THE MORPHOLOGICAL PROCESSING OF DERIVED WORDS IN L1 TURKISH AND L2 ENGLISH

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ABSTRACT

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The primary goal of this thesis was to investigate the L1 and L2 processing of morphologically complex words by making use of psycholinguistic experimental techniques. Specifically, the question to be answered in the present study was how native speakers of Turkish process morphologically complex (derivational) word forms in L1 Turkish and in L2 English. It was also aimed at investigating the potential developmental similarities and/or differences between different L2 groups at distinct proficiency levels. Using identical methodologies, the processing of transparent, frequent, and highly productive Turkish suffixes –*lI* (attributive affix; e.g. güçlü "powerful") and – *sIz* (privative affix; güçsüz "powerless") and English suffixes –*ful* (e.g. careful) and -*less* (e.g. careless) were examined in masked priming experiments. The findings of the experiments demonstrated similar priming effects for L1 Turkish and the high proficiency L2 English group, which could be taken as evidence for the fact that decompositional processes are at work during word recognition in native and second language morphological processing of derived words. Less proficient L2 speakers, on the other hand, revealed priming effects only for words derived with the –*ful* suffix. In addition, even though L1 processing and L2 processing of the high proficiency group seem to be identical, the results of an orthographic control task revealed that the L2 processing of derivational morphology is characterized by both the orthographic and the morphological properties of words, whereas L1 processing is influenced only by the morphological properties during early visual word recognition. It is therefore asserted that the L1 processing of derived words is distinct from the L2 processing of derived words to a certain extent. The observed L1-L2 distinction is discussed in terms of the quality of input that L2 speakers have been exposed to.

Keywords: L1 Morphological Processing, L2 Morphological Processing, Derivational Morphology, Masked Priming, Psycholinguistics

ÖZ

D1 TÜRKÇE VE D2 İNGİLİZCEDE TÜRETİLMİŞ SÖZCÜKLERİN BİÇİMBİLİMSEL İŞLEMLENMESİ

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Bu çalışmanın ana amacı ruhdilbilimsel deneysel yöntemler kullanarak anadil (D1) ve ikinci dilde (D2) türemiş sözcülerin biçimbilimsel açıdan işlemlenme örüntülerini ortaya çıkarmaktır. Bu çalışma ile cevaplanması hedeflenen daha özel soru ise anadili Türkçe olan konuşucuların Türkçede ve D2 İngilizcede türetilmiş yapıları ne şekilde işlemledikleridir. Buna ek olarak, farklı D2 İngilizce yeterlik seviyelerine sahip konuşucuların sergilediği gücül benzerlik ve farklılıkların belirlenmesi de amaçlanmıştır. Türkçede anlaşılır, yüksek sıklığa sahip, ve oldukça üretken olan *–lı* (niteleyici eki; güçlü) ve *–sız* (yoksunluk eki; güçsüz) ekleri ile İngilizcede aynı özelliklere ve anlama sahip olan *–ful* (Örn: careful "*dikkatli"*) ve *–less* (Örn: careless "*dikkatsiz"*) eklerinin işlemlenme yöntemleri maskelenmiş hazırlama deneyleri ile incelenmiştir. Deneylerden elde edilen bulgular anadili Türkçe olan konuşucular ve D2 yeterlik seviyesi yüksek olan konuşucular için benzer hazırlama etkileri ortaya çıkarmıştır. Bu bulgu, katılımcıların sözcük tanıma süreci esnasında, D1 ve D2'de türetilmiş sözcüklerin biçimbilimsel açıdan işlemlenmesinde ayrıştırma mekanizmasını kullandıklarına kanıt olarak kabul edilebilir. Öte yandan D2 seviyesi daha düşük olan konuşucularda hazırlama etkileri sadece *–ful* ile türetilmiş sözcüklerde gözlemlenmiştir. Buna ek olarak D1 ve D2 işlemlenmesi birbirinin aynısı gibi gözükse de, ortografik denetleme verilerinin analizleri türemiş yapıların D2'de işlemlenmesinde sözcüklerin hem ortografik hem de biçimbilimsel özelliklerinden yararlanıldığını ortaya çıkarmıştır. Diğer taraftan D2 işlemlenmesinin aksine, anadilde biçimbilimsel işlemlemenin sadece biçimbilimsel özellikler tarafından etkilendiği de elde edilen bulgular arasındadır. Bu sebeplerden dolayı, türetilmiş sözcüklerin D1 ve D2'de bir dereceye kadar farklı şekilde işlemlendikleri ileri sürülmüştür. Elde edilen farklılıklar, ikinci dil konuşucularının maruz kaldığı ikinci dil girdisinin niteliği çerçevesinde tartışılmıştır.

Anahtar Kelimeler: Anadilde Biçimbilimsel Yapıların İşlemlenmesi, İkinci Dilde Biçimbilimsel Yapıların İşlemlenmesi, Yapım Ekleri, Maskelenmiş Hazırlama, Ruhdilbilim

To my beloved family and my fiancée

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LIST OF ABBREVIATIONS

AAM	The Augmented Addressed Morphology
AoA	Age of onset of acquisition
ANOVA	Analysis of variance
ERP	Event-related potentials
fMRI	Functional magnetic resonance imaging
L1	Native language
L2	Second language
M	Morphology
MRM	The Morphological Race Model
O	Orthographic
OPT	Oxford Placement Test
PET	The positron emission tomography
RT	Reaction time
S	Semantics
SD	Standard Deviation
SPA	The Symbolic Pattern Associator
SOA	The stimulus onset asynchrony

LIST OF TERMS

Affixal Salience: A combination of affix properties such as length, homonymy, allomorphy, that have been thought to influence the processing of derived words (Laudanna & Burani, 1995).

Diaforms: Word forms which are identified consistently as the same in two languages (Sebüktekin, 1971).

Full listing: A hypothesis that suggests that all words are listed in the mental lexicon as whole units irrespective of their internal structure (Butterworth, 1983).

Full decomposition: A hypothesis which posits that multimorphemic words are listed in the mental lexicon in a decomposed form (Taft & Forster, 1975).

Masked Priming: A psycholinguistic experimental technique in which a prime word (e.g. *helpful*) is presented on the screen for a very short time (usually between 30 – 80 ms) and is followed by a target word (e.g. *help*) on which participants are required to perform a word/non-word decision (Forster & Davis, 1984).

Mental lexicon: A linguistic construct which can be defined as a mental dictionary containing information about a word's semantic, phonological or syntactic properties.

Morphological processing: The study of how words, either simplex or complex, are accessed and retrieved from the mental lexicon during word recognition or production.

Parsing: A psycholinguistic term that refers to online computation of linguistic structures during comprehension.

Priming effect: In masked priming paradigm, if a prime word facilitates the recognition of the target word, priming effects are observed.

Reaction Time: The duration it takes participants to make a word/non-word decision on a word upon its presentation on the screen.

Semantic Transparency: The degree to which the meaning of a complex word form can be established by an analysis of its constituent morphemes.

The Declarative/Procedural Memory: A language processing model which postulates two memory systems responsible for the processing of different linguistic structures (Ullman, 2001a).

The stimulus onset asynchrony: The time between the onset of the prime and the onset of the target in masked priming paradigm.

CHAPTER 1

INTRODUCTION

This introductory chapter encompasses four sections. The first section presents the theoretical background to the study. It concentrates on the leading L1 and L2 processing theories. The second section discusses the purpose and significance of the study and the third section introduces the morphological focus that will be of specific interest throughout the thesis. Finally, the fourth section addresses the research questions of the present study and the predictions made based on the research questions.

1.1 Background to the Study

Humans have the impressive capability of comprehending, producing and processing language. At the center of this capability lies the knowledge of morphology, through which a language keeps evolving, growing and contributing to the lexicon constantly. Since the mechanisms underlying the processing of language are not directly observable, the study of the morphological structures of words and how they are processed could be a way to the explanation of the organization of the mental lexicon.

Languages provide us with the infinite ability to create new word forms in different ways (i.e. inflection, derivation, or compounding). As Harley (2006) illustrates, “hopefuller”, “transformationed”, “explorationist”, “securitize” are some of the neologisms that George Bush, “[who is] famous for his tendency to coin new words on the fly”, uttered during his speeches and that are precisely understandable for native speakers of English (p. 112). What allows language speakers to form and understand such novel forms is the availability of constituent morphemes of complex words to the language user and a language's ability to recombine morphemes during on-line processing (Libben, 2003, p. 221). The availability of the constituent morphemes, the argument goes, might lead one to the conclusion that both polymorphemic and monomorphemic forms are represented in the mental lexicon, which triggered a long-lasting debate about whether morphologically complex word forms are processed as full-forms, in a decomposed format, or as both full-forms and in a decomposed format. The two strong positions that emerged to account for the relation and interaction between whole-word and constituent activation during word recognition were *the full listing hypothesis* (Butterworth, 1983) and *the full decomposition hypothesis* (Taft & Forster, 1975). The full listing hypothesis postulates that all words, simple or complex, derived, inflected or not, are listed in the mental lexicon as whole units irrespective of their internal structure (Butterworth, 1983). On the other hand, the full decomposition hypothesis posits that multimorphemic words (words that comprise more than a single morpheme) are decomposed into stems and affixes (Taft & Forster, 1975).

More recently, the debate has changed direction towards the question whether the comprehension of complex word forms requires a series of mechanisms or whether a single process is in operation in particularly L1, but also L2 processing. For L1 processing, the models that have been proposed can be broadly classified as *single mechanism associative accounts*, *single mechanism rule-based accounts* and *dual mechanism account(s)*. Similar to the full listing hypothesis, associative models of morphological processing propose that simplex as well as complex lexical items are listed as full forms in the memory, without being decomposed into smaller units (Rumelhart & McClelland, 1986). In rule-based accounts, on the other hand, the formation of complex word forms is explained in terms of formal rules (Ling & Marinov, 1993). Lastly, dual mechanism accounts (e.g., Pinker, 1999) propose that both associative and rule-based processes are employed during morphological processing.

L2 theories have so far been rather scarce since the focus has mostly been on native language processing. Some researchers have offered a "shared-systems" view, which proposes that L2 processing works in the same way as L1 processing even though L2 processing is less automatic and contains traces from the L2 speaker's native language (Perani et al., 1998). A highly prominent model, the Declarative/Procedural model (Ullman, 2005), assumes that two memory systems (a declarative and a procedural memory) are responsible for the processing of different linguistic structures. The declarative system is responsible for the storage and retrieval of whole word units from the memory, whereas the procedural system computes words using grammatical knowledge and regular morphology. The theory further postulates that L2 processing largely depends on the declarative memory while there may be a shift towards the involvement of the procedural memory as L2 proficiency increases (see chapter 2 for further details).

1.2 Purpose and Significance of the Study

Most of the research conducted to date has tried to understand the workings of language processing of native speakers. However, given the fact that more and more people possess knowledge of a second language, it is intriguing to examine potential similarities and/or differences between native and non-native language processing. In addition, examining comparable morphological structures in both native and non-native language can provide a basis for a one-to-one comparison and may provide new insights into the processing differences and/or similarities between native and non-native language processing. As Frauenfelder and Schreuder (1992) stated, Turkish and English are two contrasting languages, which differ significantly in productivity and the regularity of their morphological rules. Therefore, they argued that Turkish and English would be a sound ground to test competing views regarding *full-listing* vs. *full decomposition* (p. 168).

Secondly, previous research has mainly focused on the inflectional paradigm (e.g. regular/irregular past tense forms in English, German participles and German plural formation) while research into the processing of derivational structures has largely been neglected. Therefore, there is still no definite answer to the question of how derived word forms are processed in either L1 or L2. Thirdly, native and non-native morphological processing studies have largely revolved around a handful of languages such as English, German, Portuguese and Polish and there is a need to examine typologically different languages so as to be able to arrive at potentially generalizable findings. For this reason, the morphology of Turkish, a non-Indo-European language with agglutinating morphology, is a valuable field to scrutinize. There is also a lack of research in terms of morphological processing in Turkish since very few research studies employing an experimental psycholinguistic methodology testing L1 or L2 Turkish have been conducted so far (notable exceptions are: Gürel, 1999; Kırkıcı, 2010; Kırkıcı & Clahsen, 2013).

