morphologically related prime-target pair such as ‘washed-wash’ is not only morphologically related but also orthographically and semantically related, extensive research has been conducted to tease apart these prime effects.

A related study conducted by Gonnerman, Seidenberg & Anderson (2007) via cross-modal priming included prime-target pairs with low (hardly-hard), moderate (lately-late) and high (boldly-bold) semantic relatedness and compared lexical decision times of these prime-target pairs. Their results revealed graded effects of semantic similarity. They found strong priming effects for highly related prime-target pairs and intermediate facilitation for moderately similar items, and negative effects for low similarity pairs. They also observed that the same pattern for word pairs showing different morphological relationships such as ‘teacher-teach’, ‘saintly-sainthood’ and ‘preheat-heat’. They concluded that priming effects can be predicted based on semantic overlaps rather than morphological structure.

Meunier and Longtin (2007) investigated semantic integration during the processing of morphologically complex French words in a series of experiments. They compared the priming effects of pseudo prime words and their root to real derived words and their root forms. Using the cross modal priming technique, they presented pseudo words as primes both in interpretable and non-interpretable combinations. The non-interpretable pseudo words included combinations like ‘sportation’ which are composed of roots and suffixes and that are not grammatically compatible. Therefore, those forms were semantically unclear. Priming effect was found only for semantically interpretable morphologically complex primes which were composed of compatible grammatical categories such as ‘rapidifier’. The magnitude of priming with semantically interpretable pseudo words and real derived forms were compatible. They concluded that semantic factors are taken into account when the prime is overtly presented and only semantically interpretable pseudo primes facilitated priming. They further asserted that morphological effects come into play at least in two processing stages; morphological decomposition based on formal properties and a semantic integration based on semantic harmony between the morphemes.

In the light of these findings, it was suggested that when the primes are overtly presented (for at least 70 ms), priming effects emerge for semantically related prime-target pairs (Marslen-Wilson et al., 1994; see also Amenta & Crepaldi, 2012 for a review). In addition, in the overt prime presentation condition, facilitation (i.e. the priming effect) is observed more in transparent pairs than in opaque ones (Frost, Forster & Deutsch, 2000). The question is whether this is also the case in masked priming experiments where the prime is presented for less than 60 ms and preceded by a visual mask.

One piece of evidence comes from a masked priming study by Rastle, Davis, Marslen-Wilson & Tyler (2000) involving English derivational morphology. In their first experiment, they crossed morphological, semantic and orthographic relatedness across primes. They tested the morphological, semantic and orthographic relations between primes and targets at three different stimulus onset asynchrony (SOA)[6] measures (i.e., 43ms, 72 ms, and 230 ms). The aim of the study was to investigate whether morphological priming effects could be observed when there were no semantic and orthographic effects. Their results revealed priming effects for semantically transparent derived forms and their stems across all the SOA conditions. However, they also observed robust priming effects for semantically opaque complex items in the shortest SOA condition. The findings from the first experiment pointed to existence of orthographic representations which are morphologically structured but not facilitated by semantic transparency. However, they cautioned that the morphological effects might be the results of semantic and orthographic relatedness. Hence, they conducted another experiment including items such as 'nose – nostril' which share orthographic and semantic properties but not morphologically related. In the second experiment, they observed morphological priming effects in short SOA conditions when there were no semantic and orthographic priming effects. Semantic priming effects were observed only when the primes were consciously perceived and no orthographic effect was present in all SOA conditions. Their results showed that morphological structure plays a significant role in early visual word recognition of English words independent of both semantic and orthographic relatedness. They concluded that the priming effects in English derivational morphology cannot be reduced to semantic effects, orthographic effects or a combination of those two.

[6] In the priming paradigm, the SOA refers to the amount of time between the start of the prime, and the start of the target. Thus, the duration of the prime presentation and the inter-stimulus interval (ISI) are included in the SOA measure. The ISI refers to the time passes between the end of the prime and the beginning of the target. When the ISI is fixed to 0 ms. The SOA comes to be equal to prime duration only. All these measures can be manipulated depending on the research questions (Kinoshita & Lupker. 2012).

In the same vein, Longtin, Segui and Halle (2003) investigated the extent of morphological, semantic and orthographic priming in their study of derived words in French. Their morphologically related pairs were semantically transparent, semantically opaque or pseudo-derived. In their first experiment that involved visual masked priming, facilitation was obtained for the three types of morphological pairs but not for the orthographically related pairs, proving the role of morphological structure (independent of orthographic similarity) in lexical access. In their second experiment conducted via auditory-visual cross-modal priming, only semantically transparent pairs produced facilitation. Crucially, in both experiments, they found similar priming effects for opaque and pseudo-derived pairs, suggesting that semantic transparency alone is not sufficient to explain the processing of morphologically complex derived words.

Rastle and Davis (2008) extensively discussed the theories which postulated that decomposition of morphologically complex words are based on their semantic properties and asserted that in early stages of word recognition morphological decomposition is based on orthographic analysis. Providing evidence from masked priming studies briefly summarized above and eye movement studies (see Frisson, Nishwander-Klement & Pollatsek, 2008), they proposed that all complex words are parsed because morpho-orthographic segmentation is an efficient way for accessing morphologically structured stimuli. The findings from several studies summarized in the review article, provided evidence for priming effects for derived transparent morphological pairs (e.g., hunter – hunt), nonmorphological pairs (e.g., brothel – broth) and opaque morphological pairs (e.g., corner – corn) similarly. Rastle & Davis argue that if semantically opaque prime target pairs such as ‘corner – corn’ produce masked priming effects similar to morphologically related pairs such as ‘darkness – dark’, it implies that in early word recognition decomposition is purely based on orthography irrespective of semantic relatedness.

To sum up, the controversy regarding the role of semantic relatedness on processing complex words has remained unanswered. It seems that more evidence is required from different languages using various psycholinguistic methods to examine the effects of morphological, orthographical and semantic priming effects in complex word recognition.

As summarized above, previous research on the processing of morphology has mainly concentrated on the issues of frequency, transparency and the productivity of the affix. Findings so far have suggested that morphological parsing is facilitated as a function of frequency of different components in a complex word. Also, complex words that include transparent productive suffixes are more likely to be decomposed during lexical access. Thus stem-suffix transparency, clear semantic contribution of the suffix to the whole word meaning, and suffix productivity appeared to be important factors determining the morpheme-based processing pattern, as suggested by dual mechanism views.

3.3.3 Processing differences between inflectional and derivational morphology

With respect to processing routes, researchers have also been interested in possible differences between inflectional and derivational morphology. Several studies have been conducted comparing those two morphological processes using priming paradigms. Previous research has not revealed conclusive findings as to whether the decompositional pattern is prevalent both in inflected and derived words (see Clahsen, Sonnenstuhl & Blevins, 2003 and Marslen-Wilson, 2007 for reviews).

In an earlier experiment, Schriefers, Friederici & Graetz (1992) investigated the interrelations between morphologically related inflectionally and derivationally complex words in the mental lexicon. They used the repetition priming paradigm[7] and conducted two experiments using derivational and inflectional forms of the same stem. The first experiment examined the asymmetries between three inflectional suffixes in German (-e, -es and –em). While inflected primes facilitated their stems, the opposite interaction was not observed. That is, the stems did not facilitate the recognition of their inflected forms. The similar results were obtained for derivational items. They concluded that this asymmetry is evidence against decomposition accounts. The second experiment was carried out to test whether the same asymmetric pattern would be found with inflectional and derivational variants of a stem. Derivational forms of adjectives with the affixes '–lich' and '–heit' were merged into the experimental items together with the inflectional (–e and –em) forms of the same stems. The results of the second experiment also revealed clear asymmetries in the priming patterns. The derived form with '–lich' fully primed its stem but was not primed fully by the stem. However, derived form with '-heit' was fully primed with its stem while the stem did not effectively prime the derived form. Schriefers et al. concluded that the findings are compatible full listing models which postulate separate lexical representations for inflected and derived forms.

In another study comparing the processing of derived and inflected words, Laudanna, Badecker & Caramazza (1992) conducted three lexical decision experiments in Italian. The first experiment aimed at investigating whether an Italian derived word (*rapitore* -'abductor') primed the stem (*rapier* – 'to abduct') as

[7] The repetition priming paradigm has been used to examine the relation between morphological variants of a word. It is based on the idea that when participants are presented with a sequence of words and non-words for lexical decision, reaction to the second occurence is faster than the first one (Forbach, Stanners & Hochaus, 1974; Scarborough, Cortese & Scarborough, 1977).

effectively as the inflected form of the same stem (*rapivano* – 'they abducted') did. The results of the experiment revealed that inflectionally and derivationally related primes showed the same degree of facilitation on their targets. However, the semantic and orthographic relations were not considered in this experiment. In order to test possible effects of semantic and orthographic relatedness they conducted two more experiments. In the second and third experiments, they compared the effects of inflected stem homographs (e.g. *mutarano* – 'they changed') and morphologically unrelated derived forms with a homographic root (e.g. *mutevole*) on forms like *mute*. The results suggested that there was a consistent priming effect with the inflected forms whereas no such effect was at play with derived primes. Laudanna et al. (1992) concluded that only inflected forms but not the derived forms are represented as morphemes in the mental lexicon.

Feldman (1994) conducted a series of repetition priming experiments on Serbian inflectional and derivational formations. In the first experiment, derived forms were similar to inflected forms with respect to phonological and orthographic overlap but differed from inflected forms in word class. In Experiment 2, all derived prime words were verbs and primes differed with respect to the attachment of a suffix or a prefix. In the third experiment, half of the primes were matched to targets for word class and the other half shared one letter more in the inflection condition compared to the derivation condition. The results of those three experiments showed that all morphologically related primes facilitated targets relative to an unprimed condition but inflectionally related primes produced more facilitation compared to derivationally related primes. In other words, there was greater facilitation (i.e., priming effects) for inflectional relatives compared to derivational ones. Feldman

(1994) interpreted the results in favor of different lexical representations of inflectional and derivational formations.

Differential processing mechanisms for inflected and derived forms have been supported by a relatively recent study by Álvarez, Urrutia, Domínguez & Sánchez-Casas (2011) that involved the Event Related Potentials (ERPs) paradigm. They examined the processing patterns of morphologically complex words in Spanish by controlling the orthographical and phonological overlap and the grammatical class. In the design, morphologically related and unrelated primes were used in the derivation and inflection conditions. For example, the related condition for inflectional morphology consisted of semantically-related items like *nino-nina* (*girl-boy*). As for derivational morphology, prime-target pairs that involve orthographical relatedness such as *ramo-rama* (*bunch-branch*) were used. The results suggested an attenuation of the N-400 component[8] for both related condition. However, the effect of the attenuation seemed to last longer for inflected words, suggesting differences between inflectional and derivational processing.

The same issue has been examined in two recent studies in Turkish and in German by Kırkıcı & Clahsen (2013) and Jacob, Heyer & Verissimo (2017), respectively. Although these studies basically examine native-nonnative processing differences, it is important to note they also had data from native speakers of Turkish and German, respectively. In Kırkıcı & Clahsen (2013) in their masked priming study compared the priming effects of verbal inflection (aorist) and derivational morpheme '*-lık'* which forms nouns from adjectives. The study revealed similar priming effects both in derivational and inflectional morphology for native speakers

[8] In Event Related Potentials (ERP) studies N400 effect is linked with lexical processing and defined as a reaction to unexpected words. N400 is part of the normal brain response to words and other meaningful stimuli. Reduced N400 affects means no priming.

in Turkish. Jacob et al. (2017) also compared the morphological processing patterns inflected and derived words in German. On the basis of a masked priming paradigm, and using the same target verbs in derivational and inflectional conditions, Jacob et al. found similar response latencies for inflected and derived primes which were significantly faster than the latencies for unrelated primes. The priming effects were not due to orthographic overlap between the prime and target pairs. They concluded that in native language processing, derivational and inflectional items are processed in a similar fashion.

The studies summarized above on derivational and inflectional morphological processing in L1 have revealed inconsistent results. While some studies have found differential processing mechanism for derivation and inflection, others have argued for similar processing patterns. The studies conducted up to now have helped us gain insights into processing patterns of morphologically complex words, yet more studies are needed to reach at more definitive answers. Research conducted on L2 speakers' processing mechanisms for inflectional and derivational morphology will also contribute to our understanding of the representations of those forms in the mental lexicon. The following chapter will discuss findings from L2 morphological processing studies.

CHAPTER 4

PSYCHOLINGUISTIC STUDIES ON PROCESSING OF MORPHOLOGY IN THE SECOND LANGUAGE

Acquisition of morphology is one of the most difficult domains in second language (L2) learning. Even end-state L2 learners demonstrate variable use of inflectional morphology. In particular, inflectional morphology seems to pose major problems for adult L2 learners and it has been suggested that L2 grammars are devoid of native-like representations of morphosyntactic strucutres (e.g., Hawkins, 2001).

Some researchers have been interested in identifying psycholinguistic reasons underlying the problem of variable use of morphology (Clahsen & Felser 2006 a,b; Gürel & Uygun, 2013). It has been suggested that to account for difficulties experienced by L2 learners, it may be relevant to examine how morphologically complex words are represented and accessed in the human mind (Gürel & Uygun, 2013). Research on online processing of derived and inflected words in the L1 and L2 might be particularly important for identifying sources of difficulty in the domain of L2 morphology. As summarized below, there are basically two views regarding the question of whether late L2 learners can ever achieve native-like morphological processing, namely the convergence and divergence views.

4.1 Approaches to morphological processing in the L1 and L2

Despite extensive research on L1 morphological processing, L2 processing has attracted attention only recently. Therefore, there is yet little evidence regarding how L2 learners process inflected and derived words and whether or not morphological processing in native and non-native languages follow similar routes. Earlier L2 studies have relied on timed or untimed speech production and off-line data to investigate L2 morphology. Recently, however, researchers have begun to investigate L2 language processing using experimental psycholinguistic techniques such as response time measures, eye-movement monitoring, brain imaging and event-related brain potentials (ERP), which have produced valuable psycholinguistic data. Research findings up to now have been inconclusive and different proposals have been forwarded so far to account for L1 and L2 processing differences and similarities. Some views claim that L2 learners can achieve native-like parsing mechanisms and L1 and L2 processing differences are only quantitative (convergence view). There are, however, claims that L1 and L2 processing are not only quantitatively but also qualitatively different (divergence view).

4.1.1 The convergence view

Proponents of the convergence view claim that L2 learners employ the same mechanisms as native speakers in language processing and the differences can be accounted for on the basis of some factors such as working memory, speed of processing, and L1 influence. That is, since L2 processing is more demanding in terms of basic cognitive processes, L2 learners may simply be slower and less automatized compared to native speakers. Crucially, any quantitative differences between native speakers and L2 speakers of that language will disappear as the proficiency increases (Green 2003). This view makes reference to the processing of various morphosyntactic properties including the online access of multimorphemic words. On that note, the assumption is that late L2 learners can, as a function of increased proficiency and exposure, demonstrate native-like parsing routes (e.g., (e.g., Coughlin & Tremblay, 2015; Diependaele, Duñabeitia, Morris & Keuleers, 2011; Feldman, Kostic, Basnight-Brown, Durdevic, & Pastizzo, 2010; Gor & Jackson, 2013; Uygun & Gürel 2016; Lehtonen, Niska, Wande, Niemi, & Laine, 2006; Portin, et al., 2008). According to this view, implicit computational mechanisms responsible for decompositional processing of morphology are available not only to native speakers but also to late L2 learners.

4.1.2 The divergence view

An alternative view holds that L2 processing differs from L1 processing in more fundamental ways in the domain of grammar. The shallow structure hypothesis (SSH) proposed by Clahsen and Felser (2006 a,b) and the declarative/procedural memory model of Ullman (2001, 2004, 2005) are associated with this view as they claim that late L2 grammatical processing is fundamentally different from L1 grammatical processing. These models do not predict native-like decompositional parsing in late L2 learners particularly in processing inflected words. Instead, they use non-structural cues (e.g., lexical, semantic information) for processing morphosyntax. Since they do not have access to implicit computational mechanisms, late L2 learners do not necessarily conform to the principles that constrain native grammars (hence the SSH) (see Clahsen et al, 2010 for a review). Thus, L2 processing differs not only quantitatively but also qualitatively from L1 processing as L2 learners are slower and fail to do online linguistic computations. Ullman's (2001a, b, 2004, 2005) Declarative/Procedural model makes specific predictions for morphological processing and propose that procedural mechanisms that subserve grammatical rules both in syntax and morphology (i.e. rule-based computations) are not available to late L2 learners. Thus, they rely on declarative memory systems that are responsible for learning arbitrary, idiosyncratic word-specific knowledge including semantic, phonological and grammatical information of morphologically simple and complex words. Declarative mechanisms that are responsible for storage of irregular verb forms and non-productive derivations in L1 processing are used for morphological computations in L2 processing. In other words, unlike L1 processing, L2 processing relies on declarative storage for computations that require decompositional parsing. This, in a sense, suggests that morphologically complex forms are not computed but stored as chunks and accessed via direct access route in L2 learners. To exemplify, morphologically complex regular forms (such as *walked*) is memorized and stored in declarative memory in the L2 lexicon but undergoes a computation in the L1 lexicon. Ullman's model does not, however, imply that those grammatical rules cannot be generalized to novel conditions just because they are explicitly learnt. Declarative memory can generalize memorized patterns to new ones and productivity can be achieved (Pinker, 1999; Prasada & Pinker, 1993). It is also possible in this model that the forms are constructed by explicit learning in declarative memory but they can be applied implicitly (Ullman, 2000). For instance, grammatical rules can be consciously learnt in a pedagogic environment in a fashion similar to explicitly learnt rules and words and are consciously applied but they still differ from the implicitly learnt grammatical rules in the L1. Nevertheless, the DP model suggests that increasing amount of practice with L2 may result in procedural learning and improved performance.