For these reasons, the primary purpose of the present study is to define the way morphologically complex words are processed by L1 Turkish speakers in both their native language and in L2 English by making use of an on-line psycholinguistic experimental technique -masked priming. Specifically, the question to be answered in the present study is how native speakers of Turkish process morphologically complex (derivational) word forms in Turkish and in L2 English. Another aim is to investigate potential developmental similarities and/or differences between different L2 proficiency groups.

1.3 Morphological Focus

The processing of morphologically complex words has been extensively studied in the inflectional morphology domain in a variety of languages; thus, theories regarding morphological processing are usually restricted to inflectional phenomena and they have not been generalized to other morphological domains of languages. Since inflectional and derivational processes are thought to be distinct from each other in that inflectional morphology produces word-forms of a single lexeme whereas derivational morphology produces new lexemes (Bauer, 1983), the processing of derivational morphology should also be examined so as to map a complete picture of morphological processing. Therefore, derivational processing of L1 and L2 has been explored in the present study.

Turkish is a morphologically rich and highly productive language. To illustrate, the longest Turkish word "muvaffakiyetsizleştiricileştiriveremeyebileceklerimizdenmişsinizcesine”, which means “it’s as though you are from those we may not be able to easily make a maker of unsuccessful ones”, has 16 morphemes, and is formed by sequential suffixation. As is apparent in the example, the Turkish derivational system enables speakers to derive adjectives, nouns, verbs, and adverbs from words which belong to different word categories by means of various affixes (Kornfilt, 1997). The longest possible word in English, on the other hand, contains 6 morphemes (antidisestablishmentarianism), which indicates that English is less productive in terms of derivational morphology. Although these words are not frequently used in spoken language, they are indeed quite understandable for the speakers of Turkish and English. What makes such extraordinarily long complex words comprehensible for the hearer is the incredible and fascinating capacity of the human brain, which rapidly processes the input and extracts the meaning via the constituent morphemes which complex words carry.

Experiment 1 in the present study examines the L1 processing of words derived with the attributive suffix *–lI* (e.g. *sağlıklı* “healthy”) and the privative suffix *–sIz* (e.g. *sağlıksız* “unhealthy”), which derive adjectives from nouns in Turkish. These suffixes are transparent, highly productive, and frequent. Experiment 2, on the other hand, explores the counterparts of these suffixes in English, which are *–ful* (which encodes the meaning “possessing the object or quality expressed by the basic morpheme”, e.g. *careful*) and *–less* suffixes (which encodes the meaning “without a quality or something”, e.g. *careless*) (Kornfilt, 1997). These suffixes in Turkish and English can be taken as *diaforms*, i.e. forms which are identified consistently as same in two languages (Sebüktekin, 1971). Hence, it is hoped that testing them in both L1 Turkish and L2 English using identical methodologies will make it possible to reach a clearer picture of similarities/differences between L1 and L2 language processing.

1.4 General Research Questions

The following research questions have been investigated in the present study:

1. Are derived words in L1 Turkish and in L2 English processed as full-forms or decomposed into morphological units during visual word recognition?

2. Does the L2 processing of derived words vary as a function of L2 language proficiency?
3. Do participants make use of the same mechanisms that they employ in L1 processing during the processing of their L2?
4. Does the semantics of the suffix which derived words bear have any effect on the processing patterns in L1 and L2?

In the light of the previous findings of L1 studies, it is expected that native speakers of Turkish will process words derived with the suffixes *–lI* and *–sIz* by decomposing them into their root and suffixes. The reason for this expectation is that Turkish is a highly productive and rich language in terms of its agglutinating morphology and storing each and every derived or inflected Turkish word form will run counter to the economy of storage argument, which postulates that the listing of words in the mental lexicon would occupy too much place and the storage and retrieval of those words would impose a heavy load on the memory (Frauenfelder & Schreuder, 1992). Hankamer (1989) also refers to this constraint to argue that agglutinative languages like Turkish generate millions of word forms and the capacity of the human brain would be inadequate to list all word forms separately. Hankamer estimates that an average educated native speaker of Turkish needs to store over 200 billion entries in a full-listing lexicon, which is way above the information storage capacity of the brain. Furthermore, the Turkish and English suffixes under investigation in the present study carry the properties necessary to facilitate the usage of a combinatorial mechanism rather than the storage in the associative memory (see Chapter 3 and 4 for detailed properties of the suffixes). Therefore, a decomposition mechanism is expected to be operative during the L1 processing of Turkish words derived with the *–lI* and *-sIz* suffixes.

As for the L1 Turkish speakers of L2 English, a decompositional route is also predicted to be accessible during L2 processing, depending on the level of L2 proficiency. It is expected that there will be processing differences between the two proficiency-wise distinct L2 groups. Ullman (2005) postulated that the proficiency level of L2 speakers influences the way a second language is processed. Increased L2 proficiency results in the increased usage of the procedural memory (i.e., rule-based processing) and a decrease in the usage of the declarative memory (i.e., listing). Therefore, it is expected that the L2 speakers in the high proficiency group will make more use of rule-based, decompositional processing than the low proficiency group.

It is also predicted that L2 speakers will not make use of the same processing mechanisms that they employ during native language processing. L2 processing is claimed to be impaired due to maturational constraints and the mechanisms that L2 users employed during L1 processing might no longer be accessible to process their L2 (Ullman, 2005); therefore, L2 speakers are expected to display different processing patterns than the L1 group even if the linguistic structures are essentially similar.

Finally, it is expected that the semantic contrast between the two suffixes under investigation will have no effect on the processing of target words. Semantic transparency studies in the literature have shown that native speakers do not make use of the semantic properties of words during early visual word recognition (Rastle, Davis, & New, 2004; Marslen-Wilson, Bozic, & Randall, 2008), which makes it therefore rather unlikely that the semantic contrast between the suffixes under investigation will play a distinguishing role. Thus, the suffixes explored in the present study are expected not to display any processing differences during L1 and L2 processing.

CHAPTER 2

LITERATURE REVIEW

This chapter includes three major sections. The first section presents L1 morphological processing theories in two categories: Single Mechanism Accounts and Hybrid Models. The second section introduces L2 morphological processing theories, namely the Shared-Systems View, Zobl's Developmental Model of L2 processing, and the Declarative/Procedural Model. Finally, the last section reviews previous research studies on L1 and L2 morphological processing.

2.1 L1 Morphological Processing Theories

Morphological processing models that aim to account for the processing and representation of complex words have broadly revolved around two main views: single mechanism models, which posit only one type of representation for all complex words, and hybrid models, which postulate two separate mechanisms for the representation of different types of complex words. Single mechanism models suggest either an associative memory which contains complex words with associative links (Rumelhart & McClelland, 1986; MacWhinney & Leinbach, 1991) or a parsing system which segments words into their constituents by employing morphological rules (Ling & Marinov, 1993; Albright & Hayes, 2003). Single mechanism models can be ordered on a continuum, with full listing and direct access models at one extreme (Butterworth, 1983; Manelis & Tharp, 1977) and models which suggest an obligatory full decomposition mechanism (Taft, 1985; Taft & Forster, 1975) at the other.

The starting point of the discussion about how morphologically complex words are processed goes back to *the full listing* vs. *the full decomposition* hypotheses, each of which is characterized by different principles. The pioneers of *the full listing hypothesis* postulate that the processing of complex words is executed by the storage of words as single whole word forms and their retrieval from the lexicon during word recognition (Butterworth, 1983). *The full listing hypothesis* is thought to be constrained by the economy of processing argument (Frauenfelder & Schreuder, 1992). This argument suggests that the direct retrieval of a complex word as a full-form is both easier than parsing it into constituents and less effortful in terms of processing load. *The full decomposition hypothesis*, on the other hand, proposes an obligatory decomposition mechanism for all complex forms, which parse complex forms into their bases and affixes (Taft & Forster, 1975). This hypothesis is claimed to be constrained by the principle of economy of storage, which claims that storing each single word form in the lexicon separately will place restrictions on the storage capacity of the brain and this will result in a heavy memory load. Instead of this full listing, as the pioneers of the hypothesis argue, a more economical way of organizing the mental lexicon might be the storage of morphemes and stems according to their certain properties. Morphemes and stems can be combined during comprehension and production so that the storage place in the mental lexicon will be economized. Although it has been more than four decades that these two hypotheses emerged, it is still not unequivocal whether the principle of economy of storage or economy of processing governs the processing of different languages (see Frauenfelder & Schreuder, 1992 for a discussion). This is the main reason why different theories, either suggesting single mechanism or dual mechanisms, have continued to appear in the literature.

In some hybrid models (Caramazza, Miceli, Silveri, & Laudanna, 1985; Pinker, 1991; Frauenfelder & Schreuder, 1992; Ullman, 2001), on the other hand, both an associative memory and a morphological parsing mechanism (stem + affix) are operative during the processing of morphologically complex word forms. These single mechanism and hybrid models will be further explained below.

2.1.1 Single Mechanism Associative Accounts

Proponents of single mechanism associative accounts propose that all forms (whether they are inflected, derived or bare forms) are learned and stored in the lexicon and are associated with their variants through different links. The morphological structures of words play no specific role in the recognition and processing of words since connectionist models do not differentiate between compositional vs. noncompositional or regular vs. irregular word forms. As put by Bybee, "all types of morphological patterns can be acquired by the same processes – the storage of items, the creation of connections among them, and the formation of patterns that range over sets of connections" (1991, pp. 86-87). Such models posit an associative memory which operates over the relation established between input and output representations of word-features and maintain that these relations can be strengthened by factors such as frequency of occurrence and phonological similarity. Figure 1 illustrates the basic design and architecture of associative accounts, in which a set of input nodes are mapped into output nodes by training examples and feedback presented by an external "teacher" (as cited in Kırkıcı, 2005, p. 23).

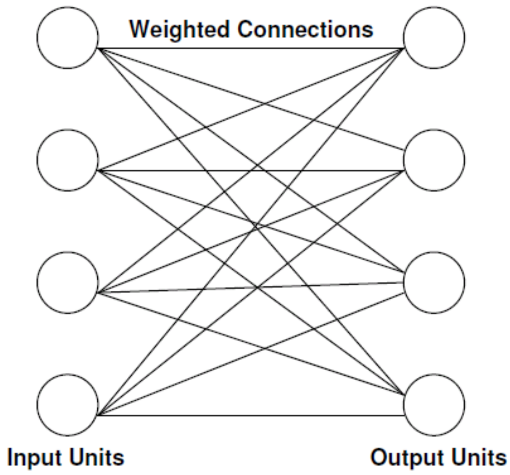

Figure 1 A simplified representation of general associative models

Although there are many different single mechanism associative models, Rumelhart and McClelland's (1986) pattern associator model, which was designed specifically for the acquisition of the past tense, is often taken as the cornerstone of associative accounts. In his model, there is only one mechanism at work during the processing of both regular and irregular past tense forms and a series of route associations between base and past tense forms are stored in the system with novel responses produced by instant generalizations from the stored words. Stems cannot be separated from the affixes and therefore, inflected forms are stored and represented as whole words which include semantic and phonological links between the stem and inflected forms without any explicit representation of rules (as cited in Silva, 2009).

This pattern associator model is not without its criticisms. It has been pointed out that the model does not fully function for the generalization of the past tense formation to verbs that the model has not been trained on. Besides, as stated by Pinker and Prince (1988), it has severe generalization problems with regular verbs. A number of other associative models with different features have been developed later on. Nevertheless, those models have been inadequate to fully account the morphological processing of complex word forms (e.g. Ramscar & Gitcho, 2007). Because of the connectionist models' flaws, which are frequently criticized in the literature, they do not hold a clear answer to the question of whether or not regular and irregular word forms are represented and processed in the same way. In addition, experimental evidence for associative accounts has been predominantly obtained from studies into the inflectional paradigm, particularly as part of the "past tense debate" (Pinker, 1999; Pinker & Ullman, 2002), mostly ignoring the representation and processing of derivational word forms. Thus, it is doubtful whether associative models can successfully account for derivational processing.