To sum up, both the shallow structure hypothesis and the declarative/procedural model point to divergent mental representations and processing strategies in L1 and L2. The DP model asserts that in L1 acquisition, regular and fully productive morphologically complex forms are computed by procedural memory whereas irregular and non-productive word forms are stored in the declarative memory. Late

L2 learners are expected to depend on declarative memory rather than procedural memory because in late L2 acquisition, there is a functional shift from the procedural system to the declarative system. Thus, L2 learners are expected to differ from L1 speakers in morphological processing in that they will rely on lexical storage of morphologically complex words rather than decomposition (Ullman, 2001).

In the light of this background, the next section will discuss the studies investigating processing of morphologically complex words in adult L2 acquisition to identify whether L1 and L2 parsers employ different processing mechanisms.

4.2 Research on L2 processing of inflectional morphology

The question of how inflected forms are processed in late L2 has attracted considerable attention in the psycholinguistic research. As discussed below, while earlier studies mostly used timed and untimed production tasks, more recent studies employed online masked and unmasked lexical decision experiments.

In one of the pioneering study testing L2 morphology, Beck (1997) conducted a series of experiments with native speakers and L2 learners of English from varying L1 backgrounds. Response time (RT) data were collected during oral elicitation of simple past forms of English verbs. Beck predicted that L1 speakers' results would yield no difference in response time between high-frequency and low-frequency regular past forms, whereas regular past forms would be sensitive to input frequency and produce effect. The prediction for L2 learners was that frequency effects would be seen for both regular and irregular verb forms because L2 learners are believed to store past tense forms in associative memory and this is input frequency sensitive. The results revealed similar mean production times for both high-frequency and low-frequency regular past tense forms for both L1 and L2 groups. This finding was taken as evidence for native-like regular past tense formation in L2 learners of English. However, the study did not reveal any significant differences between RTs of high-frequency and low-frequency irregular verb forms with L2 subjects. This unexpected finding is attributed to the fact that all participants had formal L2 instruction that involved memorization of irregular verb forms. In the formal classroom interaction, natural input frequency is not taken into account and learners are exposed to high-frequency and low-frequency irregular forms to equal degrees. Beck argued that this practice might have eliminated the expected frequency differences in this group.

In another study investigating the production of past tense inflection in L2 English, Zobl (1998) collected off-line (i.e., untimed) production data from L2 learners of English with Russian as L1; and written data from two L2 learners of English with Chinese and Arabic L1s. Zobl predicted that L2 learners would process inflected forms in a similar way as L1 speakers would. The findings were in line with the dual mechanism accounts in that the number of inappropriate uses of regular past tense forms was lower than that of irregular ones, which supports the assumption that affixed regular forms are computed whereas irregular are listed separately as stem and inflected forms.

In order to examine L2 processing in reference to potential differences between regular and irregular past tense morphology, Birdsong and Flege (2001) conducted a study with advanced late L2 learners of English with L1 Spanish to explore age of arrival (AoA) effects on morphological computation. The results demonstrated that irregulars were more prone to age effects than regulars. In Ullman's terms, this finding is interpreted as declarative memory being more sensitive to age effects than procedural memory. The results also showed that frequency effects were more salient in irregular verbs, in line with the storage view of irregular forms. The findings were also taken to suggest that L2 language processing can become native-like with sufficient practice.

In a similar L2 morphology study, Lalleman, van Santen & van Heuven (1997) investigated past tense production performance with high-frequency and low-frequency regular and irregular verb forms in L1 and L2 Dutch using an online production experiment. In contrast to their prediction, they found frequency effects for both regular and irregular verbs in both L1 speakers and L2 learners. The results are interpreted as an evidence for similar mental representation and processing of Dutch past tense in L1 and L2.

Unlike the studies noted above, L1-L2 differences were reported in a study testing Ullman's DP model. Brovetto and Ullman (2001) used a timed oral production task with L1 Chinese and L1 Spanish learners of L2 English. Participants were presented with a verb stem and a sentence context and asked to produce the past tense of verbs and the RTs were recorded. The results revealed frequency effects for both regular and irregular past forms for L2 learners, however only for irregular past tense forms for L1 speakers. This suggests both regular and irregularly inflected words are subject to full listing in the L2 whereas for native speakers, only the irregular forms are stored as such.

More recent studies employed different online paradigms such as masked or unmasked lexical decision experiments to examine potential native-nonnative differences in processing of inflectional morphology. For example, in a cross-modal priming study, Basnight-Brown, Chen, Hua, Kostic & Feldman (2007) examined regular and irregular past tense inflection in English and compared monolinguals and bilinguals. The prime was presented auditorily preceding a visual target. The items used included irregular nested stems (drawn-DRAW), which show no stem change in the past participle form of the verb, and irregular stem change verbs (ran-RUN). For regulars, in order to control semantic richness, they used past tense-present tense verb pairs that were either low (guided- GUIDE) or high in resonance[9] (pushed-PUSH). They compared the degrees of facilitation of prime words in accessing target verbs. The L2 group included L1 Serbo-Croation and L1 Chinese participants. The results revealed similar processing patterns for regular past tense inflection but different priming patterns for irregular verbs in L1 and L2 groups. Only the native speaker group demonstrated facilitation to stem change irregulars. The Serbian L1 group showed facilitation for pairs of irregular past and present tense forms with a nested stem while the Chinese L1 group did not. The different facilitation pattern between L2 learners is linked to the role of L1 on the processing of inflectional morphology. They concluded that bilinguals largely adopt the same processing strategies as native speakers.

In another study on L2 English processing, Feldman et al. (2010) used a masked priming lexical decision task to compare highly proficient L1-Serbian-speaking learners of L2 English to native English speakers. Findings revealed that both groups demonstrated priming effects for regularly inflected words and there was no facilitation effect with the orthographically related prime target pairs. Verb type, (i.e., regular and irregular verbs) did not reveal a significant difference in facilitation. The interaction between the verb type and prime type was found significant for L2 speakers when the presentations were cross-modal; and when the presentations were forward masked. Though not statistically significant, L2 data showed better facilitation for regular verbs compared to irregular verbs. On the other hand, low-

[9]Resonance is a measure of semantic richness of a word (Basnight-Brown et al., 2007).

proficiency L2 learners showed priming effects for both morphologically related and orthographically related conditions. They concluded that as the proficiency increases, L2 learners rely less on form but their reliance on semantics increases.

In an auditory priming study, Gor and Cook (2010) investigated the priming patterns of regularly and irregularly inflected Russian verbs. They found that both the native Russian speakers and advanced L2 learners of Russian showed facilitation effects for regularly, semi-regularly and irregularly inflected Russian verbs. The effect of priming even higher as the proficiency level increased.

Gor and Jackson (2013) conducted a study using a similar task. They predicted that both native speakers and L2 learners of Russian would automatically decompose regularly inflected Russian verbs. Nevertheless, L1-English-speaking L2 learners of Russian demonstrated a developmental pattern in the sense that with increasing L2 proficiency they go through a process from decomposing Russian verbs with less complex and more productive stem allomorphy to decomposing verbs with more complex less productive stem allomorphy.

In a more recent study examining the same issue in L2 French, Coughlin and Trembley (2015) used a masked-priming paradigm. Instead of lexical decision, they elicited word naming as they believed that word naming is more sensitive to morphological decomposition. The study included prime target pairs in the morphologically-, orthographically-, semantically-related, unrelated as well as identity conditions to ensure that the possible priming effects are not due to orthographic or semantic overlaps between the prime and the target. Thirty English speakers and 30 native French speakers participated in the study. The experiment included two types of targets: stem and inflected. The inflected targets were first-person-plural verbs in French. The results revealed full morphological priming for both native speakers of French and L2 learners. The priming effects in the L2 group increased with proficiency. The statistical model conducted on L2 data separately showed significantly longer latencies for the unrelated condition compared to morphological condition, significantly shorter latencies as the proficiency increases and significantly larger latency differences between the unrelated and the morphological condition with increasing proficiency. The latencies were marginally shorter in the more frequent items. The model run on all participants' latencies in the identity, orthographic and unrelated conditions revealed partial orthographic priming for both L1 and L2 groups but the size of priming was found to be different for each group. Hence, they conducted separate analysis for L1 and L2. In both models, the latencies in the identity condition were significantly shorter than the orthographic condition; and the latencies in unrelated condition were significantly higher than the orthographical condition. These findings confirmed partial orthographic priming found in the previous model. This raised the question of whether full morphological priming effects could be due to the orthographic overlap between the prime and the target pairs. To test this, they ran another model that compared orthographically related and morphologically related conditions. They found that the latencies for the orthographical condition were significantly longer than the latencies for the morphological condition. L2 learners' latencies were significantly longer than the L1 speakers'. Further analyses found no evidence for sematic priming either. They concluded that both L1 and L2 speakers of French decompose morphologically complex French verbs and rely on similar parsing mechanisms.

Recently, Foote (2015) examined in L2 Spanish whether the processing route depends on L2 proficiency and whether the type of inflection (verbal or adjectival) plays a role in this. Twenty native speakers of Spanish, 20 advanced learners and 20 intermediate learners of Spanish participated in the study that tested the processing of inflected verbs and adjectives via a masked-priming lexical decision task with 5 prime conditions (i.e., identity, morphologically related, orthographically related, semantically related and unrelated). The RT analyses revealed a significant effect of prime type only. Further pairwise comparisons yielded faster RTs for targets preceded by identity and morphological primes than any other prime types. There was no significant difference between the RTs of the unrelated and the orthographically related or semantically related primes. To ensure that the lack of semantic priming was not due to a lack of vocabulary knowledge, the semantic priming effect size was calculated by subtracting the mean RTs of unrelated primes from the mean RTs of semantically related primes. Results revealed no significant correlations in either group. Foote concluded that L2 Spanish speakers decompose regularly inflected morphologically complex words as native speakers do regardless of their proficiency level. The priming effect was not dependent on the type of inflection. The lack of priming with semantically and orthographically related prime target pairs was taken as evidence that the priming effect was morphological in nature.

Not all studies have found morphological priming effects in L2 learners. In a recent study, Jacob, Felischhauer & Clahsen (2013) used a cross-modal priming design to test morphological processing in L1-Russian-speaking learners of L2 German and found partial priming effects for both regular and irregular German past participles that require a stem change but no morphological priming for irregular German past participles without a stem change. L1 speakers of German, however, showed partial priming effects with irregular '- *n'* participles but full priming effects with regular '- *t'* past participles. The authors concluded that in line with dual-route mechanism, L2 learners store and access regular and irregular participles as full forms rather than as stems and affixes.

In sum, L2 studies testing the processing of L2 morphology have used different experimental designs to answer the question of whether late L2 learners differ from native speakers qualitatively and quantitatively in real-time use, comprehension or access of L2 inflections. The number of online L2 morphological processing studies has increased substantially in recent years. The main concerns in these studies have been L1-L2 differences in inflected word processing and potential differences between regular and irregular inflected forms, as mostly revealed by frequency effect differences. Nevertheless, findings do not converge possibly because of different methodologies, different L1 and L2s involved, incomparable proficiency levels across L2 learners, and different types of morphology tested. In order to gain more understanding, the morphological processes used by L1 and L2 speakers and identify similarities or differences between native and non-native processing of morphologically complex inflected words, further studies involving different languages are required. This line of research does not only include L2 studies testing inflectional morphology but also those testing derivational morphemes. The following section discusses L2 studies on the processing of derived words. The studies particularly focusing on differences in the processing of inflected and derived words will be discussed in the subsequent section.

4.3 Research on L2 processing of derivational morphology

Compared to studies conducted on L2 processing of inflectional morphology, the number of studies investigating L2 processing of derivational morphology is even fewer.

In one of those L2 studies involving derivational morphology, Clashen & Neubauer (2010) used unprimed lexical decision task and masked priming experiments to investigate the processing of derived nominalizations in adult L1 Polish speakers learning L2 German. Their results revealed weak or no priming effects in L2 learners. This was interpreted as an indication of full listing, even for productive derivational affix *–ung*. This finding is in line with Ullman's DP Model, however, Clashen & Neubauer caution that more studies are needed before any definitive conclusions are drawn.

Counter evidence was obtained in another study conducted by Diependaele et al. (2011) in an attempt to identify potential native-nonnative differences in morphological processing. They used a masked morphological priming experiment in L2 English. The participants were L1 Spanish and L1 Dutch speakers. They used transparent suffixed (*viewer-view*), opaque suffixed-including pseudo suffixed- (*corner- corn*) and form control (*freeze- free*) prime target pairs. The results revealed that priming was largest with transparent primes, smallest with form primes and intermediate with opaque primes in all groups. There were no qualitative or quantitative differences between L1 and L2 groups in the processing of suffixed derivations. They concluded that L1 and L2 morphological processing are similar in terms of strategies used and refuted the arguments of whole-word processing in the L2 suggested by Clahsen et al., (2010); Ullman, (2004, 2005).

Dal Maso & Giraudo (2014) investigated, via a masked priming study, the processing of derived words in 22 advanced learners of L2 Italian from different L1 backgrounds and 22 Italian native speakers. The morphological condition was formed by the affixes *'-ità'* (e.g., velocità < veloce) which has a higher numerosity, more frequent and more productive, and '*-ezza*' (e.g. bellezza < bello). The control conditions were identity, unrelated and orthographically related conditions. The analyses revealed that for L2 learners of Italian, two main factors, namely; prime type and prime frequency were significant but not the suffix type. The suffix type interacted with prime frequency. Planned comparisons showed morphological priming effects for high frequency primes with the suffix '–ità, which significantly differed from the orthographic and unrelated conditions but not from the identity condition. On the other hand, low frequency primes ending with the same suffix only marginally differed from the unrelated condition but did not differ from the orthographic condition. As for L1 Italian speakers, type of suffix, prime frequency and prime type revealed interaction. The morphological primes significantly facilitated processing of the targets and differed from the orthographic primes. The authors asserted that morphology plays a role in L2 Italian learners' processing of derived words at least for the high frequency words. With low frequency complex words with *–ità*, however, the results revealed a tendency for facilitation which shortened the latencies by 29 ms compared to unrelated primes. Native speaker processing yielded significant priming effects for both high and low frequency and in both suffixes. Orthographic similarity did not play a role in L1 processing. They concluded that L2 learners are sensitive to morphological structure of the words which have high frequency and a productive suffix. The only difference between the native and non-native processing could be attributed to language proficiency rather than substantial differences in processing mechanisms.

In the literature, the studies which found evidence for native-like processing with respect to the extent of the implicit reliance of morphological information (i.e., the extent of morphological decomposition) have been questioned as what looks like morphological priming may be due to orthographic priming. In other words, the idea is that form similarity between the prime and the target, but not morphological relatedness, may have led facilitation in processing.

To this aim, Heyer and Clahsen (2015) conducted a masked priming study with advanced learners of English with German as their L1. The authors assumed that the non-native processing might be influenced by orthographic similarities between the prime and the target rather than morphological structure. To investigate whether the observed facilitation in morphologically related prime-target pairs was purely morphological but not due to the shared letters, they compared purely orthographically related prime-target pairs (e.g. scandal -SCAN) to derived items (e.g. darkness -DARK) that share the same number of shared letters. The study revealed that only the non-native speaker group showed facilitation after the purely orthographically related primes. The facilitation effect found with orthographically related items were not significantly different from the facilitation effects obtained with morphologically related prime target pairs for non-native speakers. Thus, the authors concluded that the priming effects for derived words in non-native speakers are not morphological in nature. The orthographical relatedness (i.e., surface form of the words) facilitates early word recognition. Heyer and Clahsen note that the same mechanism might apply to inflected word forms and it is still open to investigation.

Gacan (2014) conducted a study involving L1 Turkish speakers of L2 English to investigate the processing of morphologically complex words. Sixty L2 speakers of English in two proficiency groups participated in the study. The masked priming task included English adjectives derived by the suffixes *–ful* and *–less* in the morphological condition. The control conditions were identity, unrelated and orthographically related prime target pairs. The ANOVAs on RT data of highly proficient L2 learners revealed a significant main effect of prime type both in the participant and item analysis. Planned comparisons yielded priming effects for both the *–ful* and *–less* conditions. However, they cautioned that priming effects might have been facilitated by the orthographic similarity between the prime and the target pairs and conducted another analysis to identify this. The results demonstrated a significant interaction of prime type in both the participant and item analysis. The planned comparisons revealed significant repetition priming effects in the identity condition and significant priming effects with the orthographically related condition. The priming effects between the orthographically related prime target pairs suggested that the morphological priming effects for highly proficient L2 speakers might be due to the formal overlap between the prime-target pairs. Low proficiency L2 learners, on the other hand, revealed orthographic priming effect only for the *–ful* condition but not for the *–less* condition. Further analysis with the orthographically related condition revealed a similar result in highly proficient learners. The significant priming effect for the orthographically related prime target pairs led Gacan to conclude that the observed priming effects in the morphological condition cannot only be attributed to the morphological structure of the words but also to the formal similarity of the prime target pairs. Gacan's experiment with L1 Turkish speakers in Turkish derived words will be discussed in the "Processing Morphology in Turkish" section below.

4.4 L2 research comparing inflectional and derivational processing

With regard to L2 processing, only a few studies have compared inflection and derivation using the masked-priming technique. However, these studies have reached radically different conclusions.

In an earlier masked priming study, Silva & Clahsen (2008) conducted a series of experiments with English native speakers and two groups of L2 English speakers from L1 Chinese and German L1 backgrounds. The experiment included three types of prime-target conditions: identical (e.g., pray-PRAY), test (i.e., morphologically related condition) (e.g., prayed- PRAY) and the unrelated condition (e.g., bake-PRAY). The visual prime was presented for duration of 60ms. The results revealed that native speakers showed full priming for morphologically related prime-target pairs. More specifically, significantly higher RTs were obtained in the unrelated condition compared to the identity and the test conditions. However, there was no significant difference between the RTs in the test condition and in the identity priming condition. In contrast, neither of the L2 groups showed priming effects for regular past tense. Both L2 groups showed similar RTs in the test and the unrelated priming conditions which were significantly higher than the RTs in the identity condition. The results suggest that L2 learners of English do not demonstrate morphological priming effects and this shows the reliance of lexical storage of inflected words. On the other hand, native speakers' priming patterns result from morphologically structured representations of regular past tense forms. The findings were interpreted through Ullman's declarative/procedural model which proposes that L2 inflectional processing relies more on the lexical memory system.

For the derivational experiment, Silva & Clashen (2008) examined the processing of deadjectival nominalizations derived with productive suffixes "-*ness*" and "-*ity*". Although the L1 group showed shorter RTs than the L2 groups, frequency effects for both L1 and L2 groups were evident. It was found that unlike the L1 group, L2 learners of English showed partial priming effects for derived word forms. This suggests that the derived forms are represented in a morphologically structured way in the L2 learners' mental lexicon. Furthermore, results revealed full stem priming effect for both derivational affixes in the L1 group. However, L2 English learners exhibited a reduced priming effect for both nominalizations in morphologically related prime-target pairs. The results suggest that L2 learners rely less on online computation compared to native speakers. Nevertheless, both L2 groups behaved the same in both experiments regardless of their L1s. The authors concluded that L2 processing of morphologically complex derived words is not subject to L1 influence. To sum up, Silva & Clahsen's results (2008) did not show any priming effects for inflected forms in L2 speakers in contrast to L1 speakers. However, for the derived forms, there were facilitation effects in both groups, though in different degrees. They concluded that L2 learners rely on declarative memory for derived word forms and they tend to store and process those as full forms.

Kırkıcı and Clahsen (2013) investigated the processing of inflected and derived words in native speakers and advanced L2 learners of Turkish using the masked priming paradigm. They compared inflectional and derivational morphology in Turkish using regular (Aorist) verb inflection and deadjectival (*-lık*). The two masked priming experiments yielded similar priming patterns for inflection and derivation in native speakers. Further analysis in the second experiment revealed that those priming effects could not be attributed to orthographic (prime-target) similarity. In the non-native speaker group, on the other hand, the priming effects were found to be different in inflection and derivation. L2 speakers were primed with derived word forms in derivation but not the inflected primes. In other words, L2 speakers demonstrated a different processing route in inflected word forms from native speakers. The priming effects found for derived forms (but not for inflected forms) were accounted by the lexical relations between the entries for derived forms and their bases. They suggest that the differences between L1 and L2 morphological processing cannot be attributed to L1 transfer and slower processing patterns. Although L2 learners' lexical representations of morphologically complex words are similar to those of L1 speakers, early word recognition in L2 does not involve morphological decomposition unlike L1 processing.

Voga, Anastassiadis- Symeonidis, and Giraudo (2014) challenged this account of Kırkıcı & Clahsen (2013). Voga et al. designed an experiment based on the same experimental items used in Silva & Clahsen (2008) and tested Greek speakers of L2 English. Twenty-one words derived by suffix *–ness* were used in the morphologically related condition in Experiment 1 and in Experiment 2, past tense regular inflection attached to the target words to serve as primes. L2 speakers demonstrated robust priming effects for both derivation and inflection. Thus, Voga et al. (2014) argue that processing of inflection and derivation is not different in the L2. They reasoned that the significantly different results with the same experimental items might be attributed to the profile participants tested in both studies. Silva & Clahsen tested different participants for inflection and derivation while Voga et al. tested the same participants in two experiments.

More recently, Jacob, Heyer & Verissimo (2017) designed an experiment to compare the processing of inflected and derived words in German. Forty native speakers of German and 36 highly proficient L1 Russian learners of L2 German participated in a masked priming experiment. Unlike the previous studies, Jacob et al. (2017) designed the experiment with the same target words for inflection and derivation. They claim that this design allowed them to compare the processing of inflected and derived complex morphological forms more accurately. In the morphological condition, 28 infinitival targets were either preceded by a derived form with '–ung' nominalization (*ÄNDERUNG* '(the) change'- *ändern* 'to change'), a past participle as an inflected prime (*GEÄNDERT* 'changed' - *ändern*) an identity prime or an unrelated prime. To test whether the possible priming effects were morphological in nature, they included 24 orthographically related (*Kasten- Kasse*) and 24 semantically related (*DOKTOR* 'doctor'- *Arzt* 'physician') prime target pairs. However, those prime target pairs were different from the infinitival targets as it was not possible to form those conditions with the same targets in German. Thus, they added two item sets (semantic an orthographic) which were also preceded by either identity, related or unrelated primes. The results revealed that for the L1 group facilitation found for derived and inflected primes did not differ. In the L2 group, however, they found strong priming effect in derivation but not in inflection, suggesting decomposition in derived words but not in inflected words. The semantic and orthographic conditions did not show any priming effects for either the L1 or the L2 group so the authors argued that the priming effects were morphological in nature. Jacob et al. (2017) concluded that derived and inflected words are processed differently in the L2, confirming the morphological theories that draw a distinction between the morphological processes in inflection and derivation.

4.5 Processing morphology in Turkish

It has been suggested that in agglutinative languages like Turkish, decomposition is the most efficient route to access morphologically complex words due to storage efficiency (Hankamer, 1989). Even though they agree with this assumption Frauenfelder & Schreuder (1992) caution that the route for the lexical access may shift to direct route depending on the frequency of the inflected word. In order words, given that the frequency of the morphologically complex word is high, full forms can be the most efficient route to access. In line with the above assumptions a number of studies have been conducted to investigate the access of route of morphologically complex words in Turkish.

In order to test the above predictions Gürel (1999) conducted a study with Turkish monolingual speakers using a simple lexical decision task. Recognition of simple and morphologically complex words was tested using reaction time (RT) measures. The results showed that there is no single route to access multimorphomic words in Turkish. Frequency of the suffix determined the access route. Words with frequent suffixes such as plural (*e.g. emirler,* 'orders') and locative (*e.g masada*, 'on the table' were accessed as full forms whereas words with less frequent suffixes such as ablative (*e.g., depremden,* 'from the earthquake') are accessed via the parsing route. Gürel (1999) concluded that the recognition of morphologically complex words in Turkish, at least the ones with frequent suffixes, is not as costly as the morphologically complex words in languages with little inflection such as English. Therefore, the direct route takes the ground wherever possible for the sake of economy of processing.

To take this study further, Gürel & Uygun (2013) conducted another study investigating the processing of morphologically simple and complex words by L2 Turkish learners in comparison to Turkish native speakers. In order to examine the possible impact of L2 proficiency on the processing pattern involved, intermediate and advanced level L2 learners of Turkish were involved in the study as well as native Turkish speakers. The experimental items were the same as Gürel (1999). The results of the unprimed lexical decision task revealed that native Turkish speakers employed a direct access route in word recognition as suggested by similar RTs in the recognition of multimorphemic, pseudomorphemic and monomorphemic words.

Advanced L2 learners of Turkish showed similar access patterns with native speakers in that there was no significant difference between L1 and L2 groups in the *stem-ablative* and *stem-locative* word categories. However, lower proficiency L2 learners were slower in the recognition of *stem-ablative* and *stem-locative* category than in the *stem-plural* category. In other words, intermediate L2 learners of Turkish tended to parse morphologically complex words more than advanced L2 learners of Turkish and L1 speakers of Turkish. It was suggested that the attachment frequency of the suffix rather than the suffix frequency might have determined the access route. The authors concluded that as the degree of proficiency increases, L2 learners of morphologically complex languages such as Turkish tend to decompose less for the computational efficiency. A further conclusion reached by Gürel & Uygun (2013) is that since unprimed lexical decision tasks tap into later stages rather than early stages of word recognition, the results also imply that native speakers tend to represent complex words as full forms in later stages of word recognition. L2 learners, on the other hand, decompose more but as the proficiency level increases, they adopt the direct access route. In other words, as the proficiency level increases, this conscious process is believed to turn into an unconscious representation (i.e. full listing) as a result of automatization/proceduralization.

In Uygun & Gürel (2016), Gürel & Uygun's (2013) study was replicated in a similar unprimed lexical decision experiment involving an additional L2 Turkish group consisting of L1 Russian speakers whose native language is rich in inflectional morphology. Consistent with Gürel & Uygun (2013) , native Turkish speakers did not parse morphologically complex words. L1 English advanced Turkish speakers also demonstrated the same pattern with native speakers. L1 Russian advanced L2 group, on the other hand, were much slower in accessing inflected forms except for the single suffix plural word forms. As for the intermediate level L2 speakers, decomposition effects were observed except for a few exceptions. L1 Russian intermediate speakers of Turkish seemed to decompose all the complex words except for stem-locative cases. Longer reaction times were observed with stem-ablative and stem- plural- ablative words in L1 English intermediate participants. They concluded that native like processing of inflected words can be attained by advanced L2 learners and the route seems to be from decomposition to full listing. L1 Russian speakers' accessing pattern was accounted for L1 effects.

Gacan's (2014) masked priming study also included a Turkish experiment that tested the processing of derived words by native speakers. The experiment involved transparent, frequent and highly productive suffixes *–lI* (attributive suffix) and *–sIz* (privative affix). Of the 40 morphologically related primes, 20 were denominal adjectives derived with *–lI* and 20 were denominal adjectives derived with *-sIz*. The analysis showed significant priming effects for both *–lI* and *–sIz* conditions. Orthographically related items did not reveal any main effect supporting that the priming effect was not due to the orthographic overlap between the prime and target pair but morphological in nature. Gacan concluded that Turkish derived words were subject to morphological parsing during visual word recognition in the L1.

As stated above, in the psycholinguistic literature there has been no consensus regarding native-nonnative differences in morphological processing. More studies from different languages are needed to have a better understanding of the processes involved in morphological processing in L2. To this end, this study was conducted to shed more light to the questions posed by psycholinguistic studies. The study at hand is unique in the sense that it not only uses the same verb stems in both inflection and derivation but also includes orthographic prime target pairs that merely carry orthographically relatedness. As will be explained in the methodology section, the target stems exist in the primes as whole words. That is, unlike the items of Jacob et al. (2017), the verb stems in targets fully exist in the orthographically related primes and this enables one to investigate the nature of priming better, if there is any. Moreover, the targets were carefully chosen so that they reflect 4 different frequency categories (HH, HL, LH and LL). The stem and surface frequencies were carefully considered to examine the possible frequency effects in processing.

CHAPTER 5

METHODOLOGY

The purpose of this study is to compare the morphological processing of multimorphemic words in native and non-native speakers via a masked priming paradigm. More specifically, this study aims to investigate whether L1 and L2 speakers of Turkish process morphologically complex words in Turkish, adopting similar processing patterns (i.e., decomposition, full-listing, or both). The study also aims to explore potential differences between inflected and derived words in terms of the ways they are processed, and to investigate the role of root and surface frequency in morphological processing of multimorphemic words. Thus, the study has four main components:

1. The investigation of native (i.e., L1 Turkish) speakers' processing pattern(s) in accessing multimorphemic (i.e., inflected and derived) words in Turkish.
2. The investigation of non-native (L2 Turkish) speakers' processing pattern(s) in accessing multimorphemic (i.e., inflected and derived) words in Turkish.
3. The investigation of potential native-nonnative speaker differences and L2 proficiency effects in morphological processing in Turkish.
4. The role of root and surface frequency in the processing of inflected and derived words in Turkish.

5.1 Research questions and predictions

On the basis of these main issues, the specific research questions and predictions are framed as follows:

L1 Turkish

1. How are inflected words in L1 Turkish accessed during word recognition?

It has been suggested that Turkish, as an agglutinative language with rich and productive morphology, allows for over 2000 different inflectional forms for each verb (Hankamer, 1989). Therefore, L1 speakers of Turkish are expected to show the decompositional processing pattern as would be revealed by morphological priming effects. Specifically, in the L1 group, the recognition of target verb root will be significantly faster in the morphologically related prime condition than it is in the unrelated prime condition. In addition, it is predicted that priming effects will be in the form of full priming, meaning that the recognition of target verb root in the morphologically related prime condition will be as fast as it is in the identity prime condition (i.e., ver, 'give' – ver, 'give'). Furthermore, the decompositional processing pattern is predicted to be morphologically-based but not orthographically-based. In other words, the facilitation in the recognition of a verb root (e.g., *ver*, 'give') after a morphologically-related prime (e.g., *verdi*, 'give-pst') will emerge due to morphological decomposition of the complex word into root + suffix but not due to the orthographic overlap between the root and the inflected form (i.e., the orthographically identical form, '*ver*' in the prime, *verdi*, and the target, *ver*).

2. How are derived words in L1 Turkish accessed during word recognition?

It is predicted that L1 Turkish speakers are expected to access derived verb forms as full forms because of the more lexicalized status of derived words (Lieber, 2016; Norde, 2009), Full-form representations will be revealed if the root is accessed equally fast in the morphologically related prime condition (i.e., *vergi*, 'tax' - *ver*, 'give') and unrelated condition (i.e., *bak*, 'look' - *ver*, 'give'). This would suggest that seeing a morphologically related prime right before the target verb does not facilitate the target verb recognition, indicating that the morphological decomposition has not taken place. Any facilitation in the derivational morphology may be linked to orthographic similarity but not morphological similarity between the prime and the target.

3. What are the factors determining the recognition of multi-morphemic words in the L1 Turkish?
   a) (How) does the type of affix (inflectional/derivational) affect complex word recognition in the L1 Turkish?
   b) (How) does the frequency of the root and/or surface frequency play a role in word recognition the L1 Turkish?

Given the productive nature of Turkish in morphological structures, it is predicted that L1 speakers will decompose more in inflectional morphology. Unlike inflected forms, derived verb forms are expected to be represented in full forms. Therefore, the processing route of morphologically complex verb forms depends on the type of morphology, suggesting a psycholinguistic differentiation between inflected and derived words. With respect to the frequency effects, in the processing of inflected forms, the root or surface frequency may not affect the processing pattern because decomposition is predicted in this category regardless of the root/surface frequency. Nevertheless, decompositional processing (i.e., the extent of morphological priming) may be more noticeable in low surface frequency-high root frequency words. In the derivational morpheme context, the words with high surface frequency will be subject to significantly higher full listing patterns. The root frequency effects may not be salient in derivational morpheme processing.

L2 Turkish

1. How are inflected words in L2 Turkish accessed during word recognition?

It is predicted that unlike native speakers of Turkish, L2 learners of Turkish will not be able to show full morphological priming effects. In other words, decompositional patterns will not be available to L2 learners in the processing of inflectional morphology. Orthographic facilitation is more likely in this group. This prediction is based on previously reported native-nonnative processing differences (e.g., Silva & Clahsen, 2008). In the same vein, limited L1 English inflectional morphology may also desensitize these learners and lead to storage rather than inflectional computation. Thus, L2 learners are predicted to show no morphological priming effects in the inflectional category.