2.1.2 Single Mechanism Rule-based Accounts

Single mechanism rule-based accounts argue that the processing and representation of morphologically complex words encompass only one combinatorial system in which complex words are parsed and segmented into smaller morphemic units. One of the early and prominent rule-based accounts is Taft and Forster's Prefix Stripping Model (1975), which asserts that prefixed words are segmented into their morphological components before lexical access takes place. In this model, the authors argue that a complex word (e.g. unlucky) must be decomposed into its stem (-luck), suffix (-y) and prefix (-un) so as to reach the lexical representation of a word since it would not only be economical to store the stem for different words but also semantically and alphabetically more organized (see Figure 2).

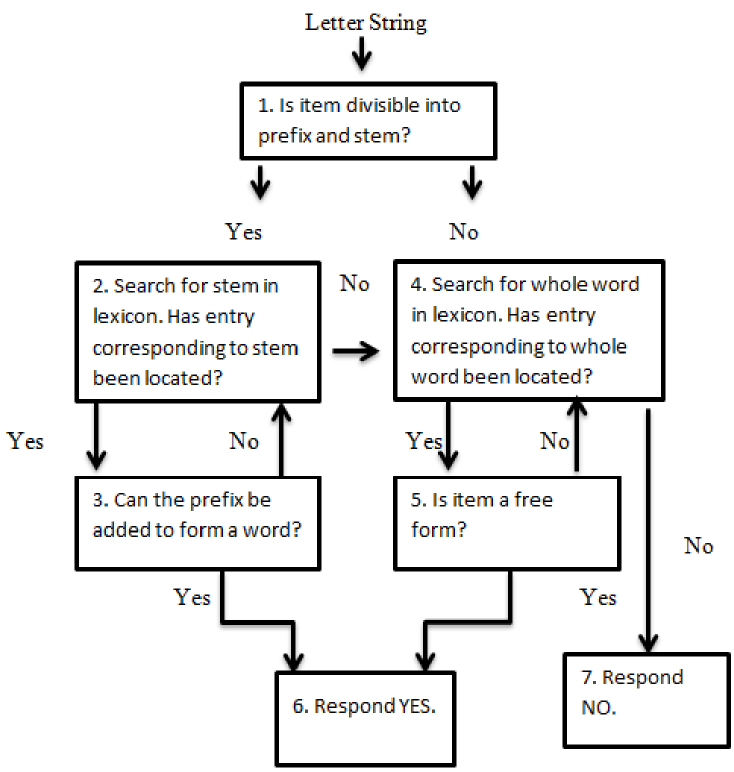

Figure 2 Taft and Forster's Prefix Stripping Model (1975)

Ling and Marinov (1993)'s symbolic model of the past tense is also of prime importance in the field. In their model, the Symbolic Pattern Associator (SPA) is the main device that was designed by using a decision tree learning algorithm called ID3. With the help of this decision tree, it is possible to extract the rules of the past tense formation by working them out from the given examples (i.e. *input)*. It was also stated that the use of decision trees (namely ID3 algorithm) allows the model to represent the production rules explicitly. After the SPA has been equipped with the series of associating trees through training, it can make use of those trees so as to generalize the usage of the past tense to new and unique cases. The basic structure of the model is illustrated in Figure 3. The model comprises two primary components, which are a pattern associator and a decoding network. While the pattern associator determines the relationship between the stem and past tense form, the decoding network transforms a featural representation of past tense form into a phonological one. All learning is claimed to occur in the pattern associator (p. 223).

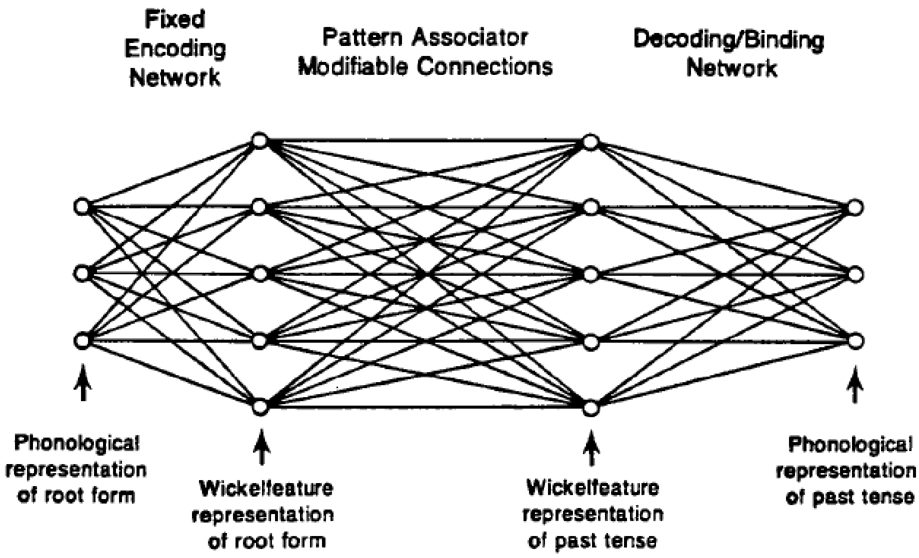

Figure 3 The basic structure of Ling and Marinov's Model (1993).

The model also accounted for the overgeneralization errors that are observed during the acquisition of English past tense formation such as adding *–ed* to the verbal stem of irregular verbs to form past tense forms (e.g. go –ed = *goed). In order to explain such errors, Ling and Marinov (1993) made use of a blocking mechanism which was adapted from the Blocking Hypothesis put forward by Pinker (1984). This blocking mechanism blocks the application of the regular past tense rule when an irregular verb stored in the lexicon is detected, which results in the retrieval of the irregular past tense form from memory. Once the blocking mechanism fails to block the usage of past tense rule, overgeneralization errors occur. Ling and Marinov claimed that their model outperforms both the Rumelhart and McClelland's (1986) model and other connectionist accounts (e.g., MacWhinney & Leinbach, 1991) by accomplishing the learning of the past tense more successfully and accurately.

2.1.3 Hybrid Models

Hybrid models essentially postulate two separate mechanisms, an associative and a decompositional route, for the processing and representation of complex words. According to these models, linguistic knowledge is learnt through, represented in, and processed over both an associationist and rule-based mechanisms, which work in parallel during the access to a word (Pinker, 1991; Ullman, 2001).

The Dual-Mechanism Account

The most well-known and ground-breaking hybrid model is the Dual-mechanism account originally proposed by Pinker (1991), which encapsulates both associationist and rule-based accounts with two divergent mechanisms. The Dual-Mechanism Model actually incorporates decomposition, rule formation, full-listing and associative processes in a complementary way. However, the fundamental mechanisms the model proposes are the associative memory which underlies the 'mental lexicon' and the rule system which is associated with the 'mental grammar'. The associative memory is thought to store words as full-forms and to be a 'productive' memory (Ullman, 2001) in that it can generalize the existing shared patterns between words to new word forms by making use of a so-called *associative full-listing structure* (Kırkıcı, 2005). On the other hand, the rule system is hypothesized to contain productive and combinatorial rules that can transform simplex words into complex words or words and phrases into sentences by means of real time rule application (Pinker & Ullman, 2002, p. 456). The model is illustrated in a simplified way in Figure 4.

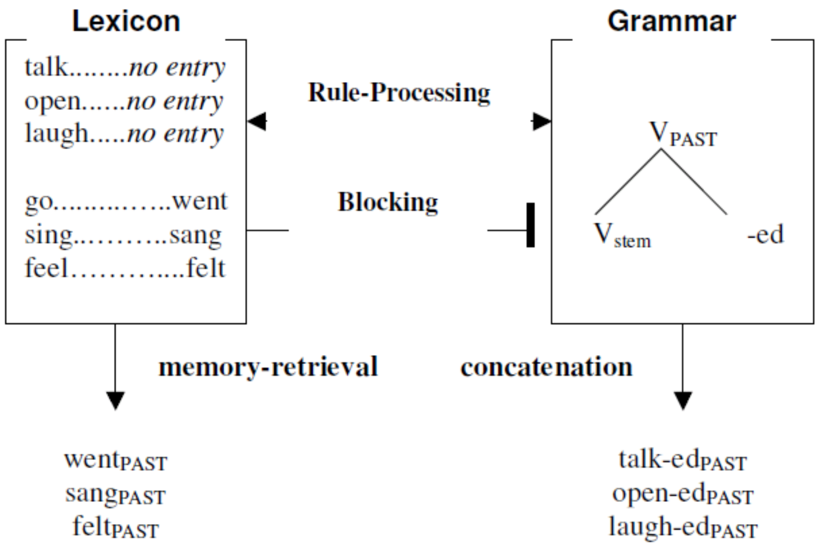

Figure 4 A simplified representation of the Dual-Mechanism model (from Kırkıcı, 2005 – based on Pinker, 1999)

When morphological processing is taken into consideration in the framework of this model, the division between the associative memory and the rule-formation system is associated with the distinction between the processing and storage of regular and irregular forms. In other words, two psychological mechanisms are operating jointly, one for regular and one for irregular word forms. It is postulated that regular word forms are computed through decomposition in the mental grammar whereas irregular forms are stored as full-forms in the mental lexicon and retrieved inflected from the associative memory (Pinker & Ullman, 2002). It is further claimed that the storage (or the memorization) of regular forms in an undecomposed fashion is also possible, though not necessary. However, some factors such as word form frequency or the existence of an irregular form might influence the likelihood of storage or rule application. For instance, several studies have demonstrated that the higher frequency of a word in the mental lexicon, the higher the possibility of storage in the associative memory (Alegre & Gordon, 1999; Bertram, Schreuder, & Baayen, 2000; Pinker & Ullman, 2002; Neubauer & Clahsen, 2009).

Although the main predictions of this model are originally based upon the representation of the English past tense system in native language processing, it was proposed as an initial stage to the discovery of the properties of human language processing. Later research in the framework of this model has been conducted on different languages (e.g. German, Polish, Finnish, Turkish), with different linguistic systems (e.g. English derivation, German inflection, Finnish derivation). To illustrate, Clahsen, Sonnenstuhl, and Blevins (2003), for example, made specific predictions about the processing of German derivational morphology in terms of the Dual Mechanism model. By investigating the processing of German derivational suffixes, they offered a modification to the Dual Mechanism Model, which differentiates three elements of the model: "frozen irregular forms stored in entries; productively derived stem entries; productively inflected word forms which are not represented in lexical entries" (Clahsen et al., 2003, p. 3).

The Declarative/Procedural Model

Often referred to as an extension of the Dual-Mechanism Account, The Declarative/Procedural Model is a mental model of the lexicon and grammar on which our language abilities are thought to depend (Ullman, 2001a; 2005). However, the systems' roles are not confined to only morphology or even language. The memorized system (the declarative memory) is thought to regulate also non-linguistic knowledge about facts and events. On the other hand, the rule-system (the procedural memory) subserves the nonconscious learning of motor and cognitive skills and habits. When language processing is taken into consideration, it is argued that the mental lexicon is the place which is responsible for sets of memorized words whereas the mental grammar is the place for rules in charge of composing lexical forms into structured larger words.

This model associates this distinction of lexicon/grammar with two brain memory systems: procedural and declarative memory systems. The declarative system is supposed to be rooted in temporal lobe circuits of the brain and the procedural system is represented by frontal/basal-ganglia structures. These two systems are considered to play a simultaneous role during the processing of words. The declarative system is hypothesized to be designated for memorizing, using noncompositional simplex words, whereas the procedural system is specialized for the acquisition and use of grammatical rules to build compositional complex forms. In other words, the declarative (memory) system is allotted for the set of memorized noncompositional structures which do not require any morphological operation, whereas the procedural system underlies the morphological transformations which are completely productive and predictive. In this model, both of the memory systems attempt to compute a complex form and if a given complex form is found in either of the systems, then it is computed in that system while the other is blocked and inhibited.