2. How are derived words in L2 Turkish accessed during word recognition?

In the context of derivational morphology, L2 speakers of Turkish are expected to demonstrate storage effects rather than morphological decomposition. This prediction is based on the assumption that late L2 learners fail to show morpheme-based computation in all types of morphology. Given that derivational morphology is subject to storage effects more than inflectional morphology does, no decompositional processing patterns are expected in the processing of derivational category for L2 learners.

3. What are the factors determining the recognition of multi-morphemic words in the L2 Turkish?

a) (How) does the type of affix (inflectional/derivational) affect complex word recognition in the L2 Turkish?

b) (How) does the frequency of the root and/or surface frequency play a role in word recognition the L1 Turkish?

Given that both inflectional and derivationally complex words are expected to be represented in full forms in this group, it is predicted that words with high surface frequency will be subject to significantly higher full listing patterns than word with low surface frequency. The root frequency effects may not be salient in derivational morpheme processing.

4. Does the level of L2 Turkish proficiency have an influence on the recognition pattern of multi-morphemic words?

It is predicted that as L2 proficiency increases, L2 learners of Turkish will display more native-like processing patterns in both inflectional and derivational morphology. This will be reflected in the form of increased tendency towards decompositional patterns in participants with higher L2 proficiency. Since both native and non-native participants are expected to adopt full listing (i.e., storage), the proficiency effects may not appear clearly in this context.

5.2 Participants

The participants were all adult L1 and L2 speakers of Turkish. All participants had normal or corrected-to-normal vision and were not diagnosed with any learning or reading disorders. Of the 72 L2 participants, 45 reported having formal Turkish instruction at varying lengths.

a) L1 Turkish group: The group consisted of 72 native speakers (24 males, 49 females; mean age= 40.08; range = 22-63). The participants in this group were all university graduates and none of them spoke a foreign/second language at more than elementary level.

b) L2 Turkish group: 72 Turkish L2 speakers (44 males, 28 females; mean age = 40.47; range = 20-63) with English as their L1 participated in the study. All L2 speakers were exposed to Turkish after puberty (after the age of 8), in other words, they were all late L2 learners of Turkish. At the time of the study, all participants were residing in Turkey. The mean length of exposure to Turkish for L2 participants was 15.12 (range = 1-40) years. The mean length of L2 residence was 13.36 (range: 1-35). In order to measure the proficiency level of L2 Turkish, the participants completed a cloze test prior to the study (see Appendix B). The cloze test scores were out of 25. The participants' scores ranged between 7 and 25). Only 4 participants got a lower grade than 15 out of 25 (one participant got 7). No proficiency grouping was made on the basis of proficiency scores; however, the cloze test scores were included in the statistical model as a variable to examine its effects on the processing patterns. (see Table 4 for the summary of participant characteristics).

All participants (N= 144) took the two masked priming tasks (i.e., for inflection and derivation) at different times (at least 10 days in between the tasks). This is due to the fact that the target verb roots were deliberately planned to be the same in the inflectional and derivational priming tasks. To avoid any potential facilitation effects due to repetition priming (i.e., recall of the target root), there was an at least 10-day interval between the experiments. The order of inflectional and derivational priming tasks was also counterbalanced. In other words, half of the participants in both groups took the inflection task first and the other half took the derivation task first.

Table 4. Participant Profile

Group	Gender	Mean age (Range)	Mean age of first exposure (Range)	Mean length of exposure in years (Range)	Mean length of stay in years (Range)	Freq. of use hours/week (Range)	Cloze test (/25) (Range)
L1 (*n* = 72)	Female (*n* = 46) Male (*n* = 22)	40.08 (22-63)	From birth	From birth	From birth	N/A	23.77 (21-25)
L2 (*n* = 72)	Female (*n* = 28) Male (*n* = 44)	40.47 (20-63)	24.65 (8-40)	15.12 (1-40)	13.36 (1-35)	21.22 (1-41)	20.15 (7-25)

5.3 Instruments

5.3.1 Cloze Test

All L2 participants were given a cloze test in Turkish to be able to obtain information about their general proficiency levels in Turkish. Although cloze tests are not completely reliable measures of proficiency, they are widely used in L2 studies involving languages in which a standardized proficiency measures are not available. The cloze test designed in Gürel & Uygun (2013) was used. The test consisted of a reading text in which every 7th word was deleted. A total of 25 blanks had to be completed without any additional cues. The participants were asked to fill in the blanks with the most appropriate words (one word for each space). The cloze test was administered just before the first task under the supervision of the researcher. The same cloze test was given to L1 speakers to assess the reliability and to determine acceptable options in L2 speakers' cloze test responses. An independent-samples t-test was conducted to compare cloze test scores of L1 speakers and L2 speakers. Although their mean scores did not differ, the analysis revealed a significant difference between L1 and L2 speakers. There was a significant difference in cloze test score for L1 (M = 23.77, SD = 2.16) and L2 (M = 20.15, SD = 3.71) groups $t(142) = 7.16$, $p = .000$.

5.3.2. Demographic information and consent form

All participants completed a demographic information form prior to other tasks. L2 speakers, unlike L1 speakers, were asked additional questions about their Turkish learning experience such as the length of exposure, age of first acquisition (AoA), frequency of exposure. L2 participants were also asked to rate their skills (reading, speaking, listening, writing) in Turkish on a 5-level Likert scale (Beginner: 1; Pre-Intermediate: 2; Intermediate: 3; Advanced: 4; Native-like: 5). It was found that the self-ratings of the participants were parallel to their cloze test scores to a large extent.

In order to determine the demographic variable that best fits to explain the variability in the data, a step-wise regression model was run on L2 learners' length of exposure, age of acquisition, frequency of exposure, cloze test scores, length of stay, frequency of use and self-ratings. All the parameters correlated with each other but the strongest predictor of the cloze test score was found to be the length of exposure (AIC = -6897.1).

5.3.3. Masked priming task

The masked priming paradigm was utilized to investigate participants' processing routes in both inflectional and derivational experiments. The masked priming paradigm (Forster & Davis, 1984) is believed to tap into early automatic processes in word recognition. In this paradigm, a prime word (e.g. *sergi*) is presented on the screen for a very short time (usually between 30 – 80 ms) and is followed by a target word (e.g. *SER, 'spread/lay out'*) on which the participants are asked to make a word/non-word decision. The time between the onset of the prime and the onset of the target is called stimulus onset asynchrony (SOA). The crucial factor in this paradigm is that the prime words are masked with a string of symbols (e.g. #####) so that the participants are not aware of the prime words. The prime words are presented in lower case while the target words are presented in upper case in order to prevent visual overlap between the words.

Using the masked priming technique, several studies have found morphological priming effects for inflected and derived word forms in different languages. These priming effects could not be fully accounted for on the basis of orthographic and/or semantic overlap between primes and targets (Rastle, Davis, Marslen-Wilson, & Tyler, 2000; Rastle & Davis, 2004). Due to the short presentation times of primes, the priming effects cannot be associated with conscious recognition of the relationship between the prime and the target. In addition to this, it is believed that using the masked priming paradigm, episodic memory effects are eliminated as much as possible and it gives a clearer account of the activation of lexical representations.

In the current study, the SOA between the prime and the target was set to 50 ms to ensure that participants were not aware of the manipulation and could not develop strategies. The 50 ms- SOA was kept the same in both inflectional and derivational tasks. Typically, participants cannot consciously perceive the prime in such short SOA and this enables the task to tap into implicit processing.

5.3.3.1 Items

The critical items in this study consisted of verb roots (stems). As noted earlier, the same verb roots were used in both inflectional and derivational tasks. The target words were preceded by four different primes (i.e., identity, morphologically-related, orthographically-related, unrelated primes). Thus, in each task, the target items were distributed into four groups: 'identity condition' (e.g., *ser – SER* 'spread' 'morphologically related condition' (*serdi* 'spread'– *SER*; *sergi* 'exhibition'– *SER*), 'semantically and morphologically unrelated condition' (*sat* 'sell'– *SER*) and 'orthographically-related condition' (*serçe 'sparrow' – SER*). The identity, orthographically-related, and unrelated primes were the same in inflectional and derivational tasks. Only the morphologically-related primes were different. As mentioned before, the morphologically-related primes were –DI-past tense-marked complex words in the inflectional task, -GI-attached derived forms in the derivational task. The bare root forms of the verbs which were presented in capital letters were the targets in each condition. The primes were presented in lower case to ensure that the form similarity did not affect the results and that the results reflected morphological priming rather than visual priming.

Recent studies have generally included an orthographically related condition in masked priming experiments to determine the nature of priming. It has been claimed when a target such as *ser* is preceded by a morphologically-related prime such as *serdi* 'spread/laid out', the priming effects could also be attributed to the orthographic similarity between prime (*serdi*) and target (*ser*) rather than the morphological structure itself. The orthographically related condition was included into the design to clearly identify whether any observed priming effects were morphological in nature or purely orthographic. Thus, the orthographically related primes served as the control condition to ensure that the priming effect, if any, could not be accounted for by orthographic overlap between the prime and the target. The primes in the orthographic condition included the verb root fully but it did not have any morphological or semantic relationship with the target verb (e.g., *serçe-SER*). In that sense, the present study provides a more improved design compared to other previous studies that included an orthographic priming condition but not sought strick criteria for the orthographically related items (e.g. Jacob et al. 2017).

The critical test items included 24 bare verb forms (See Appendix A, Tables A1, A2, A3, A4, A5, A6, A7, A8, A9). The target bare verb forms were divided into 2 groups: higher frequency (mean= 64.37) and lower frequency (mean= 2.36). All critical target items were matched in word frequency, number of syllables (1 syllable) and number of letters (2-3 letters). The length of the primes was also matched in terms of the number of syllables (2 syllables) and number of letters (4-5 letters). The frequency counts of the primes were taken into consideration; the higher frequency primes (mean = 49.23) and lower frequency primes (mean = 2.28) were crossed with high and low frequency targets. Thus, four frequency-based prime-target categories were obtained:

HH: High surface frequency, High stem frequency

HL: High surface frequency, Low stem frequency

LH: Low surface frequency, High stem frequency

LL: Low surface frequency, Low stem frequency

It is important to note here that high and low frequency (e.g., LH) in a prime-target pair indicates the relative frequency of the morphologically related prime to its target (i.e., its root) For example, a prime-target pair such as *kattı*, ‘added’ – *KAT* ‘add’ is in the LH category because the inflected form has the frequency of 4.93; whereas the bare root has the frequency of 92.94.

The primes and the targets were analyzed for written surface frequency and root frequency using Turkish National Corpus (Aksan et al., 2012). Given that the both tasks included the same stem targets, the frequency analysis were run once. Higher frequency targets (e.g., *yaz* ‘write’) had a mean frequency of 64.36 (per million), while the lower frequency targets (*e.g., ser* ‘spread’) had a mean frequency of 2.36 words (per million), yielding a statistically significant difference t (22) = 2.117 p = 0.010.

Further analyses were run to ensure that the mean frequencies of four target frequency conditions (i.e., (HH, HL, LH and LL) were significantly different from each other. Greenhouse-Geisser was applied when necessary. Prime words in the inflectional study were analyzed to ensure that the mean frequencies of four frequency conditions were different from each other and that they did not differ across the experimental conditions. The between subject effects analysis revealed that there was a significant main effect for frequency, F (3) = 6.780, p = .002, η = .0504, obs. power = 0.943. The results of within subject effects analysis confirmed that the mean frequency of HH, HL, LH and LL conditions matched across the Identity, Test, Unrelated and Orthographically related conditions, F (1.648) = .656, p = .497, η = .032.

Similar analysis was conducted for the derivational study. The between subject effects analysis revealed that there was a significant main effect for frequency, F (3) = 7.155, p = .002, η = .0518, obs. power = 0.954. The results of within subject effects analysis confirmed that the mean frequency of HH, HL, LH and LL conditions matched across Identity, Test, Unrelated and Orthographically related conditions, F (1.674) = .657, p = .497, η = .032.

The target words were also matched across experiments and condition in number of syllables and letters. No statistically significant difference was observed. The priming conditions are exemplified in Tables 5 and 6 below.

Table 5. Priming conditions (Inflection)

	Identity	Test	Unrelated	Orthog-related
INFL HH	yaz-YAZ	yazdı-YAZ	çek-YAZ	yazık-YAZ
INFL HL	sar-SAR	sardı-SAR	kork-SAR	sarhoş-SAR
INFL LL	ser-SER	serdi-SER	sat-SER	serçe-SER
INFL LH	as-AS	astı-AS	uç-AS	aslan-AS

Table 6. Priming conditions (Derivation)

	Identity	Test	Unrelated	Orthog-related
DER HH	Kat-KAT	katkı-KAT	ye-KAT	katır-KAT
DER HL	sev-SEV	sevgi- SEV	giy- SEV	sevap- SEV
DER LL	sil-SİL	silgi- SİL	kok- SİL	silah- SİL
DER LH	at-AT	atkı- AT	gir- AT	atlas- AT

It is important to note here that the HH category in the inflectional item list and the derivational item list did not necessarily include the same prime-target pairs because the inflected and derived forms of the same root (e.g., *kattı* 'added' versus *katkı* 'additive/contribution' did not have the same surface frequency-root frequency relationship. While *kattı-KAT* was in the LH category, katkı-KAT was in the HH category. Therefore, the frequency analyses were run separately in each item list.

Following the analysis of the test items, four experimental lists were prepared for each task and the critical prime-target pairs were distributed to each list using a Latin square design so that each participant saw the same target in a different condition and not more than once (Table 7 and 8).

Table 7. Latin Square Design for Inflection Task

Target Item	**Version 1**	**Version 2**	**Version 3**	**Version 4**
SAY	(Identity) say-SAY	(Morphologically related)[10] saydı- SAY	(Unrelated) git- SAY	(Orthographically related) saydam- SAY
BİÇ	(Orthographically related) biçare – BİÇ	(Identity) biç- BİÇ	(Morphologically related) biçti- BİÇ	(Unrelated) gez- BİÇ
SER	(Unrelated) sat- SER	(Orthographically related) serçe- SER	(Identity) ser- SER	(Morphologically related) serdi- SER
SİL	(Test) sildi-SİL	(Unrelated) ört- SİL	(Orthographically related) silah- SİL	(Identity) sil- SİL

[10] Morphologically related condition is also referred to as the 'test condition'

Table 8. Latin Square Design for Derivation Task

Target Item	Version 1	Version 2	Version 3	Version 4
SAY	(Morphologically related) saygı-SAY	(Unrelated) git- SAY	(Orthographically related) saydam- SAY	(Identity) say- SAY
BİÇ	(Identity) biç- BİÇ	(Morphologically related) biçki- BİÇ	(Unrelated) gez- BİÇ	(Orthographically related) biçare - BİÇ
SER	(Orthographically related) serçe- SER	(Identity) ser- SER	(Test) sergi- SER	(Unrelated) sat- SER
SİL	(Unrelated) ört- SİL	(Orthographically related) silah- SİL	(Identity) sil- SİL	(Morphologically related) silgi-SİL

Each list consisted of 24 prime-target pairs: 6 identity, 6 test (morphologically related), 6 unrelated and 6 orthographically related. Seventy-two filler items consisting of 36 nouns and 36 adverbs were added to each list to prevent participants from developing expectations and predict the structure of the target stimuli. In addition to this, 96 non-words were formed by changing two letters of existing Turkish words which were orthographically possible but non-existent. Thus, the whole list (n = 192) included 96 real words and 96 non-words (Table 9). The presentation order of the critical and filler items was randomized across participants.

Items from four different frequency categories were distributed equally among the lists so that each participant saw the equal number of HH, HL, LH and LL prime target pairs.

Table 9. Distribution and the Number of the Test Items

	Version 1	Version 2	Version 3	Version 4
Practice Items	10	10	10	10
Experimental Items	24	24	24	24
Fillers (Real words)	72	72	72	72
Non-words	96	96	96	96
Total	202	202	202	202

5.3.4 Procedures

In both the inflectional and derivational tasks, participants were presented with a forward mask of hashmarks (#####) as a fixation point for 500ms. Then the prime appeared on the screen for 50 immediately followed by the target word. The participants were asked to decide whether the target word was a real word or not by pressing colored 'yes' or 'no' buttons on the keyboard. The 'yes' button was on the right-hand side for right handed people and on the left hand side for left handed participants. The target word stayed on the screen until the participants pressed either the 'yes' or 'no' button. If the participants did not respond to the target word in 5000 ms, a new forward mask appeared on the screen followed by the next prime-target pair (Figure 1 shows a masked priming design).

In this study, the primes were always presented in lowercase and targets were presented in uppercase (white, Verdana font and 40 points size) on a black 17 inch screen, as illustrated below. E-prime Professional 2.0 (Schneider, Eschman & Zuccolotto, 2012) was used to present the stimuli and measure response times (RTs).