The model takes the productivity of complex words into consideration as well. Fully productive transformations (ability to apply to new words) are computed in the rule system. The rule system, therefore, is thought to handle kinds of operations which underlie affixation. On the other hand, the morphological transformation of an individual word can be stored in and retrieved from the associative memory depending on its frequency. If a word's surface frequency is high, then it needs to be stored in the associative memory, whereas low frequency words can be computed by the rule system. Therefore, both memory systems might be simultaneously activated in order to compute a given word, resulting in the blockage of the (sub-) system that is not the right candidate to compute the word.

There are also other hybrid models, which are relatively similar to the Dual-Mechanism model. One of such models is the Augmented Addressed Morphology Model (AAM) (Caramazza, Miceli, Silveri, & Laudanna, 1985). Caramazza et al. argued that complex words are represented in a morphologically decomposed format in the orthographic lexicon, but they are accessed through direct whole-word addresses. In addition, Frauenfelder and Schreuder (1992) also devised a similar hybrid model named the Morphological Race Model (MRM). According to their model, two distinct access routes or mechanisms operate in parallel and compete with each other in order to be the winning route. After a complex word is encountered, both the parsing route and direct look-up of whole-word are initiated. Some determinant factors such as the phonological and semantic transparency of a word, surface frequency, and the frequencies of other related complex words play a key role in ascertaining whether the direct route or the parsing route will be quicker to convey the required meaning to the processing system (p. 151).

The morphological processing models in L1 have been reviewed in this section so far. In brief, the first group of models, namely Single Mechanism models, propose one type of representation, either a rule based route or an associative route, for all complex word forms. The second group of models, Hybrid Models, on the other hand, suggest two distinct cognitive mechanisms for the processing of different complex word forms (frequent vs infrequent, inflected vs. derived, or regular vs. irregular). These mechanisms are the associative memory, which stores words as full-forms and the rule formation system which is thought to be operative during the acquisition and use of grammatical rules to recognize and build compositional word forms. These L1 processing models and corresponding research studies have not yielded a clear and unequivocal picture of L1 morphological processing yet and there seems to be a need for more extensive research studies in different languages with different linguistic structures to reach more generalizable and universal conclusions. The next section will be dealing with the theories of L2 morphological processing.

2.2 L2 Morphological Processing Theories

Whereas native language processing has been the centre of attention with a great deal of research studies conducted over a long period of time, the non-native processing of a second language (L2) has received comparatively less attention than native language processing and is, therefore, still in its infancy. Theories and models of non-native processing and psycholinguistic accounts of the similarities and/or differences between L1 and L2 processing have started to emerge rather recently.

Generally, L2 processing has been observed to be influenced by a variety of factors such as L1 transfer effects, age of onset of acquisition (AoA), or heavy cognitive load. For instance, the processing of similar linguistics structures in both L1 and L2 can be facilitated via effects of L1 transfer. However, the reliance on L1 during L2 processing might decrease with increased proficiency over time as shown in the study of Tokowicz and MacWhinney (2005). In addition, the AoA of a second language might play a role in transfer effects, with a decrease of dependence on L1 as AoA decreases (McDonald, 2000). Automaticity might also be reduced with a more demanding processing cost, higher working memory effects, and slower processing time.

With regards to these general properties of L2 processing, three different opposing views have been generated for L2 processing: the Shared-Systems View (Perani et al., 1998), Zobl’s Developmental Model (1998), and the Declarative/Procedural Model (Ullman, 2001; Ullman, 2005). These models will be explained in turn below.

2.2.1 The Shared-Systems View

The Shared-Systems View postulates that the same processing mechanisms are employed during L1 and L2 processing. Hence, it is suggested that L1 and L2 processing are essentially identical, with the exception of a few factors such as processing costs and L1 transfer effects on behalf of L2 learners. This hypothesis has received considerable support from brain imaging studies which employed PET, fMRI and ERP techniques in order to discover the neural bases of L2 processing and its relation to L1 processing (Perani et al., 1998; Wartenburger et al., 2003; Perani & Abutalebi, 2005). In these studies, the same neural devices have been found to overlap during L1 and L2 processing depending on factors such as the level of proficiency, AoA, and amount of exposure to L2. To illustrate, Perani et al. (1998) investigated L1 and L2 processing similarities/differences in an fMRI study with early and late bilinguals and found that similar parts of the brain were activated during listening to words both in L1 and L2. Another example comes from an fMRI study of Italian-German bilinguals’ grammatical processing, which showed that age of L2 acquisition has a facilitatory or inhibitory effect on grammatical processing depending on earlier or later AoA and neural devices were overlapping in L1 and L2 processing in the case of early bilinguals (Wartenburger et al., 2003).

Overall, the shared-systems view posits that L1 and L2 processing make use of the same mechanisms even though L2 processing might be constrained by variables such as L1 effects, age of acquisition, proficiency level, or computational demands (Perani & Abutalebi, 2005). The shared-systems view does not make specific references as to how morphologically complex words are processed by L2 learners or what mechanisms are employed during L2 processing. However, it still makes general conclusions about the similarities/differences between L1 and L2 processing.

2.2.2 Zobl's (1998) Developmental Model of L2 Processing

Zobl (1998) put forward a developmental model of L2 processing which contains two distinct types of representation akin to the dual-mechanism model. These psychological components are developmental in that one of them rests in an early *listing* stage and the other is a *computational* stage, which evolves later on during the development of L2. In other words, according to this theory, L2 learners tend to basically list words as full-forms in the mental lexicon and retrieve them as whole-words in the early stages of L2 acquisition. Less proficient L2 learners lack a rule mechanism and compute both regular and irregular forms over an associative memory. As productive rules start to develop in their mental grammar, L2 learners develop the ability to compute complex words by productively applying any suffix on any root. In relation to the past-tense debate (Pinker, 1999), Zobl (1998) offers the view that both regular and irregular English past tense forms are fully listed by L2 users in the initial stages of L2 acquisition; however, at later stages of L2 development rule application emerges with increasing proficiency. Zobl (1998) empirically investigated these claims by conducting semi-structured interviews with three L1 Russian adult learners of L2 English, who were at different developmental stages with different levels of L2 English proficiency. He observed an increasing pattern of accurate usage of regular and irregular verb forms as the participants' level of L2 proficiency increased. Zobl makes the claim that these findings are supportive of his theory; however, subsequent analyses of the experimental design of Zobl (1998) are rather critical of a number of points. Furthermore, other studies investigating the same phenomenon (e.g. Murphy, 2000) arrived at results that contradicted those of Zobl in that the proposed developmental differences between different proficiency groups were not observed.

2.2.3 The Declarative/Procedural Model

Although the Declarative/Procedural Model, the details of which were explained above, was originally established as a model of L1 acquisition and processing (Ullman, 2001a), the specific implications of the model for L2 processing were more recently also discussed in a number of publications (e.g., Ullman, 2001b; Ullman, 2005; Ullman, 2012). It is posited that the same mental mechanisms hypothesized to be at work for L1 processing, are also responsible for L2 processing, though the L2 reliance on the proposed mechanisms may show great variation. It is put forward that L2 processing is highly influenced by maturational constraints, which leads to the outcome that L1 and L2 processing are fundamentally different processes. Since L2 learners usually start learning their L2 after puberty, the mechanisms that are employed during L1 acquisition may no longer be accessible to process the L2, which makes L2 processing essentially different from and more complicated than L1 processing. Due to these maturational constraints, the argument goes; late L2 learners depend on the declarative system for grammatical functions to a higher extent than on the procedural system, whereas earlier L2 learners employ the procedural system for the same functions. Besides, since the amount of exposure to the L2 decreases when L2 learners begin to learn their L2 at later ages, they depend more on memorized words (the declarative memory). However, the increase in L2 proficiency might result in a shift towards more reliance on the procedural memory for the computation and construction of linguistic forms.

2.3 Previous Research on Morphological Processing

2.3.1 Inflectional Processing

Many morphological processing studies have been conducted to date that focus on the inflectional paradigms of different languages and, based on the findings obtained, a number of L1 and L2 processing theories have been established. The bulk of the empirical research has been conducted on the processing of the English past tense (as part of the so-called *past tense debate; e.g.,* Prasada & Pinker, 1993; Pinker, 1999; Pinker & Ullman, 2002; Murphy, 2004; Silva & Clahsen, 2008; Ullman, Babcock, Stowe, & Brovetto, 2008; Babcock, Stowe, Maloof, Brovetto & Ullman, 2012; Clahsen, Balkhair, Schutter, & Cunnings, 2013) to observe whether there is a fundamental distinction between lexical storage and combinatorial rules since English regular and irregular past tense formation is a suitable ground to test the validity of the dual-mechanism model (Pinker, 1991; Pinker, 1999). Despite researchers' ongoing interest in English past tense formation over other grammatical structures, more recent studies have focused on diverse linguistic systems in typologically different languages such as German regular and irregular past participle forms and plural nouns, Portuguese verbal conjugational stems, Turkish regular (Aorist) verb inflection, and Spanish inflected verbal forms in order to reach generalizable findings (Neubauer & Clahsen, 2009; Hahne, Müller & Clahsen, 2003; Verissimo, 2009; Kırkıcı & Clahsen, 2013; Bowden, Gelfand, Sanz & Ullman, 2010).

In addition to the importance of testing a variety of languages to be able to generalize any findings obtained, L2 learners' native languages also play a crucial role in determining the way they process a second language since it has been claimed that L1 might be influential during L2 processing and L2 speakers tend to perform better at linguistic structures which are identical both in their L1 and L2 (Rehak & Juffs, 2011). Several studies have been performed on participants whose L1 is German, Polish, Chinese, Spanish, Greek, Turkish, Russian, Spanish, Arabic (Neubauer & Clahsen, 2009; Babcock et al., 2012; Pliatsikas & Marinis, 2013; Kırkıcı, 2005; Hahne et al., 2003; Bowden, 2010; Clahsen et al., 2013).

The main purpose of many morphological processing studies has been to figure out what mechanisms are at work while L2 learners perceive and/or produce words even though the linguistic structure under investigation, the methodology or the participant profile may completely change. Therefore, different morphological processing studies dealing with the processing of inflected word forms by L1 and L2 learners, their results and general conclusions will be presented below.

As pointed out above, the English past tense has long been the center of attention in morphological processing studies. Studies dealing with the morphological processing of the English past tense have employed various methods ranging from behavioural tasks like elicited production, acceptability judgments, visual lexical decision, cross-modal / masked priming, and self-paced reading to on-line psycholinguistic methods like event-related brain potentials (ERP) or eye-tracking experiments. The results of these studies have led to the establishment of two different theoretical perspectives on L1 morphological processing. The first group of results largely supports some kind of a single mechanism model in which both regular and irregular past tense forms are accessed through a single process. In the associationist account, for example, stems and inflectional morphemes cannot be separated from each other during the processing of regular and irregular inflection but are all processed undecomposed through an associative memory (e.g. Rumelhart & McClelland, 1986). Another version of a single mechanism model proposes a rule-only account in which regulars are formed by the addition of *–ed* to the verb stem whereas irregular verb stems go through a number of changes that can also be accounted for using rules (e.g. Ling & Marinov, 1993).

The second group of results, in line with the basic tenets of the dual mechanism account first proposed by Pinker (1999), largely demonstrates that regular verb forms are dissociated from irregular verb forms. This has been taken as support for the idea that native speakers of English store and access irregulars as full-forms (i.e., as unanalysed wholes) in the mental lexicon, whereas regular forms are generated by means of a morphological rule. It has been reported that irregular past tense forms produce frequency effects in lexical decision tasks, whereas regulars produce frequency effects only when sufficiently high in frequency (Ullman, 1999; Ullman, 2001). This processing pattern has been taken as an indication of the fact that irregular forms are fully listed in the lexicon while regulars are decomposed into stems and suffixes (Clahsen, 1999; Pinker & Ullman, 2002).