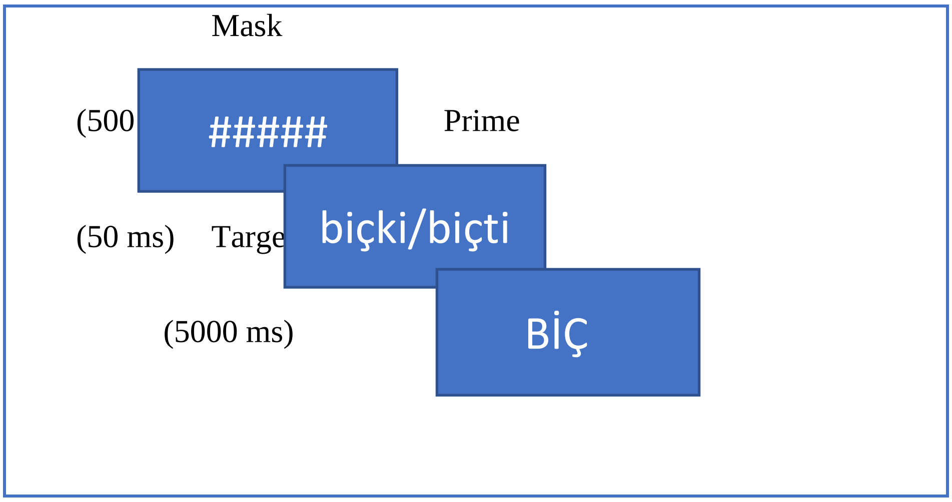

Fig. 1. The presentation of the stimuli

Prior to the experiment, 10 trial sessions were administered from both L1 and L2 groups. Those trial sessions were not included in the analyses. Each experiment took around 4-5 minutes. Each participant was tested individually and the experiment was administered in a quiet place with no distractors. Participants were asked to decide if the target word was a real word or not as quickly as possible. The participants were also requested to look at the screen throughout the experiment. Half way through the task, there was an optional break, during which participants could rest as much as they wished before they continued with the second part of the task. If they did not need a break, they could resume the task immediately by pressing any key on the keyboard. After completing the task, participants were asked if they saw anything visually strange during the task. No participant reported having seen the primes.

After completing the two tasks, L2 speakers were given a vocabulary list consisting of the target words in the study (see Appendix C). They were asked to write down the English equivalent of the target Turkish words. They could also paraphrase/describe/explain the word either in Turkish or English if they could not remember the exact English equivalent of the words. The aim of this additional task was to make sure that the participants already knew the target words. The task lasted 10 minutes on average for the L2 group. All L2 learners were able to translate the target words into English. Thus no item had to be taken out of the reaction time and accuracy analyses.

5.3.5 Analysis

Prior to data analysis, all individual experimental stimuli responses were analyzed in terms of accuracy. Incorrect responses to target stimuli were excluded from the analysis and this elimination accounted for 9 % of L2 data and 5 % of L1 data. Following this, reaction times (RTs) that were 3 standard deviations above or below the mean RT of each individual participant were excluded as outliers from individual data (this corresponds to 2 % of L2 and 4 % of L1 data). These exclusions accounted for a total of 11% of L2 data and 9% of L1 data.

The identity and unrelated conditions served as baseline to trace priming effects. The identity condition was expected to facilitate the maximum priming while the unrelated condition was expected to yield the minimum. In other words, the RTs to the targets were expected to be shortest in the identity condition, and longest in the unrelated condition. The morphological condition served the experimental condition and the orthographic condition was the control condition to ensure that the possible priming effects, if any, were morphological in nature and could not be attributed to orthographic overlap between the primes and the targets. If the RTs in the morphological condition were as fast as the ones in the identity condition but faster than those in the unrelated condition, this was interpreted as ‘full-priming’ (i.e., morpheme-based decomposition). If the RTs in the morphological condition were slower than the ones in the identity condition but still faster than the unrelated condition, this was interpreted as ‘partial priming’. If, on the other hand, the RTs in the morphologically related condition were not significantly different from those in the unrelated condition, this indicated ‘no priming’ (Coughlin & Tremblay, 2015; Silva & Clahsen, 2008). Table 10 shows the criteria used for priming effects.

Table 10. Interpretation of the RTs in Terms of Priming Effects

Finding	Interpretation
Identity condition = Test Condition < Unrelated condition	Full priming
Identity condition < Test Condition < Unrelated condition	Partial priming
Identity condition ≤ Test Condition = Unrelated condition	No priming

RTs were log-transformed and analyzed with linear mixed-effects models using lme4 package. Afex library was utilized in the Ime4 package to obtain p values. The results of the orthographically related condition were analyzed in different models for both L1 and L2 groups. All models had the log-transformed RTs as dependent variables. The morphological models included prime type (identity, test, unrelated), group (L1, L2) and suffix (inflection, derivation) as fixed variables. Native speakers’ RTs in the test HH conditions were taken as baselines. Additional models were run for L2 learners’ results separately, with proficiency as a fixed variable to investigate whether the possible priming effects in L2 learner data were modulated by their L2 proficiency, Separate models were fitted for L1 and L2 speakers to investigate whether frequency plays a role in the processing route adopted by the participants. In these models, fixed effects included four frequency categories (HH, HL, LH and LL) along with the identity, test and unrelated conditions. The results of these analyses were presented and discussed in the following chapter.

CHAPTER 6

RESULTS

This chapter presents the results of the two masked priming experiments conducted with L1 and L2 Turkish speakers to test the processing of inflected and derived words. It is important to note again that since the target words in both experiments included the same verb roots for which either the inflected and derived words were used as primes (i.e., *sevdi*, 'loved' – *sev*, 'love' versus *sevgi*, 'love' (noun) – *sev* 'love'), the study provides a direct comparison between the processing of inflected and derived forms. In the analyses, the reaction time (RT) data were compared both in terms of within-groups and between groups differences.

Prior to analysis, the first step in data cleaning was appliedon basis of the accuracy rates of participants. The participants who met the overall accuracy criteria of 25% qualified for the analysis. In other words, the participants who had more than 25% incorrect response (i.e., a 'no' response to a real target word; and a 'yes' response to a nonword) were excluded from the study. That way, a total of 8 participants were excluded from the study. Thus, the experiments included 72 L1 Turkish speakers and 72 L2 Turkish learners.

Each participant's incorrect responses were removed and this elimination accounted for 9 % of L2 data and 5 % of L1 data. Following this, reaction times (RTs) 3 standard deviations above or below the mean RTs of each individual participant were excluded as outliers from individual data. (i.e., 2% of L2 data and 4% of L1 data). These exclusions accounted for a total of 11% of L2 data and 9% of L1 data. A further data cleaning included group-level outlier removing. In other words, L1 and L2 data, the RTs which were 3 SD above and below the mean RTs of each task (derivation and inflection separately) were excluded as group outliers. This accounted for 1.6% of L2 data and 0.47% of L1 data. The RTs were log transformed to meet the normality assumption (see Baayen & Milin, 2010; Ratcliff, 1993). RTs were analyzed using mixed linear effects models and parameters were estimated with restricted maximum likelihood (reml).

6.1 Morphological Condition

A linear mixed effects model was fitted using the log-transformed RTs of all participants in identity, morphological and unrelated conditions (Table 11 shows raw mean response latencies (ms) per condition). The model was run with the random effects for participants and with the fixed effects of group (L1 and L2), prime type (identity, test, unrelated) and suffix type (inflection, derivation). The overall model revealed main effects of Group, $t(142) = 4.7307$, $p < .001$ reflecting significantly longer RTs for L2 speakers and Prime Type, $t(4402) = -3.7327$, $p < .001$ revealing significantly shorter RTs for identity condition compared to morphological condition. The model also revealed a marginally significant effect of unrelated primes, $t(4402) = 1.9446$. Table 12 shows the results of the overall model. These results suggest that overall L2 learners differ from L1 learners in terms of overall RTs. Also, identity prime conditions reveal faster RTs than morphologically related prime conditions and unrelated prime conditions for all participants. Figure 2 shows the overall (inflected and derived) raw mean RTs in the overall data.

Table 11. Raw Mean Response Latencies (ms) per Condition

Condition	Identity (*N* = 72)		Test (*N* = 72)		Unrelated (*N* = 72)		Orthograph-related (*N* = 72)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
L1 Turkish	656.26	190.47	666.52	195.17	685.53	197.30	664.80	187.85
L2 Turkish	732.41	239.32	774.33	261.25	772.39	247.51	759.23	240.29

Table 12. Linear Mixed-Effects Model on All Participants' Log-Transformed RTs

Variable	Value	Std. Error	Df	*t*	*p*
Intercept	6.472657	0.019522508	4404	331.5485	0.0000
Group L2	0.124475	0.026312126	142	4.7307	0.0000
PrimeType (Identity)	-0.031560	0.008455016	4404	-3.7327	0.0002
PrimeType (UNR)	0.016560	0.0085155599	4404	1.9446	0.0519

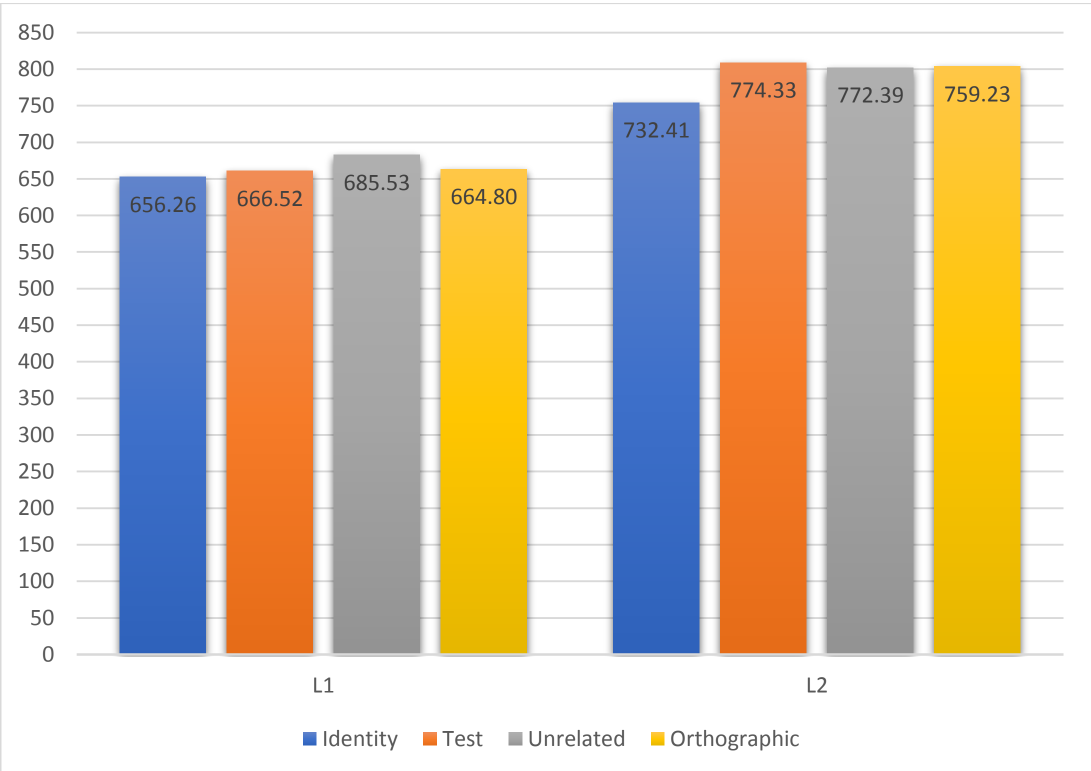

Fig. 2. Raw mean reaction times for all participants

Separate RT data obtained from the inflectional and derivational priming experiments are presented in figure 3 and 4. The test condition prime here represents the morphologically related prime condition.

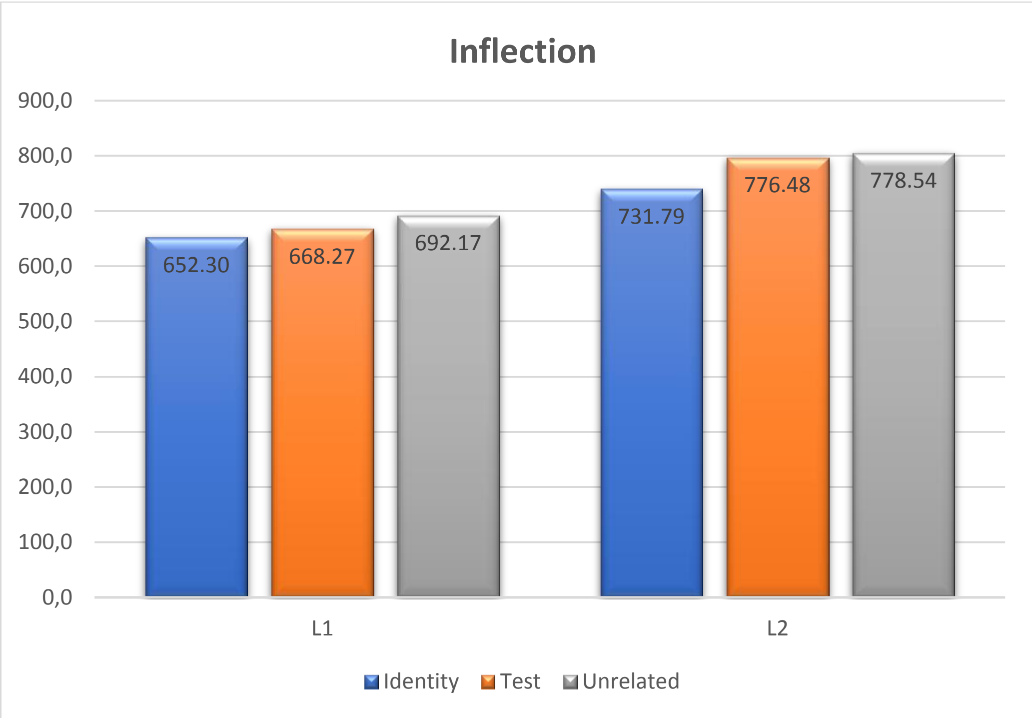

Fig. 3. Raw mean reaction times for inflectional study

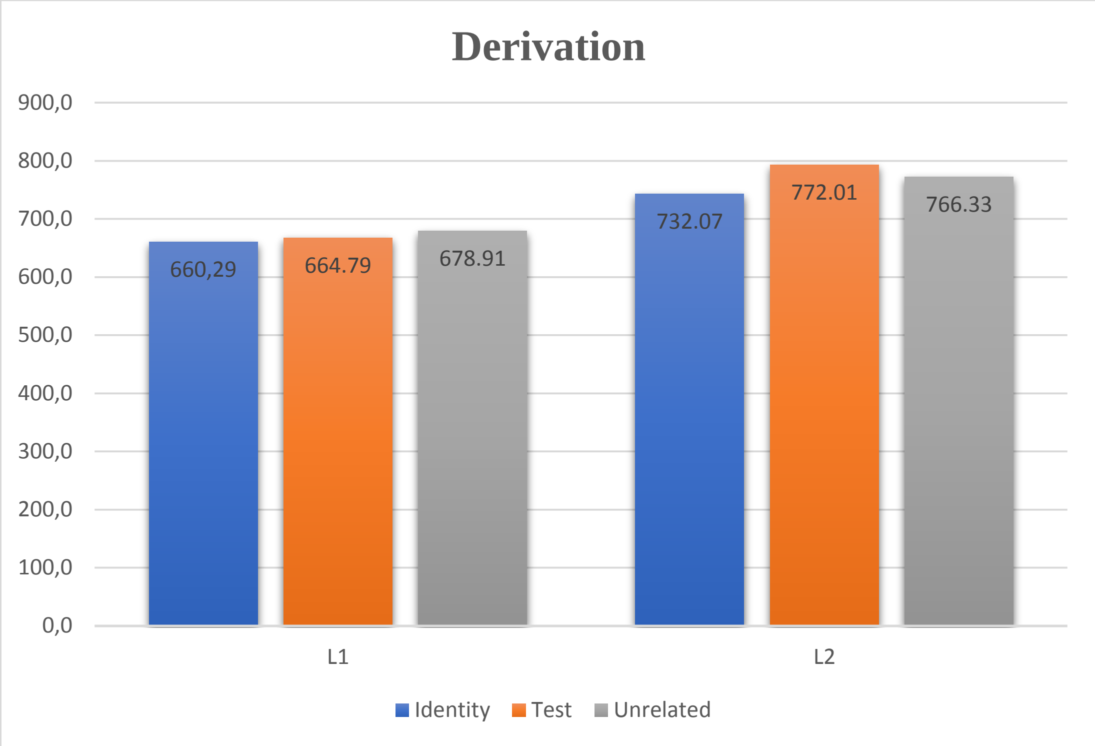

Fig.4. Raw mean reaction times for derivational study

Given the large differences in the responses of L1 and L2 groups, separate models were fitted to each group. The next model was conducted on the overall data of L1 speakers' latencies in the identity, morphological and unrelated conditions with participants as random effects (Table 13). The model revealed the following interactions: RTs in identity and morphological conditions were not statistically different but the unrelated primes revealed significantly longer RTs in comparison to morphological condition $t\ (2259) = -1.400$ $p < .05$. Suffix type did not reveal any effects but marginally longer RTs were observed in the inflectional primes, $t\ (2259) = 0.4757$, $p = .63$. These findings suggest full priming pattern for L1 speakers in both inflectional and derivational morphology in Turkish.