In addition to research into the 'past-tense debate', there have also been a number of L1 morphological processing studies that have analysed the processing of inflectional morphology by focusing on distinct languages and structures. Clahsen, Eisenbeiss, Hadler and Sonnenstuhl (2001), for example, tested L1 speakers of German with lexical decision and priming tasks on German adjectives inflected for case, number, and gender and strong verb forms with different stem forms. In their first experiment (lexical decision task), which tested adjectives inflected by *–m* and *–s*, their purpose was to differentiate between the potential effects of affix frequency and word-form frequency and to determine whether inflected adjectives are decomposed or stored as wholes based on the effects of frequency types. The authors expected that *–s* forms of adjectives would lead to shorter lexical decision times whereas *–m* forms would produce longer reaction times since *–m* forms are more specific in the paradigm than *–s* forms, which was also supported by the results of Experiment 1. It was found that lexical decision times were not affected by word-form frequency but by affix frequency. Their second experiment, which was a cross-modal priming task, also corroborated the findings of Experiment 1 and showed that *–m* forms elicited longer response times than the other forms. On the basis of these results, Clahsen et al. (2001) reached the conclusion that inflected adjectives in German are processed in a decomposed format and the obtained priming effects are the results of the morpho-syntactic content of the affixes in their experiment. The authors argued that these findings did not fit within associative models and proposed instead that combinatorial models of inflection were at work during L1 processing.

Kırkıcı and Clahsen (2013) worked on the processing of Turkish inflectional and derivational phenomena by L1 and L2 users of Turkish, which is the only study conducted on the processing of Turkish derivational and inflectional morphology as a second language so far. The authors studied regular (Aorist) inflection and deadjectival – *lIk* nominalization and obtained different priming patterns for inflection and derivation, supporting the proposal that derived and inflected forms have different morpholexical representations. As for the processing of inflected verbs, significant priming effects for the Aorist in the L1 group was found whereas no priming was obtained for the Aorist in the L2 group, which is in agreement with the L1 studies reported above and L2 studies presented below. Priming effects for the L1 group suggest that L1 speakers decompose verbs inflected with the Aorist into stem and affix. No priming effect for the L2 group, on the other hand, denotes that L2 speakers do not apply early automatic morphological parsing mechanisms in the same way as L1 processing.

Most morphological processing studies have been conducted on native speakers in order to understand the L1 processing mechanisms and representation in the mental lexicon. Although the amount L2 morphological processing studies is markedly less compared to native language processing, more recently L2 morphological processing studies have started to be conducted and have produced some highly interesting results. The processing of inflected words has received a lot of attention in these L2 processing studies so as to compare the potential processing similarities/differences between L1 and L2 morphological processing. It needs to be pointed out, however, that researchers have not yet reached a commonly accepted answer to the question of whether and how non-native language processing diverges from native language processing.

Some researchers have found no L1/L2 differences in the processing of regularly inflected word forms (Basnight-Brown, Chen, Hua, Kostic & Feldman, 2007; Diependaele, Dunabeitia, Morris & Keuleers, 2011), arguing that L2 processing relies on the same mechanism as L1 processing does and adding that L1 transfer might have an effect on slower and less automatized L2 processing. Hence, the idea is supported that observed L1-L2 differences might result from the learners' native language and L2 speakers' slower cognitive processes (e.g. working-memory limitations or slower processing speed) rather than from L1-L2 processing differences (e.g. McDonald, 2006; Perani & Abutalebi, 2005).

Other studies, however, have reported evidence for L1/L2 differences in morphological processing, particularly with respect to regular inflection (Silva & Clahsen, 2008; Neubauer & Clahsen, 2009; Babcock et al., 2012; Clahsen et al., 2013). These studies have reached a common conclusion that the differences observed between L1 and L2 processing are more fundamental. They cannot be simply attributable to the processing cost of an L2, the heavy cognitive load or the L1 transfer effects. The differences would rather require more complicated and theoretically sound explanations. One such an explanation/model in line with the findings of these studies is the Declarative/Procedural model proposed by Ullman (2005) as already explained above. The model suggests that L2 processing relies more on the declarative memory system, which involves the full-form storage of memorized words, rather than the procedural system, which employs morphological decomposition. L2 learners still make use of morphological parsing in L2 processing; however, it is considerably less when compared to L1 processing. Different studies which reveal this kind of differences between L1 and L2 inflectional processing will be examined in detail below.

Hahne et al. (2003) investigated the L1 and L2 processing of participial inflection and plural formation in German through an elicitation task, an acceptability judgment task and event-related brain potential experiments conducted with native speakers of German and advanced L2 speakers of German with Russian as their native language. It was hypothesized that L2 processing does not use the same mechanisms as the L1 processing of inflected words. For the processing of German participles, the results showed that two forms of participles, -*t* and –*n*, have different generalization properties in both native speakers and the L2 learners; –*t* can apply to any kind of verb and includes rule-based formation whereas participles with –*n* are stored in the lexicon. The ERP data of the L2 learners demonstrated that L2 learners are in fact decomposing the inflected word forms during early processing by making use of rule-based morphological decomposition like L1 speakers. As for the processing of German plurals, -s being the least and –*n* being the most common plural affix, it was demonstrated that –*s* plural regularization errors are first decomposed into constituent morphemes and at a later stage of processing participants reanalyse the regularized plural form to repair the processing as indicated by the P600 effect. This study makes the strong claim that regular participles and plurals are decomposed into stems and affixes and their irregular counterparts are stored in the memory as full-forms. These two mechanisms, morphological decomposition and lexical storage in the mental lexicon, are also employed by L2 learners though the decomposition mechanism may be more restricted in L2 speakers compared to L1 speakers

Neubauer and Clahsen (2009) also examined the same subsystem of German inflection through the use of an acceptability judgment task, a lexical decision task and a masked priming task. The study compared the L1 processing of regular and irregular participle forms in German to the processing of L2 speakers with Polish as their L1. Unlike the results reported in Hahne et al. (2003), this study revealed striking L1-L2 contrasts for regular participles. The results of the lexical decision task showed frequency effects in the irregular but not in the regular participle condition for L1 processing. As for L2 processing, frequency effects were obtained for both regular and irregular participles. Since frequency effects are taken as signs of full-form storage, these results suggest L1 speakers were affected by the combinatorial structure of regular participle forms but stored irregularly inflected verbs as full-forms, whereas L2 learners did not display any evidence for morphological decomposition and possibly tended to use the lexical memory more than native speakers.

The processing of regular past tense forms in English was also examined by Silva and Clahsen (2008) through masked priming experiments employed on both native speakers of English and L1 Chinese and L1 German learners of L2 English. Due to the relatively higher degree of similarity between German and English, it was expected that more native-like priming patterns in the L1 German group would be found if L1/L2 similarity was beneficial during L2 processing. In line with previous studies, native speakers showed efficient priming for regularly inflected verb forms, indicating morphological parsing processes. In contrast to L1 speakers, L2 learners demonstrated no priming effects, suggesting L2 learners rely less on such processes than L1 processing. The two different groups of L2 learners displayed similar priming patterns, implying that the similarity between L1 and L2 does actually not play a role in the processing of L2. Clahsen et al. (2013) also explored the same inflectional phenomenon with a group of advanced Arabic-speaking learners of English through masked priming experiments. The results replicate previously found L1/L2 differences in the processing of regular inflectional paradigm in that no morphological priming effect was obtained for the regular inflection by the L2 speakers.

Different from recognition studies of past tense formation, Kırkıcı (2010) probed the same area from a "production" perspective. The purpose of the study was to investigate the patterns of regular and irregular past tense production by L1 and L2 users of English. An oral elicitation task was administered to 8 native speakers of English and 49 Turkish learners of English, who were further divided into advanced level and low-level L2 English proficiency. The results demonstrated that the production rates of past tense marked regular forms were not related to the relative frequency of verbs' past tense forms and that the majority of high frequency and low frequency regular verbs were correctly inflected by both groups of L2 learners. Based on this finding, the author endorses the view that both low and advanced level L2 learners decompose regular past tense forms into the root and suffix. Irregular past tense forms, however, were found to be retrieved as full forms from the memory since the results showed that the production of irregular past tense forms was influenced by their past tense frequencies. Kırkıcı (2010) argues that the results were in line with the dual mechanism account, but did not necessarily support a strong version of the L2 developmental changes model proposed by Zobl (1998).

Multiple interacting factors such as proficiency level, the nature of L2 exposure (classroom vs. naturalistic), gender, age of L2 acquisition and L2 speakers' native language have also been taken into consideration in some studies (e.g., Babcock et al., 2012; Pliatsikas & Marinis, 2013). For example, Pliatsikas and Marinis (2013) tested the controversy about the past tense formation in L2 processing from a different perspective, which integrated the factor "the nature of L2 exposure" into the experimental design and controlled for the level of L2 proficiency, AoA. By testing two groups of highly proficient L2 speakers who started L2 acquisition around at the age of 8 and were exposed to L2 in naturalistic and/or classroom environment, Pliatsikas and Marinis (2013) investigated how different groups of L2 speakers process the regular and irregular verbs in English by means of a self-paced reading task. They specifically tested whether L2 speakers retrieve both regular and irregular verb types from memory as full forms or they parse regular verbs into morphological constituents and store irregular verbs as full forms as predicted by the Dual Mechanism Account (Pinker, 1999). The results demonstrated that both groups of L2 speakers applied rule-based processing regardless of the type of exposure they had. It was argued that the type of exposure is not influential to determine the processing of regular and irregular past tense forms since the groups of L2 speakers processed the regular and irregular verb forms similarly. Based on this finding, they claimed that "all highly proficient L2 learners are likely to be able to employ the past tense rule automatically" (p. 20). It was concluded that the dual system processing is available for both L1 and L2 speakers and the processing of L2 is not influenced by the type of exposure, but the overall amount of L2 exposure and the consequent proficiency level.

Babcock et al. (2012), exploiting the same subsystem of past simple formation, examined the factors influencing the L1/L2 computational differences. By examining the past tense frequency effects on a past tense elicitation task, the authors investigated the effects of length of L2 exposure, age of L2 acquisition, L2 speakers' native language, and gender on the L1 and L2 inflectional processing similarities/differences. Their findings were partially consistent with the previous findings in that L2 learners always stored irregular verb forms. As for the regular forms, various factors affected their decomposition or storage. In L1, only female participants stored regulars whereas both sexes stored regulars in L2; females' reliance on storage decreased with longer residence in the target country; higher adult ages of arrival were associated with more dependence on storage. By comparing the results of their study with those of Silva and Clahsen (2008), they argued that their results confirmed the idea that regular past tense formation can evolve into an automatic process with an increase in L2 experience as put forward by Ullman (2004).

In this section, previous work on the processing of inflectional paradigm in L1 and L2 speakers has been reported. It has been claimed that the processing of inflected and derived word forms differ from each other substantially, reflecting different morpholexical representations. Based on the findings of the studies reported above, it can be cautiously concluded that L1 and L2 processing are not alike with regard to inflectional processing and that the observed L1-L2 processing differences cannot be attributed to only L1 transfer or the heavy cognitive load of L2 speakers during processing. Whereas native speakers consistently display priming effects for inflected word forms, L2 speakers fail to show significant priming effects for inflected word forms. This pattern is supportive of the view that L2 speakers are less sensitive to the morphological structure of morphologically complex word forms than L1 speakers and, instead, depend more on full-form access during processing. Taken together, the results reported above are consistent with Ullman's model which claims that L2 processing is heavily dependent on the declarative memory rather than on procedural processing.

2.3.2 Derivational Processing

Although a clearer picture has started to emerge in terms of both native and non-native inflectional processing, both theories and the number of studies regarding derivational processing are still insufficient and limited to several languages such as German, English, and Finnish. The bulk of research has focused on L1 derivational processing and L2 derivational processing is still in need of further investigation so as to gain a better understanding how L2 speakers process their L2. On the other hand, derivational studies have been conducted from a range of different perspectives such as base and surface frequency effects, semantic transparency, affixal salience and proficiency levels of L2 learners on different languages with different linguistic sub-systems. Different derivation studies on L1 and L2 learners, their results and general conclusions will be presented in the next section below. In the second section, different considerations that have been scrutinized in L1 and L2 derivational processing will be explained.

2.3.2.1 General L1 and L2 Derivational Processing Studies

Clahsen et al (2003) investigated the native processing of German derivational morphology and how it differed from the processing of inflectional morphology. As a result of the investigation of two derivational suffixes (*-ung* nominalizations and diminutive forms with *–chen*) of German using a cross modal priming task and a visual lexical decision task with 60 L1 speakers of German, Clahsen et al. (2003) observed frequency effects for both suffixes, suggesting that full-form representations are available for both. However, the results of the cross modal priming experiment indicated that the stems of derived words primed their derived word forms as effectively as the derived forms themselves, yielding full priming effects. Based on the findings, the authors contended that a clear linguistic distinction lies between the processing of inflection and derivation. Whereas it might be appropriate to claim that the words derived with the suffixes under investigation are stored as undecomposed forms in the mental lexicon and hence pattern with irregular forms, based on the priming effects one could also conclude that German derived words are morphologically decomposed into their constituents. These results showed that productive derivation is similar to both productive and non-productive inflection. Although these results are partially in line with the tenets of the Dual Mechanism

Model, the authors propose a readjustment to the model which identifies three types of elements: "(i) frozen irregular forms, stored in entries, (ii) productively derived stem *entries* and (iii) productively inflected word *forms* which are not represented in lexical entries" (p. 5).

The L2 processing of the suffix *–ung* was also investigated by Clahsen and Neubauer (2010), who tested German native speakers and competent L2 users of German with Polish as L1 using different experiments. The findings of a visual lexical decision task revealed frequency effects in both the L1 and the L2 group, which suggests that German *–ung* forms are represented as full-forms in both native and non-native processing. However, the results of the masked priming experiment showed that priming patterns were distinct in the L1 and L2 group. Whereas the L1 group had similar reaction times in the Test and Identity conditions and shorter reaction times in the Unrelated condition (full priming), the L2 group displayed similar reaction times in the Test and the Unrelated conditions, both of which were significantly longer than the Identity condition, yielding no priming effect. Although the lexical decision experiment indicated that native speakers of German probably store derived words as full-forms, the masked priming experiment revealed that derived words in German are combinatorial in nature. The authors explain these contradictory results in terms of the less direct diagnostic features of frequency effects in lexical decision tasks (p. 22). Overall, the findings of this study replicated the results of Clahsen et al. (2003) with respect to L1 processing. Regarding L2 morphological processing and L1/L2 contrasts, this study exhibited similar findings to those of Silva and Clahsen (2008), which indicate less reliance on combinatorial systems for L2 users when compared to L1 speakers.

Silva and Clahsen (2008) analysed English deadjectival nominalizations *–ness* and *–ity* in adult L1 English and proficient L1 German and L1 Chinese users of L2 English by using masked priming experiments The authors state that *–ness* and *–ity* forms are combinatorial word forms although they bear differences in terms of productivity and transparency (i.e. *–ity* is less productive and transparent than *–ness*) (p. 10). The results showed that L1 Chinese learners of English produced higher error rates than both the native speakers and the L1 German learners of English for both suffix types.

As for the priming effects, whereas native speakers showed full priming effect for both derived word forms, both groups of L2 learners demonstrated only reduced (partial) priming effects. The L2 groups did not show a full priming effect for morphologically related pairs in any experiment, supporting the view that L2 learners depend more on lexical storage and less on combinatorial processing of morphologically complex words compared to native speakers. Based on these results, the authors argue that L2 learners' processing of derivational word forms functions less effectively than that of native speakers and that the partial priming effects in L2 learners are still inherently morphological (p. 31). As for the potential impact of L1 background, no effect of native language on L2 derivational processing was found since the priming patterns were alike in both L2 groups.

Similar results regarding the lack of L1 influence on L2 morphological awareness to those obtained in Silva and Clahsen (2008) were reported in Koda (2000), in which L1 Chinese and Korean learners of L2 English participated in a timed separability judgment task. Since Korean and Chinese are two typologically distinct languages and Korean has, unlike Chinese, a rich and productive system of derivational morphology similar to English, it was hypothesized that L1 Korean L2 English learners would be more sensitive to the morphological structure of complex words than L1 Chinese L2 English speakers. Therefore, it would have been plausible to expect more sensitivity to internal structure of complex words in L1 Korean L2 English learners than L1 Chinese users due to native language (Korean) influence on L2 (English) morphological awareness. However, the findings revealed no difference between the two L2 groups and suggested that L2 speakers process their second language in the same manner, regardless of their L1 backgrounds. On the other hand, this assertion has been partially challenged by Rehak and Juffs (2011), who replicated Silva and Clahsen (2008) by employing a different group of L2 participants whose L1 was Spanish to determine any potential L1 transfer effects. Three groups of participants took part in the masked priming experiments: native speakers, L1 Spanish L2 English, and L1 Mandarin Chinese L2 English. Investigating the native and non-native processing of a variety of English suffixes (both inflectional *–ed* and derivational *–ness*, *-ity*, *-un*, and *–re* suffixes), the researchers obtained no significant difference between the two L2 groups (L1

Spanish vs. L2 Mandarin Chinese) for the processing of –ness suffix. On the other hand, L2 groups displayed significant differences for the processing of *–ity* suffix, hinting at a possible L1 transfer in the Spanish L2 group. As Spanish has a similar suffix to the English suffix *-ity* (i.e. the suffix *–idad* in words such as *fatalidad* – fatality), Rehak and Juffs (2011) concluded that L1 Spanish group might be transferring morphological processing from their native language during the L2 processing of prime words derived with *–ity*.

In addition to English and German, typologically different languages with different linguistic systems have also been scrutinized to reach more generalizable findings. One such study dealt with the L1 processing of Japanese *–sa* and *–mi* deadjectival nominals, which are distinguished from each other in terms of productivity and semantic properties (Clahsen & Ikemoto, 2012). Whereas *–sa* is highly productive and denotes a certain meaning (i.e. the degree of X-ness), *-mi* is restricted to a limited number of adjectives and expresses unpredictable meanings (e.g. feelings, location). Nominals derived using *–sa* and *–mi* were investigated through eye-movements during reading, an unprimed lexical decision task and a masked priming task. Firstly, the eye-movement experiment which tested these nominals in context demonstrated longer reading time for *–mi* forms when compared to *–sa* forms due to the unpredictable semantic labels *–mi* nominal displays. Secondly, the findings of the unprimed lexical decision task revealed frequency effects for both types of nominals, suggesting access to whole word representations in both cases. Finally, the masked priming experiment produced similar priming effects for *–sa* and *-mi* nominals. Given the fact that both nominals had different behaviours when presented in context and similar behaviours when presented as single words, it was proposed that they behave identically at the word-form level but differently at the meaning level and that the semantic properties of suffixes influence the processing of derived words when complex words are presented in context. The authors explained the observed distinction between the nominals in terms of level of representations. They stated that whereas both nominals were represented similarly at word-form level, they were represented differently at the meaning or functional level.

Further results from the scrutiny of a typologically different language system come from Finnish, a morphologically rich language (Vannest, Bertram, Järvikivi & Niemi, 2002). The study at the same time constitutes an interesting cross linguistic comparison to English, a language with a relatively poor morphology. With a series of lexical decision tasks probing into the processing of words derived with several Finnish and English suffixes (*-kAs*, *-tOn*, *-iSa* suffixes in Finnish; *-hood*, *-ship*, *-less*, *-ness*, *-ity*, *-able,* and *–ation* suffixes in English), it was found that Finnish complex words with these suffixes are stored as full-form representations. For English, on the other hand, a great deal of evidence was found to support the view that derived words are decomposed into their component morphemes. Overall, the results of the study revealed thus more computation for English than for Finnish despite the fact that it one would expect more morphological decomposition in Finnish so that native speakers of Finnish can deal with the very high number polymorphemic words more effectively.

A language in which the number of L1 and L2 studies on derivational processing is highly restricted is Turkish. Although Turkish is very similar to Finnish in that both of them are morphologically very rich and productive, Turkish has not received the same attention as Finnish; therefore, there is a serious lack of experimental evidence on Turkish morphological processing. The first study on the processing of Turkish multimorphemic words was carried out by Gürel (1999) to determine to what extent the lexical access to Turkish complex word forms involves decomposition or storage since it has been argued that agglutinative languages must predominantly involve combinatorial processing (Hankamer, 1989). The results of a visual lexical decision task revealed that the access mechanisms for complex word forms in Turkish depend on the frequency of suffixes: the higher the frequency of a suffix, the easier and faster the retrieval of those words through whole-word access. Overall, it was put forward that not all multimorphemic words in Turkish are accessed via the parsing route.

More recent evidence for the processing of Turkish complex words comes from Kırkıcı and Clahsen (2013) who also explored the processing of deadjectival nouns derived with the *–lIk* deadjectival nominalization suffix in L1 and L2 Turkish (in addition to inflectional processing, which was reported above). Employing masked priming experiments with L1 speakers of Turkish and advanced learners of L2 Turkish from different L1 backgrounds, the authors found significant priming effects for both participant groups. Based on this result, the authors concluded that native and non-native processing of Turkish derived words is similar to each other and that L2 speakers of Turkish do not seem to store morphologically complex words as full-forms in the mental lexicon, which supported the existing literature on L2 derivational processing.

Although the results of these two Turkish processing studies are not directly comparable because of the differences in the experimental methods used and the selection of stimuli, it is evident that more research into Turkish is required so as to reach a clearer picture of inflectional and derivational processing in Turkish and to assess the generalizability of findings from other studies to typologically different languages.

2.3.2.2 Different Aspects of L1 and L2 Derivational Processing

Base and Surface Frequency Effects

Manipulations of base/surface frequency have been extensively employed as diagnostic tools to determine the nature of morphological processing for more than 30 years. The logic behind such manipulations is the assumption that it is both easier and faster to retrieve a word from the mental lexicon if the word is frequently encountered in a given language. Based on this assumption, frequency effects have paved the way for psycholinguistic studies experimentally distinguishing between full form storage and decompositional accounts through the manipulation of frequency-related variables. To illustrate, the role of storage has been explored by varying the surface frequency of complex words while keeping the base frequency constant. On the other hand, the role of computation has been investigated by varying the frequency of the base word while keeping the surface frequency constant (Bertram et al., 2000). When frequency effects for base words are stronger, it is assumed that the lexical representation of the base word is activated and decomposition into constituents takes place. However, when frequency effects are stronger for surface word forms, full form storage is likely to be the route of processing.

Even though this paradigm has been frequently employed by many researchers over the years and has been successfully applied to empirically test a number of theoretical considerations, more recently it has been argued that the surface frequency effect cannot be readily accepted as evidence for full form access and the absence of a base frequency effect does not automatically entail the lack of decompositional processes (Järvikivi, Bertram, & Niemi, 2006; Taft, 2004). Taft (2004), for example, contends that the presence or absence of base/frequency effects can be integrated into an obligatory decomposition account in which all morphologically complex words are accessed via the base in the first stage and the affix and base are combined in the second stage. In addition, various affix properties, known to enhance or inhibit affixal salience, have also been reported to affect the perceptual analysis of derived words in different languages. The properties that contribute to affixal salience will be further explored below.