Table 13. Linear Mixed-effects Model on L1 Speakers' Log-transformed RTs.

	Value	Std.Error	DF	t-value	p-value
(Intercept)	6.463296	0.018478200	2259	349.7795	0.0000
PrimeTypeIDPR	-0.015551	0.011107710	2259	-1.4000	0.1616
PrimeTypeURPR	0.030160	0.011174907	2259	2.6989	0.0070

The next model was conducted only on L2 learners' log transformed RTs with proficiency as fixed variable. The model (Table 14) revealed marginally longer RTs for unrelated condition compared to morphologically related condition, t (1563) = 0.31737, p > .05; and slightly shorter RTs for the identity condition, t (1563) = -1.24206, p > .05. Suffix type did not reveal any significant effects though the latencies decreased marginally in inflectional items, t (1563) = -0.96444, p > .05. None of the effects reached significance levels. Latencies slightly increased with the higher proficiency but the difference was not statistically significant, t (69) = 1.09721, p > .05. L2 learners did not demonstrate any priming effects either in inflectional or in derivational items. The results could be interpreted as the absence of decomposition in morphologically complex verb forms for L2 speakers.

Table 14. Linear Mixed-effects Model on L2 Speakers' Log-transformed RTs

	Value	Std. Error	DF	t-value	p-value
Intercept	6.569246	0.3158349	1563	207.9962	0.0000
PrimeTypeIDPR	-033733	0.02715909	1563	-1.2420	0.2144
PrimeTypeURPR	0.008620	0.02715909	1563	0.3173	0.7510
SuffixInf	-0.027388	0.02839718	1563	-0.9644	0.3350
Proficiency	0.001942	0.00176960	69	1.0972	0.2764

The overall analysis of L1 data revealed significant priming effects both in inflection and derivation. Hence, further analyses were conducted to examine the processing patterns in inflectional and derivational morphology, respectively. If the full priming pattern is observed in any analysis, further orthographic priming effects analyses were run following the main models. The findings of the analyses are presented below.

6.2 The analysis of L1 Turkish data

To test whether the morphological priming pattern for L1 speakers in inflectional and derivational items exhibited different patterns, separate models were run for inflectional and derivational tasks.

6.2.2 The RT analysis of L1 data in the inflectional task

A separate linear model was conducted on L1 speakers' log transformed RTs in the identity, morphological and unrelated conditions. Table 15 shows the output of the model. The model revealed a significant main effect of unrelated primes, $t(1094) = 2.14344$, $p < .05$ but no effect of identity primes. The results suggest full priming for L1 speakers in inflectional morphology.

Table 15. Linear Mixed-effects Model on L1 Speakers' Log-transformed RTs, Inflectional Morphology

	Value	Std. Error	DF	t-value	p- value
Intercept	6.468417	0.02047016	1094	446.3420	0.0000
PrimeTypeIDPR	-0.018714	0.01540752	1094	-1.21458	0.2248
PrimeTypeURPR	0.033379	0.01557251	1094	2.14344	0.0323

To examine the source of priming, another model was run on orthographic, identity and unrelated conditions for L1 speakers on the inflectional morphology. The model revealed no significant effect of identity primes but a significant interaction between the orthographically related primes and unrelated primes, t (1087) = 2.3666, $p < .05$. Therefore, it is concluded that the priming pattern observed in inflectional morphology with L1 speakers might be partially attributed to the orthographic similarity rather than the morphological relation.

To better understand the nature of priming effect in the inflectional morphology for L1 speakers, a further model was fitted to compare the orthographic condition with the morphological condition, setting morphological condition as the baseline. The model revealed marginally longer RTs for the orthographic condition, although the difference was not statistically significant, t (1087) = 0.59202, $p > .05$.

The results of the models run up to this point show that L1 speakers of Turkish use decomposition route when processing inflectional verbal morphology in their native language, Turkish. The parsing route they adopt does not seem to stem from orthographic overlap since the morphological facilitation is greater in the morphologically related words than any other condition.

6.2.3 The RT analysis of L1 data in the derivational task

The derivation analysis in L1 speakers yielded the following results: RTs in identity primes and morphologically related primes were not significantly different, t (1092) = -0.58250, p > .05. The same pattern was observed in the unrelated condition. That is, the difference between the morphologically related primes and unrelated primes were not significant, t (1092) = 1.86443, p > .05.(Table 16). Given that there were no significant differences between unrelated and morphological conditions and between identity and morphological conditions, the results suggest that there are no priming effects for L1 speakers in derivational morphology. In other words, L1 speakers of Turkish represent derived verb in a fully listed manner. Table 6 shows the output of the derivational morphology analysis for L1 speakers.

Table 16. Linear Mixed-effects Model on L1 Speakers' Log-transformed RTs, Derivational Morphology

	Value	Std. Error	DF	t-value	p- value
Intercept	6.462554	0.02080514	1092	310.62300	0.0000
PrimeTypeIDPR	-0.008621	0.01479940	1092	-0.58250	0.5604
PrimeTypeURPR	0.0276638	0.01482375	1092	1.86443	0.0625

6.3 The RT analysis of L2 data

The initial analysis on L2 data were fitted on the overall RTs (i.e., merged data for inflection and derivation). The first model was fit to log transformed RTs with fixed effects for the prime type (the identity, morphological and unrelated) and suffix type (derivation and inflection) and random intercept for participants. Proficiency was not found to be a significant factor effecting L2 data. The model was refitted without proficiency being a fixed effect. The likelihood ratio tests (Baayen, 2013) using the Anova revealed that the fixed effect for proficiency did not improve the model ($\chi 2$ (1) = 0.0355, p = 0.8505). Hence, proficiency was removed from the subsequent analyses. The overall analysis of L2 data (as shown in Table 17), revealed longer RTs in the morphological condition than in the identity condition, t (2142) = -3.76349, $p < .05$. The unrelated condition did not yield any significant effect. The results of this model show that L2 learners show evidence of repetition priming only.

Table 17. Linear Mixed-effects Model on L2 Speakers' Overall Log-transformed RTs

	Value	Std. Error	DF	t-value	p-value
Intercept	6.612855	0.2220643	2142	297.79016	0.0000
PrimeType ID	-0.0482148	0.01282011	2142	-3.76349	0.0002
PrimeTpye URPR	0.002356	0.01292653	2142	0.182222	0.8554

6.3.1 The RT analysis of L2 data in the inflectional task

In inflectional morphology, L2 speakers revealed a different pattern from L1 speakers. The model fit on inflectional L2 data yielded a significant effect of identity prime, t (1022) = -2.93108, p <.05. Responses after unrelated primes were only marginally slower than those after morphologically related primes, suggesting that there was no significant morphological priming (i.e., no facilitation in the recognition of target verbs after inflected primes). (see Table 18 below).

Table 18. Linear Mixed-effects Model on L2 Speakers' Log-transformed RTs, Inflectional Morphology

	Value	Std. Error	DF	t-value	p- value
Intercept	6.612323	0.02413349	1022	273.98949	0.0000
PrimeTypeIDPR	-0.050967	0.01738840	1022	-2.93108	0.0035
PrimeTypeURPR	0.005826	0.01743543	1022	0.33416	0.7383

6.3.2 The RT analysis of L2 data in the derivational task

The model run on L2 derivational data, which is presented in Table 19, showed that L2 speakers responses to identity primes were significantly faster than the responses to the morphological condition, t (1047) = -2.5915, p < .05 while the RTs for unrelated primes did not differ from those for morphologically related primes statistically. However, L2 learners responded to unrelated primes in shorter times compared to the morphological primes, t (1047) = -2.5915, p > .05.

Table 19. Linear Mixed-effects Model on L2 Speakers' Log-transformed RTs, Derivational Morphology

	Value	Std. Error	DF	t-value	p- value
Intercept	6.607356	0.02382894	1047	277.2828	0.0000
PrimeTypeIDPR	-0.046921	0.01812111	1047	-2.5915	0.0097
PrimeTypeURPR	-0.001843	0.01835130	1047	-0.1004	0.9200

In sum, the analyses of the L2 data revealed that L2 speakers of Turkish display no morphological priming effects either in derivational or inflectional verbal morphology.

6.4 Frequency analyses

The effects of frequency (morpheme frequency, stem frequency, surface frequency, lemma frequency, etc.) in the processing morphologically complex words has been widely discussed in the psycholinguistic literature (see Amenta & Crepaldi, 2012 for a review). However, cross-linguistic findings in masked priming studies have not been conclusive so far. For instance, Giraudo & Grainger (2000) found larger priming effects in highly frequent primes in derived forms compared to low frequency ones. In contrast, McCormick et al. (2009) could not find any interaction between prime frequency and the decompositional route since all the derived words, regardless of their frequency counts, were parsed into its constituents. In the current study, the target items in each condition were also classified into 4 different categories based on root and surface frequency. To contribute to the debate of frequency effects, two separate models were run to investigate the possible frequency effects on morphological processing.

For L1 speakers, the inclusion of frequency measures to the model proved a better model (AIC = -246.6408). The analysis revealed a significant priming effect for the HL (high surface, low root frequency) condition ($t\ (2256) = 3.4384$, $p < .05$) as well as the LL (low surface, low root frequency) condition ($t\ (2256) = 6.1764$, $p < .05$). The main effect of frequency did not change in inflectional and derivational morphology. A similar effect was observed in L2 data. L2 speakers responded to the HL and LL morphological conditions more slowly than the HH (high surface, high root frequency), $t\ (2139) = 7.01977$ and $t\ (2139) = 5.67134$, respectively.

Since the previous model in inflection and derivation did not involve frequency-based analyses, additional models were fitted to investigate whether the frequency (surface or root) influenced the processing patterns in L1 and L2 data and for inflection and derivation separately. More specifically, data from each frequency condition (HH, HL, LH and LL) were analyzed separately in derivation and inflection in separate models. The models for L1 derivation revealed that for L1 speakers only HL condition, that is, the derived forms with high surface frequency, low root frequency, was facilitated with frequency $t\ (207) = 2.22007$, $p < .05$. For the inflection task, RTs in the unrelated were significantly higher than test condition in HL (high surface frequency, low root frequency), $t\ (228) = 2.84646$, $p < .05$ but in LL (low surface, high root frequency) conditions the significance was disputable, $t\ (228) = 1.96142$, $p = .05$. No significant effects were observed in the HH and LH conditions.

L2 speaker data were analyzed using the same procedure. None of the analyses yielded significant effects of priming. In other words, L2 learners did not demonstrate priming effects in any of the frequency conditions.

In the light of the findings above, the next chapter will discuss the findings in relation to the research questions and previous findings in the field.

CHAPTER 7

DISCUSSION AND CONCLUSION

7.1 Discussion

Recall that the present investigation focused on four issues: 1) potential processing dichotomy between inflected and derived forms; 2) the role of root and/or surface frequency; 3) potential native-nonnative differences with respect to morphological processing; 4) the role of L2 proficiency in native-like processing. In this chapter, the findings of the study are discussed in reference to these issues considering specific research questions and findings of related studies reported in the previous literature.

7.1.1 First language (L1) processing

The first and the second research questions addressed L1 processing of morphologically complex inflected and derived words in Turkish, respectively. The third research question was about potential processing differences between the inflectional and derivational morphology and potential effects of root and surface frequency on the inflected and derived word processing patterns.

Turkish native speaker data revealed clear morphological priming effects in accessing inflected words. In other words, Turkish inflected verbs are represented in a decomposed form. This finding is in line with our prediction and also with previous views on morphologically rich agglutinating languages (e.g., Hankamer, 1989; Kırkıcı & Clahsen, 2013; Portin et al., 2008). L1 speakers of agglutinative languages with rich morphology like Turkish are expected to decompose morphologically complex words (Hankamer, 1989; Portin et al., 2008). Indeed, some previous lexical decision studies with L1 Turkish speakers also supported this prediction (Kırkıcı &

Clahsen, 2013; cf. Gürel, 1999). For example, Kırkıcı & Clahsen's (2013) masked priming study, investigating the processing of the Aorist verb inflection (-A/Ir) revealed that inflected verbs were efficient primes for target verbs in L1 Turkish, suggesting full morphological priming in accessing inflected words. The present masked priming study also revealed full morphological priming effects in the verbal domain (in verbs inflected with past tense –DI). Nevertheless, this decompositional processing pattern in the verbal domain has not been found in studies examining the processing in the nominal inflectional domain. For example, both Gürel (1999) and Uygun & Gürel (2016) investigated, via unmasked lexical decision tasks, the processing of nominal inflection (i.e. case- and/or plural-marked complex nouns). The native speaker data in these studies demonstrated full-listing patterns that are clearly observed in the processing of multimorphemic words that consist of frequent suffixes (see also Lehtonen & Laine, 2003 for similar frequency-based full form representations in L1 speakers of Finnish, another agglutinating language).

Unlike Gürel (1999) and Uygun & Gürel (2016), the results of the current study with inflected verbs converge with the results of Kırkıcı & Clahsen (2013), which also looked at inflected verb processing and found decompositional patterns. Given this, the inconsistent findings in the domain of L1 Turkish inflection may be due to the fact that verbal and nominal domains are subject to differential processing patterns. It may also be the case that these divergent results are linked to the experimental paradigms used. As noted above, like Kırkıcı & Clahsen (2013), the current study used masked priming which involves a brief prime-presentation right before the target. However, Gürel (1999) and Uygun & Gürel (2016) used unmasked simple lexical decision tasks. As suggested in the literature, unlike the simple lexical decision paradigm, the masked priming paradigm taps into early processes of word recognition, during which access to lexical items may occur only unconsciously. In that sense, it can be said that in the early phase of word recognition, morpheme-based access is still possible in L1 processing of Turkish. Simple lexical decision tasks, however, do not necessarily capture very early processing phase, revealing frequency-based dual routes.

The second research question pertains to L1 Turkish processing of derived verb forms. Recall that the derivational suffix tested in this study, namely -GI is quite productive and semantically transparent. In that sense, it is comparable to the inflected morpheme tested in the study, namely, -DI past tense. The results of the derivational masked priming study revealed a direct access route for L1 speakers of Turkish. This expected finding is also consistent with some of the previous studies. For example, English data in Stanners et al. (1979) and Italian data in Laudanna et al. (1992) revealed similar full-listing representations for derived forms. Nevertheless, some studies reported full priming (i.e., decompositional pattern) in the L1 processing of derived words as well (Silva & Clahsen, 2008; Jacob et al. 2017; Kırkıcı & Clahsen, 2013). Several other studies, however, found support for the dual route in the processing of derivational morphology. Marslen-Wilson et al. (1994) have reported semantic transparency effects in the extent of decompositional patterns, in the sense that while opaque forms such as ‘department-depart’ do not reveal priming effects, semantically transparent forms such as ‘darkness-dark’ do. Suffix productivity is also considered a determining factor in the processing route employed, as revealed by previous findings that complex forms with more productive derivational suffixes are subject to morpheme-based parsing (Bertram et al., 1999; Ford, Davis & Marslen-Wilson, 2003). Thus, in some studies, factors such as stem-suffix attachment transparency, clear semantic contribution of the suffix to the whole word meaning, and suffix productivity seem to be important factors determining the extent of morpheme-based processing pattern. Nevertheless, previous findings are not completely consistent on this issue. In the context of the present study, the derivational suffix, -GI is a productive morpheme and, the derived forms consisting the verb root and –GI are always transparent with respect to the morpho-phonological boundaries between them. In other words, the root-suffix boundary is always clearly identifiable. The only issue here is the allomorphic change between –gI and –kI. In other words, this consonant initial suffix sometimes surfaces as –gI and sometimes as –kI, depending on the voicing feature of the final phoneme in the root that it attaches to (e.g., *sev-gi*, 'love' versus *kat-kı* 'contribution). Nevertheless, the g/k change is completely predictable, thus, does not negatively affect morpho-phonological transparency.

In short, on the basis of some of the previous findings, the features of the derived forms tested in the current study, may be considered conducive to morphological decomposition. However, it seems that Turkish native speakers resort to the direct route in verbal derivational morphology. Despite morpho-phonological transparency and productivity (as well as frequency), complex forms derived with the suffix –GI (i.e., noun forming suffix) are not decomposed. This finding is not in line with the results of Kırkıcı & Clahsen (2013) for derivational morphology in L1 Turkish. Recall that they tested derived nouns with a productive suffix -lIk and found decomposition. This differential result may be due to the fact that the suffix tested in Kırkıcı & Clahsen (2013) (i.e., -lIk) is different from the suffix –GI tested in this present study in that -lIk produces nouns from nouns (e.g., doctor, 'doctor' – doktorluk, 'doctorship') as well as from adjectives (e.g., aç, 'hungry'- açlık, 'hunger') whereas -GI only derives nouns from verbs. This might have led to decompositional patterns in Kırkıcı & Clahsen's (2013) study, but not in the current one.

The absence of morpheme-based computation in derived words may also be due to computational efficiency. In other words, native speakers of Turkish might tend to employ full-listing whenever morpho-phonological and semantic conditions permit (see Gürel, 1999; Gürel & Uygun, 2013; Uygun & Gürel, 2016). Indeed, the finding that native Turkish speakers employ root-suffix decomposition in inflected words but not in derived words suggest dual-route processing and this is in line with previous findings revealing inflectional-derivational processing dissociation in the literature. For example, in an earlier study comparing inflectional and derivational processing, Stanners et al.(1979) found stronger priming effects in inflectional than derivational morphology. Similarly, Laudanna et al. (1992) found full form representations for derived words but not in inflected forms in Italian. Feldman (1994) also found that inflectionally related primes produced significantly greater effects than derivationally related primes, suggesting differentiation between the two morphological systems.

Differential processing mechanisms for L1 speakers in derivation and inflection may be accounted for on the basis of the theoretical distinction drawn between derivational and inflectional morphology (e.g., Anderson, 1982, 1992). As discussed earlier in Chapter 2, first of all, unlike inflection, derivation changes the grammatical class of the root it attaches to. Also, unlike the inflectional process, derivation creates new lexical items with different semantic meanings. In that sense, the semantic relation between a derived form and its stem may not always be as direct as the one between an inflected form and its stem (see Amenta & Crepaldi, 2012 for a review). L1 speakers of Turkish might be sensitive to syntactic category and meaning change in derivation and this may lead to additional cost for these derived forms, hence full listing rather than computation. These factors may account for the differential processing route found between inflected and derived words (i.e., decomposition for inflected forms and full listing for derived words) in L1 Turkish speakers. To illustrate, the derivational suffix –GI changes the syntactic category and the semantics of the verbal stem it attaches to. The noun, *saygı* 'respect', derived from a verbal root is also semantically different from the verb form *say* 'to count/to respect'. As suggested by Bybee (1985) this unpredictability might lead to full listing of derived forms. On the other hand, inflectional suffix -DI does not alter either the syntactic category or the semantics of the verb it attaches to (e.g., *saydı*, 'counted/respected'). Therefore, inflected forms are more predictable. Thus, while the inflected form, *saydı*, is subject to computation rather than full listing, the derived form, *saygı* has full form representation in the mental lexicon.

It is also crucial to note that if priming effects revealing decomposition had been due to orthographic similarity between the complex form and the stem (e.g., *sevdi*, 'loved' – *sev*, 'love versus *sevgi*, 'love' (noun) – *sev* 'love'), we would have seen similar facilitation in both types of processes. However, as noted above, only inflected words (e.g., *sevdi*) prime the verb root (e.g. '*sev*'). The additional statistical analyses discussed in the previous chapter also implied that facilitation found in the inflected prime and the stem is not orthographically-based.

Regarding the third question examining potential effects of root and/or surface frequency on word recognition the L1 Turkish, the findings suggest that somewhat more salient priming effects in morphologically related primes that consisted of low frequency roots (compared to whole-word frequency). However, the frequency categories (i.e., HH, HL, LH, and LL) did not reveal considerably different morphological priming effects for the target words in either inflected or derived words. In other words, the extent of priming effects found in the inflectional task did not vary substantially as a function of frequency. In the derivational context, the absence of morphological priming was found to be consistent across all frequency categorization.

In sum, the present findings revealing differential processing mechanisms for inflection and derivation in L1 Turkish supports the dual system accounts (cf. Raveh, 2002). While the processing of inflectional morphology undergoes morpheme-based decomposition, derivational morphology does not. This dissociation may be the consequence of many linguistic differences between inflectional and derivational morphology. It is still possible that this processing difference may emerge due to native speakers' attempt to economize in morphological computation whenever possible (see also Gürel, 1999).

7.1.2 L2 language processing

The current study explored the above-mentioned research questions also in L2 learners' processing of inflected and derived words. The findings revealed that late L2 learners of Turkish did not demonstrate any priming effects for either inflectional or derivational verbal morphology. As noted in the predictions, higher L2 proficiency was expected to lead to native-like processing in the L2, namely decompositional patterns in accessing inflected forms and full listing in derived forms. However, the results showed no proficiency-based differences among L2 learners in the processing of either inflectional or derivational morphology. Furthermore, no effects of frequency (root or surface) were found in the results.

The absence of morphological priming in inflected words has also been reported in previous L2 studies (e.g., Jacob et al. 2017; Kırkıcı & Clahsen, 2013; Silva & Clahsen, 2008). Such a finding was also predicted by Ullman's (2005) declarative-procedural model that assumes that late L2 learners lack an ability to do online linguistic computations, thus, store inflected forms as chunks. However, the current L2 findings on inflected word processing is in contrast, for example, with Feldman et al.'s (2010) study that revealed priming effects for L2 speakers of English in the processing of regular and irregular past tense forms. The results of the current study also contradict full priming effects reported for L2 French inflection (Coughlin & Tremblay, 2015) and for L2 Spanish infection (Foote, 2015). Similarly, the present study is not in conformity with the opposite priming patterns (i.e., decomposition for L1 Turkish speakers and decomposition for L2 Turkish learners) reported in the unmasked priming experiments of Uygun & Gürel (2013) and Uygun & Gürel (2016).

With respect to derivational morphology, the absence of morphological priming in L2 learners that was found in the current study has also been reported earlier. For example, Clahsen & Neubauer (2010) found no decomposition in the processing of derived forms in L2 German learners. Similarly, Silva and Clahsen (2008) reported only reduced priming for derived forms in L2 learners. Nevertheless, the current L2 findings on derivational morphology, are not in line with other related studies that found native-like decompositional patterns in L2 processing of derived forms (e.g., Diependaele et al., 2011).

With respect to the comparison of inflected and derived word processing in the L2 group, the current study revealed no differences in the type of morphology. This contrasts with the findings of Jacob et al. (2013) that revealed robust priming effects for derived but not for inflected forms in L2 speakers. The current L2 findings also diverge from the L2 Turkish data of Kırkıcı & Clahsen (2013) that revealed decompositional patterns in the processing of derived words but not in inflected words. Nevertheless, the present results seem to support, albeit partially, Silva & Clahsen's (2008) findings that showed no priming for inflected and reduced priming for derived word forms for L2 learners.

7.1.3 Factors determining L1 and L2 processing differences

Overall, the findings suggest that L2 learners of Turkish diverge from native speakers with respect to the processing of inflected forms as the decompositional pattern was found only in native speakers. For derived word processing neither group revealed morphological priming effects, suggesting that derived forms have full listing representations in both groups. The inflectional-derivational difference in native speakers may be linked to clear linguistic differences in inflectional and derivational morphology. Derived words creating new lexical items appear to have full listing representations while inflected words always undergo computation, irrespective of frequency. The lack of priming differences between inflected and derived words in the L2 group suggests that irrespective of morphological type, late L2 learners tend to store morphologically complex forms as chunked units (Clahsen et al. 2010; Ullman, 2005). Proficiency does not seem to have an effect on this.

The lack of facilitation in L2 inflected words may also be due to non-linguistic factors such as length of L2 exposure. The L2 participants' proficiency levels were assessed via a cloze test and they were all found to be advanced learners. Nevertheless, the participants' length of exposure to Turkish varied. It is possible that the processing pattern in the L2 proceeds on a continuum from full listing to decomposition (cf. Gürel & Uygun , 2013; Uygun & Gürel, 2016). The present data actually revealed that morphologically related primes led to faster RTs than unrelated primes. Nevertheless, the difference between these prime conditions was not statistically significant. This suggests that with longer L2 exposure (particularly more exposure to a variety of multmorphemic words in Turkish), these participants may gradually develop a clear decompositional pattern, at least for inflected forms (see also Gor, 2000 for a parallel discussion in Russian).

With respect to frequency effects, L2 learners' insensitivity to frequency can also be explained by the extent of their exposure to these L2 forms. Regardless of the root and surface frequency, L2 learners in the current study employ full listing for these morphologically complex words. In a study, involving bilingual speakers of Finnish, another morphologically rich agglutinating language, Lehtonen & Laine (2003) reported no sensitivity to frequency effects in any of the high, medium or low frequency conditions in the sense that bilingual Finnish speakers parsed all inflected forms. Lehtonen & Laine (2003) explain this pattern by the lower rates of exposure of L2 speakers. In other words, due to short L2 exposure length, frequency effects do not become affective in the L2 group. Thus, they resort to decomposition in all frequency range, unlike what was found here. Given that in the current study, full listing is observed in the L2 group for inflection and derivation regardless of the frequency of the root and the whole word, and given that full listing is also relevant in L1 derivational processing, the language exposure-based accounts may not be plausible to account for the current data. Nevertheless, it may still be possible to suggest that if full listing and decomposition form a continuum, then L2 learners may be expected to adopt this direct access route until they become more exposed to L2 complex forms. After that decompositional effects may emerge. This, however, does not rule out the possibility that L2 learners may still display dissociation, like native Turkish speakers, between inflected and derived forms. It is possible that prolonged exposure to L2 Turkish may lead to a switch from full listing to computational parsing in inflected forms, whereas derivational forms may still retain full form representation due to their distinct linguistic features, as discussed above.

7.2 Conclusion: Summary and general evaluation

This study investigated the processing of verbal inflection and derivation in L2 Turkish. To this aim, L1 Turkish speakers and high proficiency L1-English speaking learners of L2 Turkish were tested via two different masked priming tasks that involved past tense –DI-marked inflected primes and noun forming suffix, GI-marked derived word primes. In both tasks, the same verb roots served as target items for which participants were asked to make lexical decision as accurately and as fast as possible. In addition to morphologically related primes (i.e., inflected and derived words), the target items were preceded by three other different primes, namely identity primes, orthographically related primes and unrelated primes. RT analysis was carried out on the correctly responded items and RTs to target items in each prime condition were compared to one another. Following the basic assumptions in the masked priming paradigm, RTs in the morphologically related prime condition were predicted to be as fast as the RTs in the identity condition but lower than those in the unrelated condition. Such a finding was interpreted as full morphological priming, indicating that a morpheme-based decomposition took place in lexical access. If RTs in the morphologically related condition were higher than those in the unrelated condition, this was taken as evidence that being exposed to a morphologically related prime did not facilitate (i.e., speeded up) target word recognition any more than being exposed to an unrelated prime. Such a finding was taken to mean the absence of decomposition in word recognition. In other words, this was interpreted as full form representation for a multimorphemic word in the lexicon. Given that a prime-target pair such as *sevdi*, 'loved'− *sev*, 'love' is not only morphologically related but also orthographically related, the nature of facilitation needed further investigation. Thus, in order to understand whether facilitation effects between *sevdi* and *sev* is morphological in nature (but not due to an orthographic overlap between prime and target) another condition involving a purely orthographically related prime was also introduced in the design: *sevap*, 'good works' – *sev*, 'love'. The RT difference between the morphologically related condition and the unrelated condition was predicted to be bigger than the RT difference between the orthographically related condition and the unrelated condition.

In this study, L1 and L2 Turkish groups were compared with respect to their processing patterns in accessing inflected and derived words. L2 proficiency was also examined as a variable in the study. Potential processing differences between inflected and derived forms and the role of root and/or surface frequency either in the L1 and the L2 data were interpreted in light of the specific research questions. Given the proficiency levels of L2 learners, we predicted native-like processing patterns in the L2 group. In addition, due to more lexicalized status of derived words, it was predicted that while derived words would be subject to full form representation, inflected forms would be accessed in a decomposed fashion. Furthermore, it was predicted that even though inflected verbs would be decomposed, the extent of decomposition would be more salient in complex words that have low surface frequency and high root frequency than those that have high surface frequency and low root frequency. In the context of derived words, however, it was predicted that the words with high surface frequency would be subject to significantly higher full listing patterns than the words with low surface frequency. The root frequency effects were not predicted to affect the full listing pattern expected in derivational morpheme processing.

The results of the masked priming experiments indicated that L2 speakers differed from L1 speakers of Turkish only in processing of inflectional morphology. L1 speakers decomposed inflected Turkish verbs while they employed a direct access route (i.e., full listing) for derived words. L2 speakers, on the other hand, represented both inflection and derivation as unanalyzed chunks in their mental lexicon. Unlike what was predicted, L2 proficiency did not appear to be a significant variable in the results. Furthermore, in contrast to our predictions, the surface and root frequency effects were not strong enough to interpret them as strong variables.

L1 results clearly suggest that morphological facilitation occurs in inflected prime-target pairs but not in derived prime-target pairs. This finding shows that facilitation is not orthographical. Otherwise, derived words would have also primed the target verbs. The decompositional processing pattern found in native speakers' processing of inflectional morphology and full listing in derivational morphology imply that the theoretical distinction assumed for these two types of morphological processes has a psycholinguistic reality. Given that the same roots were used in both inflectional and derivational tasks, the clear distinction found in the processing patterns support the theoretical distinction drawn between them.

It is also important to note that according to some previous views, in agglutinative languages with a rich morphological system, morphologically complex forms should be parsed into constituent morphemes (Hankamer, 1989). L1 inflectional data support this prediction. Nevertheless, given that not all morphological processes are subject to decomposition (i.e., derived forms have full listing), native Turkish speakers tend to store multimorphemic units as whole units whenever possible. It seems that derived forms with their clear lexicalization features (i.e. they create new lexical items) are suitable for this kind of full listing route. The processing dichotomy between inflectional and derivational morphology in L1 data suggests that a dual route mechanism is at play here.

The lack of decomposition in the L2 leaners' processing of inflectional and derivational morphology is not completely unprecedented as previous L2 studies have already reported clear native-nonnative differences in the processing of both types of morphology (see Clahsen et al. 2010 for a review). Particularly, the lack of decomposition in inflectional morphology in L2 Turkish has already been reported (Kırıkıcı & Clahsen, 2013; cf. Gürel & Uygun, 2013; Uygun & Gürel, 2016). L2 learners' problems in the computational system have also been implicated in various L2 models such as Ullman's (2005) declarative-procedural model and Clahsen & Felser's (2006) shallow structure hypothesis. Both models predict that late L2 learners would fail to do online linguistic computations. The lack of morphological decomposition in the L2 data seems to support these models. L2 proficiency does not seem to play a major role in attaining L2 processing. This is at least what was found in the current L2 data.

As for the effects of frequency of root and/or whole word, the results do not indicate that they are significant variables affecting the processing patterns in either group.

The methodology used in this study is unique in that the same roots as targets were used in both derivational and inflectional experiments. Also, the orthographically related primes overlap with the target words in the first three letters in most items (e.g. *sevap-sev, baston-bas*). In addition, the Latin Square design was used (there were four versions of the test and no participant saw the same target more than once in each masked experiment). Nevertheless, the same participants took the both inflectional and derivational tests which consisted of identical root forms. This allowed for a direct comparison between the two types of morphology within the same participants. Therefore, the results are not confounded by the participant or by the items. In most masked priming studies, this was rarely ensured.

7.3 Limitations of the study

The findings of the present study should be evaluated considering its limitations. One of the limitations was the limited number of experimental items in the masked priming tasks. This was due to the fact that it was not possible to find more items that would match the length (number of letters and syllables) and frequency criteria used in the study. Furthermore, HL, HH, LH, and LL grouping was only possible with those target words. In addition, it was not possible to find orthographically related primes that would overlap with the targets in two or three word initial letters. Crucially, since the experiments were designed to use the same verb root forms in both tasks, the primes that consisted of the inflected and derived forms of the same verbs were also matched on the basis of the above criteria. Only a small number of verbs could be matched with these criteria. In other words, it was not possible to find more verbs that would take –DI and –GI, and match the frequency and length criteria at the same time.

Another limitation was about the participant profile. All L2 speakers were L1 speakers of English which is considered as a morphologically limited language. The presence of another experimental group from a morphologically rich L1 background might have revealed a more complete picture for investigating potential L1 effects. Although investigating L1 effects on L2 processing was not one of the aims of the current study, having another L2 group would have made it possible for us to forward stonger arguments for native and non-native differences that found here.

The lack of a standardized proficiency test in Turkish makes the identification of proficiency levels of L2 speakers a difficult task. Therefore, the cloze test used in the study may not have been a reliable measure to assess L2 proficiency. In addition, due to difficulty finding L2 Turkish participants, it was not possible to match L2 participants in terms of the length of L2 exposure.