Affixal Salience (Distributional Properties of Affixes)

Laudanna and Buranni (1995) stated that the processing of a derived word is determined by a number of distributional properties of an affix. The affix properties that have been reported in several studies to affect the processing of derived words are suffix length and frequency, homonymy, allomorphy, and productivity, all of which contribute to the so-called affix salience. According to Laudanna and Burani (1995), affix salience is "the likelihood that a derivational affix will serve as a processing unit" (p. 352). Based on studies investigating the relevance of these properties for derivational processing by manipulating surface and base frequency, it has been hypothesized that the balance of storage and decomposition during lexical processing can be highly influenced by the degree of affix salience (e.g. Baayen, 1994; Laudanna & Burani, 1995; Bertram et al., 2000). Hence, each of these affix properties will be explained with specific reference to the relevant studies in the literature.

In dual route models of lexical access, complex words are thought to activate two types of access mechanisms, namely a mechanism for whole-word retrieval and another one for the morphemes of complex words. According to these models, as the frequency of the whole word and constituent morphemes are considered to affect the activation of different units in different components, frequency is regarded as the major determinant of access mechanisms in lexical processing. Although base and surface frequency effects have been explored in a great number of studies so far (see also above), affix frequency has been relatively overlooked. Burani and Thornton (1992), however, scrutinized the effect of both root and suffix frequency on the processing of Italian derived words through lexical decision tasks. It was found out that pseudo-words with high frequency suffixes activate corresponding morphemic access units whereas pseudo-words with medium or low frequency suffixes do not activate access to the same units, which is taken as sound evidence for the role of affix frequency in lexical processing. Furthermore, when the effect of suffix frequency on real word processing was investigated, words with high frequency suffixes elicited shorter reaction times and more accurate performance than words with lower frequency suffixes. The finding that words with high frequency suffixes were processed via their constituent morphemes was confirmed in their last experiment, which furthermore suggested whole-word processing for words derived with low frequency suffixes.

Affix length was also shown to have significant influence on the possibility of an affix to serve as a separate constituent in lexical processing by Laudanna and Burani (1995), who investigated Italian prefixes in terms of frequency, length in letters, and productivity. Their results demonstrated that lexical decision reaction times differed as a result of both the length of the affixes and the ratio between prefixed and pseudo-prefixed words in Italian, which was determined by the number of orthographic strings shared by both the prefixed and pseudo-prefixed word. In addition, non-words with long prefixes led to longer reaction times than other prefixed non-words. The error data showed that the amount of errors varied depending on the prefix length, with non-words including longer prefixes leading to more errors than non-words with shorter prefixes. The results, overall, affirmed the hypothesis that prefix salience can be strengthened by prefix length though the researchers were cautious about attributing the observed effect to prefix length alone. It should be noted, however, that the results failed to show the hypothesized effects of affix frequency and productivity, which the authors explained by a variety of factors (e.g. experimental errors, the nature of the task).

Affixal homonymy and productivity are further prominent factors that have been thought to influence a derived word's compositionality or storage. Affixal homonymy can be defined as an affix form performing two or more semantic/syntactic functions at the same time and bringing about additional competition into a decompositional process with more than one meaning competing for a single form (Järvikivi et al., 2006, p. 396). To illustrate, *-er* morpheme is ambiguous both in English and Dutch in that it can be used both as an agentive marker (work-er) and comparative suffix (small-er). This one-to-many mapping between the affix form and its functions creates confusion during processing since the suffix needs to be classified into the correct grammatical category (or, word formation category, as the former produces derived words whereas the latter produces inflected words). On the other hand, affixal productivity is defined as the ability of an affix to coin new words in a language. For instance, Anshen and Aronoff (1988) demonstrated that English derived word formation was affected by affix productivity. They observed that productive affixes (e.g. *–ness*) formed a greater number of words than less productive suffixes (e.g. *–ity*). Based on this finding, it can be hypothesized that words derived using less productive affixes are more likely to be fully stored in the mental dictionary than words derived using more productive suffixes.

Bertram et al. (2000) scrutinized the above properties on the Dutch homonymic suffixes *–er* (functions: productive agentive and comparative marker) and *–te* (functions: productive past tense vs. unproductive deadjectival abstract noun marker). These suffixes were investigated through visual lexical decision tasks in which surface and base frequency were manipulated to observe the role of storage and decomposition. The results revealed base frequency effects for the past tense *–te*, which are indicative of computation, but surface frequency effect for derivational *–te*, suggesting full-form storage. It was asserted that the dependence on full-form storage for the latter might be caused by the co-existence of a productive and frequent homonym and an unproductive derivational suffix. On the other hand, the results obtained for the suffix *–er* revealed a different pattern. The results showed that both derivational *–er* and inflectional *–er* suffixes were stored as full-forms. Whereas the processing of productive derivational *–er* suffix behaved similar to the processing of unproductive derivational *–te* suffix, the processing of productive inflectional *–te* suffix did not show affinities with the processing of productive inflectional *–er* suffix. The authors attributed the dependence of the inflectional *–er* suffix on storage to the productivity of rival productive derivational suffix, which created a disambiguation between two productive functions. Given these findings, it is sound to reach a conclusion that both affixal homonymy and lack of productivity favor storage of derived words in Dutch.

Parallel to the design of Bertram et al. (2000), Bertram, Laine and Karvinen (1999) investigated Finnish, a language with a remarkably productive morphology, so as to compare Dutch and Finnish. 3 Finnish suffixes were experimentally analyzed in the study: unambiguous and unproductive denominal suffix *–la*, productive but homonymic suffix *–ja*, which has both an inflectional and a derivational function, and unambiguous and productive suffix *–sto*. It was questioned whether a pattern of findings similar to that obtained for Dutch would be attained, given the fact that Finnish has a considerably more productive morphology than Dutch and was therefore expected to employ parsing strategies to a higher extent. The findings of the experiments showed that no statistical differences were found between word forms derived with *–la* and *–ja* and monomorphemic control words. Words derived with *–sto*, on the other hand, elicited shorter reaction times when compared to monomorphemic control words. These findings are similar to those obtained for Dutch by Bertram et al. (2000) in that unambiguous and productive suffixes were found to be accessed faster than ambiguous and unproductive suffixes even though the two languages are rather different with respect to morphological richness. The authors concluded that affixal homonymy affects the processing of derived words, triggering storage and that productivity enhances computation of complex words without a homonymic suffix. Hence, it was displayed that both affixal homonymy and productivity play a crucial role in the morphological processing of typologically different languages.

Schreuder and Baayen (1995) suggested that the phonological transparency of a morphological category is also relevant to the affix properties. In other words, affixal allomorphy, which is the opposite of affixal homonymy, is cited as another influential factor that contributes to affixal salience. Unlike in affixal homonymy, in affixal allomorphy many forms are competing for only one meaning. To illustrate, the Dutch diminutive suffix has five allomorphs: *-je, -tje, -etje, -kje*, and *–pje.* It has been argued that it would take longer and be harder to discover an affix with allomorphs rather than an affix with a single phonological form, such as *–ful* in English (Schreuder & Baayen, 1995; Järvikivi et al., 2006).

Järvikivi et al. (2006) probed the processing of Finnish derivational morphology to observe whether affixal allomorphy would have any significant effect on the processing of derived words. By employing a series of lexical decision tasks with native speakers of Finnish, they aimed at finding an answer to the question whether the morphological transparency of a complex word can be boosted by the structural invariance of a suffix form increasing the likelihood of that suffix to be computed. In order to do so, they selected four different Finnish suffixes which vary in terms of affix properties and manipulated their base or surface frequency. The first experiment, inspecting the role of high suffix frequency on affixal salience with *–Us* suffix, demonstrated that the words derived using this suffix are accessed through their whole word form only. It was concluded that high suffix frequency, on its own, is not adequate to boost affixal salience and to help morpheme-based processing take place. Experiment 2 further investigated whether productivity played a role in affixal salience along with suffix frequency with *–(U)Us* deadjectival suffix. The results revealed that words derived using this suffix are not decomposed into morphological units, suggesting that there might be additional factors decreasing the affixal salience of these suffixes. Therefore, the role of affix allomorphy was assessed in the next two experiments with two suffixes that are structurally invariant (i.e. they lack suffix allomorphy) to test the hypothesis that affixal salience would be enhanced by a suffix without allomorphy. Faster reaction times were elicited for the high surface frequency condition than for the low surface frequency condition, indicating enhancement of decomposition for words with these suffixes as a result of structural invariance. Based on all the experiments, it was concluded that it would be insufficient to explain the results in terms of suffix frequency or productivity and that the lack of suffix allomorphy, which turned out to enhance affixal salience in this study, had an important function during the processing of derived words.

Dissociating Form, Morphology, and Meaning

The semantic transparency of the morphological relationship between the derived form and its stem has received a great deal of attention as a variable affecting the morphological representation. Semantic transparency plays a major role in determining whether the lexical representations of derived words are morphologically constructed or not. Besides, the manipulation of the semantic transparency of the relationship between prime and target words in masked priming studies is a way to counter arguments regarding methodological shortcomings of the masked priming paradigm. In the masked priming technique, a prime word (e.g. helpful) is presented on the screen for a very short time (usually between 30 – 80 ms) and is followed by a target word (e.g. help). Participants are required to make a lexical decision on the basis of the target word. This technique has been extensively practiced to test whether the prime word facilitates the recognition of the target word, which would suggest decomposition of the prime word into its morphological constituents. However, it has been argued that there might be some confounding factors which might prevent researchers from attributing the observed facilitation only to morphological properties (Marslen-Wilson, 2007, p. 185). It is apparent that words which share morphemes also tend to share phonological, orthographic and semantic properties and the observed priming effect could be due to shared form or meaning between a prime and target word. In order to rule out semantic transparency as a confounding factor and to dissociate form and meaning from morphology, the semantic transparency of prime words is often manipulated (Rastle, Davis, Marslen-Wilson, & Tyler, 2000; Rastle et al., 2004; Marslen-Wilson et al., 2008).

By using the masked priming technique in a variety of languages such as English, German, French, Polish, Arabic, Hebrew, and Dutch, researchers have explored the priming effects of the morphological relation between primes and targets. The studies have mainly focused on the debate whether the observed effects are morphological in nature or not (Rastle et al., 2000; Longtin, Segui, & Halle, 2003; Rastle, et al. 2004; Marslen-Wilson et al., 2008). Most of these studies are convergent on the result that an early *blind* decomposition process (similar to the obligatory decomposition account proposed by Taft and Forster in 1975) takes place whenever a word ends with a real suffix or a morpheme-like suffix during early visual word recognition. However, other studies with similar experimental designs even detected facilitation between prime and target words which did not bear any transparent semantic relationship but a 'historical morphological' relationship (Diependaele, Sandra, & Grainger, 2005; Rastle et al., 2000), as will be explained below.

Marslen-Wilson, Tyler, Waksler, and Older (1994) studied the organization of lexical entries in the mental lexicon and their relation to morphological and semantic properties with a series of auditory-visual cross-modal priming experiments in which the critical items were suffixed and prefixed words in English. The semantic and phonological transparency of prime words was manipulated in six experiments so as to be able to uncover the effect of the morphological properties of words during visual word recognition. The first three experiments investigated the processing of derived words and the last three experiments explored the processing of prefixed words. Given the findings from the first three experiments on derivationally suffixed words, it was stated that the priming effect cannot be easily ascribed to surface phonetic overlap between prime and target pairs since phonetically related but morphologically unrelated pairs did not result in priming effects whereas morphologically related primes did so. Besides, regardless of morphological relation, semantically unrelated pairs did not prime each other reliably, which shows that semantic transparency is necessary but not sufficient to obtain priming. Lastly, derived forms did bring about priming effects even when they shared the same stem and were strongly semantically related. On the whole, it was put forward that derived words produce priming effects through the activation of shared morphemes in the lexical entry and that the results were compatible with a model where semantically transparent and morphologically complex words are represented in decomposed form with the basic unit being "clearly the morpheme" at the level of lexical entry (p. 31).