7.4 Implications and suggestions for future research

Although this study does not aim to provide direct pedagogical implications for teaching Turkish as a foreign language, the findings can be interpreted in reference to learning and teaching L2 morphology. Given that L2 learners in this study fail to do decomposition but do full listing, it can be argued that chunk representations of multimorphemic words should be reflected in learners' highly accurate production of complex words. This prediction should be tested in future research that compares the processing and production of L2 morphology. Such a design would allow one to identify the question of whether the decompositional or full listing pattern leads to more omission errors in the use of L2 morphology in an agglutinative language like Turkish. In this context, the current findings can also be evaluated with reference to the question of whether explicit form-focused instruction to teach L2 morphology is really necessary to attain native like processing patterns.

In the context of L2 pedagogy, another suggestion for further research might be to investigate L1 effects in relation to L2 instruction in L2 processing of morphology. To be able to do that another L2 group that consists of speakers of a morphologically rich L1 should be added to the study. Potential effects of the L1 morphological system (e.g., the richness and regularity) and L2 instructions and the interaction between them can be examined in reference to the question of whether the L2 instruction differentially affects the use and processing of L2 morphology in learners with different L1 backgrounds.

APPENDIX A

EXPERIMENTAL STIMULI IN MASKED PRIMING TASKS

Table A1. Experimental stimuli

TARGET	Test condition Prime-Derivation	Test condition Prime-Inflection	Unrelated prime	Ortographically related prime
DEL	delgi	deldi	kok	delil
SEZ	sezgi	sezdi	yak	sezon
ÖR	örgü	ördü	sok	ördek
BİÇ	biçki	biçti	ört	biçare
SER	sergi	serdi	sat	serçe
SİL	silgi	sildi	gez	silah
SEV	sevgi	sevdi	giy	sevap
SÜR	sürgü	sürdü	öp	sürahi
DOL	dolgu	doldu	sön	dolaş
SAR	sargı	sardı	kork	sarhoş
ÇAL	çalgı	çaldı	kay	çalı
ÇİZ	çizgi	çizdi	sark	çizme
BAS	baskı	bastı	yat	baston
TUT	tutku	tuttu	çık	tutu
YAZ	yazgı	yazdı	çek	yazık
YEN	yengi	yendi	tak	yenge
AT	atkı	attı	gir	atlas
VER	vergi	verdi	bak	verem
AS	askı	astı	uç	aslan
YAY	yaygı	yaydı	aç	yayla
DİZ	dizgi	dizdi	gel	dizel
SAY	saygı	saydı	git	saydam
İÇ	içki	içti	kes	içtima
KAT	katkı	kattı	ye	katır

Table A2. Inflectional Task – Identity Condition Primes – Target Words

Condition	Target	Frequency	Number of syllables	Number of letters
Inf-LL	DEL	4,83	1	3
Inf-LL	SEZ	0,04	1	3
Inf-LL	ÖR	1,51	1	2
Inf-LL	BİÇ	0,86	1	3
Inf-LL	SER	1,83	1	3
Inf-LL	SİL	4,51	1	3
	Mean	2,26	1	2,83
	SD	1,96	0	0,41
Inf-HL	SEV	4,51	1	3
Inf-HL	SÜR	2,04	1	3
Inf-HL	DOL	0,26	1	3
Inf-HL	SAR	2,62	1	3
Inf-HL	ÇAL	4,24	1	3
Inf-HL	ÇİZ	1,07	1	3
	Mean	2,46	1	3
	SD	1,69	0	0
Inf-HH	BAS	12,3	1	3
Inf-HH	TUT	13,24	1	3
Inf-HH	YAZ	113,35	1	3
Inf-HH	YEN	6	1	3
Inf-HH	AT	70,88	1	2
Inf-HH	VER	55,79	1	3
	Mean	45,26	1	2,83
	SD	42,56	0	0,41
Inf-LH	AS	7,22	1	2
Inf-LH	YAY	12,03	1	3
Inf-LH	DİZ	18,14	1	3
Inf-LH	SAY	6,97	1	3
Inf-LH	İÇ	363,86	1	2
Inf-LH	KAT	92,94	1	3
	Mean	83,53	1	2,67
	SD	141,24	0	0,52

Table A3. Inflectional Task – Morphologically Related Condition

Condition	Test condition Prime	Frequency	Number of syllables	Number of letters
Inf-LL	deldi	0,61	2	5
Inf-LL	sezdi	1,32	2	5
Inf-LL	ördü	0,59	2	4
Inf-LL	biçti	0,65	2	5
Inf-LL	serdi	2,81	2	5
Inf-LL	sildi	5,84	2	5
	Mean	1,97	2	4,83
	SD	2,08	0	0,41
Inf-HL	sevdi	6,36	2	5
Inf-HL	sürdü	48,8	2	5
Inf-HL	doldu	15,2	2	5
Inf-HL	sardı	11,2	2	5
Inf-HL	çaldı	21,8	2	5
Inf-HL	çizdi	7,81	2	5
	Mean	18,5	2	5
	SD	15,8	0	0
Inf-HH	bastı	16,4	2	5
Inf-HH	tuttu	33,1	2	5
Inf-HH	yazdı	33,5	2	5
Inf-HH	yendi	6	2	5
Inf-HH	attı	66,6	2	4
Inf-HH	verdi	216,	2	5
	Mean	62,1	2	4,83
	SD	78,5	0	0,41
Inf-LH	astı	3,78	2	4
Inf-LH	yaydı	1,49	2	5
Inf-LH	dizdi	0,97	2	5
Inf-LH	saydı	4,07	2	5
Inf-LH	içti	7,77	2	4
Inf-LH	kattı	4,93	2	5
	Mean	3,84	2	4,67
	SD	2,47	0	0,52

Table A4. Inflectional Task – Unrelated Condition

Condition	Unrelated prime	Frequency	Number of syllables	Number of letters
Inf-LL	kok	2,92	1	3
Inf-LL	yak	2,39	1	3
Inf-LL	sok	2,37	1	3
Inf-LL	ört	1,32	1	3
Inf-LL	sat	2,85	1	3
Inf-LL	gez	1,81	1	3
	Mean	2,28	1	3
	SD	0,61	0	0
Inf-HL	giy	2,37	1	3
Inf-HL	öp	2,88	1	2
Inf-HL	sön	0,23	1	3
Inf-HL	kork	1,95	1	4
Inf-HL	kay	0,76	1	3
Inf-HL	sark	0,36	1	4
	Mean	1,43	1	3,17
	SD	1,12	0	0,75
Inf-HH	yat	12,59	1	3
Inf-HH	çık	103	1	3
Inf-HH	çek	27,94	1	3
Inf-HH	tak	12,41	1	3
Inf-HH	gir	6,91	1	3
Inf-HH	bak	183,2	1	3
	Mean	57,68	1	3
	SD	71,22	0	0
Inf-LH	uç	29,95	1	2
Inf-LH	aç	54,57	1	2
Inf-LH	gel	100,2	1	3
Inf-LH	git	58,16	1	3
Inf-LH	kes	6,7	1	3
Inf-LH	ye	24,81	1	2
	Mean	45,73	1	2,50
	SD	32,90	0	0,55

Table A5. Inflectional Task – Orthographically Related Condition

Condition	Ortographically related prime	Frequency	Number of syllables	Number of letters
Inf-LL	delil	13,71	2	5
Inf-LL	sezon	31,74	2	5
Inf-LL	ördek	5,96	2	5
Inf-LL	biçare	2,08	3	6
Inf-LL	serçe	8,96	2	5
Inf-LL	silah	85,66	2	5
	Mean	24,69	2,17	5,17
	SD	31,61	0,41	0,41
Inf-HL	sevap	4,39	2	5
Inf-HL	sürahi	1,51	3	6
Inf-HL	dolaş	5,79	2	5
Inf-HL	sarhoş	27,12	2	6
Inf-HL	çalı	6,57	2	4
Inf-HL	çizme	3,27	2	5
	Mean	8,11	2,17	5,17
	SD	9,49	0,41	0,75
Inf-HH	baston	1,74	2	6
Inf-HH	tutu	0,23	2	4
Inf-HH	yazık	84,97	2	5
Inf-HH	yenge	5,14	2	5
Inf-HH	atlas	5,88	2	5
Inf-HH	verem	4,11	2	5
	Mean	17,01	2	5
	SD	33,36	0	0,63
Inf-LH	aslan	37,89	2	5
Inf-LH	yayla	7,03	2	5
Inf-LH	dizel	2,9	2	5
Inf-LH	saydam	10,58	2	6
Inf-LH	içtima	0,92	3	6
Inf-LH	katır	2,98	2	5
	Mean	10,38	2,17	5,33
	SD	13,92	0,41	0,52

Table A6. Derivational Task – Identity Condition Primes – Target Words

Condition	Frequency	Number of syllables	Number of letters
Der-LL	0,86	1	3
Der-LL	2,04	1	3
Der-LL	4,83	1	3
Der-LL	4,51	1	3
Der-LL	4,24	1	3
Der-LL	2,62	1	3
Mean	3,18	1	3
SD	1,59	0	0
Der-HL	0,04	1	3
Der-HL	1,07	1	3
Der-HL	0,29	1	3
Der-HL	4,51	1	3
Der-HL	1,83	1	3
Der-HL	1,51	1	2
Mean	1,54	1	2,83
SD	1,61	0	0,41
Der-HH	6,97	1	3
Der-HH	363,86	1	2
Der-HH	55,79	1	3
Der-HH	92,94	1	3
Der-HH	13,24	1	3
Der-HH	12,3	1	3
Mean	90,85	1	2,83
SD	137,83	0	0,41
Der-LH	7,22	1	2
Der-LH	70,88	1	2
Der-LH	5,71	1	3
Der-LH	113,35	1	3
Der-LH	18,14	1	3
Der-LH	12,03	1	3
Mean	37,89	1	2,67
SD	44,31	0	0,51

Table A7. Derivational Task – Morphologically Related Condition

Condition	Test condition Prime	Frequency	Number of syllables	Number of letters
Der-LL	biçki	0,36	2	5
Der-LL	sürgü	0,61	2	5
Der-LL	delgi	0,86	2	5
Der-LL	silgi	1,87	2	5
Der-LL	çalgı	3,21	2	5
Der-LL	sargı	3,63	2	5
	Mean	1,77	2	5
	SD	1,40	0	0
Der-HL	sezgi	6,02	2	5
Der-HL	çizgi	46,47	2	5
Der-HL	dolgu	6,0	2	5
Der-HL	sevgi	134,3	2	5
Der-HL	sergi	22,71	2	5
Der-HL	örgü	6,26	2	4
	Mean	36,97	2	4,83
	SD	50,28	0	0,41
Der-HH	saygı	86,21	2	5
Der-HH	içki	48,15	2	4
Der-HH	vergi	185,6	2	5
Der-HH	katkı	52,43	2	5
Der-HH	tutku	10,96	2	5
Der-HH	baskı	92,52	2	5
	Mean	79,32	2	4,83
	SD	59,83	0	0,41
Der-LH	askı	1,74	2	4
Der-LH	atkı	1,78	2	4
Der-LH	yengi	0,4	2	5
Der-LH	yazgı	3,55	2	5
Der-LH	dizgi	1,93	2	5
Der-LH	yaygı	0,15	2	5
	Mean	1,59	2	4,67
	SD	1,22	0	0,52

Table A8. Derivational Task –Unrelated Condition

Condition	Unrelated prime	Frequency	Number of syllables	Number of letters
Der-LL	ört	1,32	1	3
Der-LL	öp	2,88	1	2
Der-LL	kok	2,92	1	3
Der-LL	gez	1,81	1	3
Der-LL	kay	0,76	1	3
Der-LL	kork	1,95	1	4
	Mean	1,94	1	3
	SD	0,85	0	0,63
Der-HL	yak	2,39	1	3
Der-HL	sark	0,36	1	4
Der-HL	sön	0,23	1	3
Der-HL	giy	2,37	1	3
Der-HL	sat	2,85	1	3
Der-HL	sok	2,37	1	3
	Mean	1,767	1	3,17
	SD	1,15	0	0,41
Der-HH	git	58,16	1	3
Der-HH	kes	6,7	1	3
Der-HH	bak	183,2	1	3
Der-HH	ye	24,81	1	2
Der-HH	çık	103	1	3
Der-HH	yat	12,59	1	3
	Mean	64,75	1	2,833
	SD	68,16	0	0,41
Der-LH	uç	29,95	1	2
Der-LH	gir	6,91	1	3
Der-LH	tak	12,41	1	3
Der-LH	çek	27,94	1	3
Der-LH	gel	100,2	1	3
Der-LH	aç	54,57	1	2
	Mean	38,67	1	2,67
	SD	34,44	0	0,52

Table A9. Derivational Task –Orthographically Related Condition

Condition	Orthographically related prime	Frequency	Number of syllables	Number of letters
Der-LL	biçare	2,08	3	6
Der-LL	sürahi	1,51	3	6
Der-LL	delil	13,71	2	5
Der-LL	silah	85,66	2	5
Der-LL	çalı	6,57	2	4
Der-LL	sarhoş	27,12	2	6
	Mean	22,77	2,33	5,33
	SD	32,24	0,52	0,82
Der-HL	sezon	31,74	2	5
Der-HL	çizme	3,27	2	5
Der-HL	dolaş	5,79	2	5
Der-HL	sevap	4,39	2	5
Der-HL	serçe	8,96	2	5
Der-HL	ördek	5,96	2	5
	Mean	10,02	2	5
	SD	10,81	0	0
Der-HH	saydam	10,58	2	6
Der-HH	içtima	0,92	3	6
Der-HH	verem	4,11	2	5
Der-HH	katır	2,98	2	5
Der-HH	tutu	0,23	2	4
Der-HH	baston	1,74	2	6
	Mean	3,43	2,18	5,33
	SD	3,77	0,41	0,81
Der-LH	aslan	37,89	2	5
Der-LH	atlas	5,88	2	5
Der-LH	yenge	5,14	2	5
Der-LH	yazık	84,97	2	5
Der-LH	dizel	2,9	2	5
Der-LH	yayla	7,03	2	5
	Mean	23,97	2,00	5,00
	SD	32,64	0	0

APPENDIX B

CLOZE TEST

Aşağıdaki parçayı okuyarak boşlukları anlamlı kelimelerle doldurunuz.

Türkiye

Türkiye dünyada yer alan 180 ülkeden biridir. Türkiye, Avrupa ve Asya kıtalarının arasında, _________________[1] başka değişle Avrasya'da bulunmaktadır. Türkiye devletinin _________________[2] adı Türkiye Cumhuriyetidir. Türkiye sekiz ülke _________________[3] sınır komşusudur. Türkiye'nin üç tarafı denizlerle _________________[4]. Türkiye Avrupa ile Asya kıtalarının birleşim _________________[5] yer aldığı için dünyada jeopolitik olarak _________________[6] önemli bir yeri vardır. Türkler nüfusun _________________[7] bir kısmını oluşturmaktadır. Türkiye'de en yaygın _________________[8] İslam olup ülkenin resmi dili Türkçedir. _________________[9] en büyük gelir kaynaklarından biri turizmdir. _________________[10] yıl Avrupa'nın değişik ülkelerinden Türkiye'ye milyonlarca _________________[11] gelmektedir ve ülkenin değişik bölgelerini ziyaret _________________[12].

Türkiye Osmanlı İmparatorluğu'nun yıkılması ile 1923 _________________[13] Mustafa Kemal Atatürk önderliğinde kurulmuştur. Türkiye'nin _________________[14] ve laik bir yapısı vardır ve _________________[15] yapı anayasa tarafından belirlenmiştir. Türkiye oldukça _________________[16] bir kültür ve tarih mirasına sahiptir. Türkiye _________________[17] devletleri ile iyi ilişkiler kurup Avrupa Konseyi, NATO, OECD gibi _________________[18] üye olmuştur. Türkiye 2005 yılında Avrupa _________________[19] ile tam üyelik konusunda müzakerelere başlamıştır ve _________________[20] halen sürmektedir. Türkiye aynı zamanda doğu _________________[21] ile de kültürel, ekonomik ve tarihi _________________[22] koparmayıp iyi ilişkilerini devam ettirip tüm _________________[23] tarafından gelişmiş bir ülke olarak görülmektedir. _________________[24] yanı sıra Türkiye politika uzmanları ve _________________[25] tarafından bulunduğu bölgede önemli bir güç olarak görülmektedir.

APPENDIX C

VOCABULARY TEST

Please write down the English equivalent of the following Turkish words (you can also paraphrase/describe/explain the word either in Turkish or English if you cannot remember the exact English equivalent of it)".

Fiiller	
Asmak	
Atmak	
Basmak	
Biçmek	
Çalmak	
Çizmek	
Delmek	
Dizmek	
Dolmak	
İçmek	
Katmak	
Örmek	
Sarmak	
Saymak	
Sermek	
Sevmek	
Sezmek	
Silmek	
Sürmek	
Tutmak	
Vermek	
Yaymak	
Yazmak	
Yenmek	

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