Rastle et al. (2000) also analysed whether the observed facilitation between prime and target words is purely due to their morphological relationship or it can be attributed to semantic and/or orthographic overlap between prime and target by manipulating the semantic transparency of the words and the SOA (the stimulus onset asynchrony). The aim was to tap into the nature of morphological decomposition throughout the word recognition process and to determine whether morphological priming was affected by semantic transparency during early visual word recognition or only at later stages of processing. Therefore, two sets of visual priming experiments were carried out in three SOAs (43, 72, and 230 ms). In addition, five different conditions of prime-target pairs in which morphological, semantic, and orthographic relationships were manipulated were created. The conditions are illustrated in Table 1.

Table 1 Experimental conditions in Rastle et al. (2000)

Condition	Example
1. (+M +S +O)	departure - DEPART
2. (+M -S +O)	apartment - APART
3. (-M +S -O)	cello - VIOLIN
4. (-M –S +O)	electrode - ELECT
5. Identical	cape - CAPE

The first set of results presented robust priming effects in Condition 1 and the priming effects did not vary across SOAs. Priming effects in Condition 1 were greater than the ones in Condition 3, which did not vary across SOAs. Likewise, priming effects in Condition 1 were much greater than the ones in Condition 4 (form controls) in all SOAs. On the other hand, transparent pairs (Condition 1) produced more priming than opaque pairs (Condition 2). Priming effects were not existent in Condition 4 at any SOA. Finally, no statistical difference was obtained between the priming effects in Condition 2 and 4 though there was a gradual decline of priming in both conditions as SOA increased. The results of first set of experiments corroborated the idea that "morphemically structured representations play a role in visual word recognition" since priming effects in semantically transparent condition were greater than the effects of semantic relatedness and of orthographic relatedness (p. 517).

Rastle et al. (2000) conducted a second set of experiments to investigate whether the priming effects observed in Experiment 1 could be summed effects of semantic and orthographic relatedness. By testing a set of prime-target pairs which have an orthographic and semantic relationship but no morphological relationship across the same three SOAs in Experiment 1, the authors replicated the results of Experiment 1 and observed priming effects for (+M +S +O) in the absence of semantic and orthographic priming effects in short SOA conditions. Therefore, it can be said that the observed priming effect in Experiment 1 is due to only morphological properties of prime-target pairs rather than semantic relatedness, orthographic relatedness, or the summed effects of semantic and orthographic similarity and the authors concluded that "the early visual word recognition system is characterized by a process at which morphemes are treated differently from whole words" (p. 518).

In another study by Rastle et al. (2004), the role of semantic information in word segmentation was investigated. In order to do so, three groups of prime-target pairs were formed: a semantically transparent morphological relationship (e.g. cleaner-clean), a semantically opaque morphological relationship (e.g. corner-corn), and a non-morphological form (e.g. brothel-broth) relationship between the target and the prime. The results of masked priming experiments with an SOA of 42 ms revealed no statistical differences between the transparent and opaque conditions; however, the priming effect in the transparent and opaque conditions was remarkably greater than priming in the form condition, which was in line with visual priming results of Longtin et al.'s French study (2003) (see below). These results suggest that native speakers of English are not aware of the semantic relationship between the prime-target pairs at an SOA of 42 ms during early visual word processing; thus, a purely structural decomposition takes place irrespective of the semantic effects. Given the findings of both this study and other semantic transparency studies in English, the conclusion is reached that complex words that contain a stem and a potential affix undergo a rapid process of morphological decomposition regardless of the semantic transparency of words.

Marslen-Wilson et al. (2008) explored the role of morphological, semantic, and orthographic factors in the early stages of visual word recognition by manipulating the above-named factors in an incremental masked priming paradigm. In this technique, the stimulus onset asynchrony (SOA) is varied across conditions so as to find out when different types of information (e.g. orthographic, semantic, and morphological) become available during the word recognition process. In the first set of experiments, prime – target pairs are varied in morphological decomposability, semantic, and orthographic relatedness and presented at three SOAs (36, 48, and 72 ms). The strongest priming effects at each SOA were found for morphologically related pairs and the priming effects for these pairs showed an increasing trend over SOAs. Whereas semantic relatedness alone produced mixed effects, no significant priming effect was obtained for the form-overlap condition at any SOA. Lastly, no interaction was found between semantic relatedness and amount of priming in the morphologically related conditions. The results of the first experiment indicated that a morphological priming effect can be dissociated from a semantical priming effect. In the second set of experiments, the order of prime and target was reversed (stem-derived order) in order to interpret the nature and locus of morphological priming effects. Significant priming effects were found for all of the morphologically decomposable groups, corroborating the view that facilitation does not require the target word to actually include the prime stem as part of its representation. The researchers concluded that multiple mechanisms are employed in the processing and representation of morphologically complex words and these mechanisms are triggered by different tasks in different ways.

While the studies reported above obtained robust priming effects for semantically related but not for opaque pairs, others reported priming effects for both transparent and opaque pairs in visual masked priming tasks. It therefore seems that semantic transparency has an inconstant effect that is dependent on the experimental conditions under which the data are collected and the languages analysed. In what follows, both convergent and divergent cross-linguistic evidence on the role of semantic transparency in derivational processing will be presented.

The first evidence comes from a study conducted on French native speakers (Longtin et al., 2003). The priming effects for semantically transparent pairs (e.g. *agreement – agree*), opaque pairs (e.g. *apartment – apart*), pseudo-derived pairs (e.g. remark – mark) and orthographic control pairs (e.g. *archer – arch*) were compared in a masked priming experiment with an SOA of 46 ms and a cross-modal priming experiment. Whereas the results of the masked priming experiment demonstrated significant facilitation for semantically transparent, opaque and pseudo-derived pairs but not for orthographic controls, the cross-modal masked priming task led to completely different results with priming effects obtained only for transparent pairs. Based on these sets of results, it was stated that semantic transparency might play a more central role in morphological processing when the prime is auditory and consciously recognized. However, a more recent investigation of French by Diependaele et al. (2005) discovered partially different findings from those reported in Longtin et al. (2003). First, Diependaele et al. found facilitation effects both for transparent and opaque forms in visual word processing although the facilitation for the opaque condition occurred at a longer SOA than in the transparent condition and the facilitation effects in the latter were much larger than in the former. Second, in auditory word processing, significant and equal priming effects were obtained for transparent and opaque pairs unlike Longtin el al., who reported priming only for transparent pairs in the same modality. Diependaele et al. concluded that neither supralexical nor sublexical models of lexical processing could be supported and explained through this set of findings and that there were two unique processing systems sensitive to different properties, which are morpho-orthographic and morpho-semantic systems.

In the same vein, Reid and Marslen-Wilson (2003) sought for further evidence regarding the effects of semantic opacity on the processing of complex word forms investigating a typologically different language, Polish, by using cross-modal priming tasks. The aim of Experiment 1 was to replicate the robust stem priming effects found across many languages and to find whether priming was affected by semantic opacity, unlike in Semitic languages (Arabic and Hebrew) which have a highly salient and extensive morphological system similar to Polish. The authors hypothesized that if similar opacity effects are not absent in Polish, then the reason for such a set of results in Semitic languages might be attributed to the nonconcatenative nature of their morphological system. Experiment 1 showed robust stem priming effects and no significant priming for semantically opaque forms (+M, - S pairs) similar to English and French. The authors claim that the lack of semantic effects in Arabic and Hebrew cannot be ascribed to their productive and salient morphological system since Polish is also morphologically productive but does not produce priming effect for opaque pairs.

A further language that has been studied to determine the role of semantic transparency in the lexical representation of complex word forms is Hebrew (Frost, Forster & Deutsch, 1997; Frost, Deutsch, Gilboa, Tannenbaum, & Marslen-Wilson, 2000). Hebrew is an unusual language in terms of the way in which the morphemes are joined to construct words. The great majority of words are constructed from roots which generally have three consonants (e.g. K.D.M). Unlike most of the languages in which the morphemes are conjoined to roots linearly to form words, the roots are embedded in pre-existing phonological patterns in order to compose new word forms in Hebrew morphology. To illustrate, the Hebrew word "*MIKDAMA*" (meaning *pre-payment*) is a combination of the root morpheme "K. D. M" and phonemes of the word pattern "MI – A - A" (p. 1278). A series of masked priming experiments were carried out on native speakers of Hebrew in order to probe the role of roots and word patterns in governing the lexical organization of the Hebrew mental lexicon. The results demonstrated robust stem priming effects, like many other languages, which were independent of semantic factors since no priming effect was obtained for semantically related but morphologically unrelated pairs. Based on the results of a series of masked priming tasks, Frost et al. (1997) concluded that roots serve as lexical entities that facilitate lexical access to a large group of words that are derived from them and word patterns are lexically represented but may have a rather minor role in accessing all the words that are constructed with them.

In addition, Frost et al (2000) strengthened the findings with a masked priming and cross-modal priming experiment which explored the role of semantic and phonological overlap on the obtained facilitation. The first experiment investigated word-pattern priming effects in the nominal and verbal system by means of a cross-model priming experiment to dissociate phonological overlap from the morphological priming effects. The results demonstrated significant cross-modal priming for the pairs that shared a verbal pattern as the same underlying morpheme was accessed by both the primes and targets. On the contrary, no significant priming was obtained for the pairs that shared a nominal word pattern. These results are in line with the idea that the priming between morphologically related pairs cannot be attributed to phonological priming. The second experiment probed the effect of semantic relationship between word pairs by employing a masked priming experiment. The results showed that strong facilitation effects for prime-target pairs which are morphologically related but semantically unrelated and that the priming effects increased with semantic similarity between word pairs. It was concluded that obtaining morphological priming in Hebrew does not require either semantic transparency or morpheme linearity.

A similar pattern of results was attained in Arabic as well (Boudelaa & Marslen-Wilson, 2005). By varying the SOA (32, 48, 64, and 80 ms) and the relationship between prime and target morphologically, orthographically, and semantically, the authors focused on the question whether morphological effects had a different time course than orthographic and semantic effects. The findings demonstrated strong priming effects for both semantic and opaque pairs at all SOAs and likewise significant priming effects for pairs that shared semantic but no orthographic relationship only at the longest SOA. It was clarified that the observed facilitation effects for prime-target pairs did not reflect any semantic or orthographic confounds and they were purely morphological driven.

Overall, the results of semantic and orthographic overlap studies have started to draw an increasingly clearer picture. Whereas the processing mechanisms in Indo-European languages (mainly languages with concatenative morphology) such as English, French, and Polish are reported to be sensitive to the semantic properties of word pairs, those of the Semitic languages that have been investigated so far (Arabic and Hebrew) are less or not affected by semantic transparency and automatically decompose complex word forms with morphologically decomposable units regardless of their meanings. Unfortunately, the number of studies and the variety of languages that have been investigated thus far do not allow us to generalize the findings and reach firm conclusions about the effects of semantic transparency on visual word recognition. Additionally, it is still largely unknown how semantic transparency influences L2 learners' visual word recognition and processing as the number of L2 studies is highly limited compared to L1 studies.

One of the very few L2 studies was conducted by Diependaele et al. (2011), who aimed at testing L1-L2 differences in morphological processing by comparing semantically transparent and opaque word forms with pure form priming. Furthermore, they intended to scrutinize the claims of Clahsen and collaborators, who put forward that L2 derivational processing depends less on combinatorial processing than L1 derivational processing. In Diependaele et al. (2011), the role of semantic transparency of words was explored in L2 derivational processing to observe the L1/L2 differences. English native speakers, a group of Dutch-English bilinguals and a further group of Spanish-English bilinguals, who were relatively proficient in English, participated in a masked priming experiment which contained three groups of prime-target pairs: semantically transparent pairs that have an apparent morphological relationship (e.g. viewer – view), semantically opaque pairs that could be parsed into a suffix and a root (e.g. corner – corn), and form - control primes that could be parsed into a target and a non-morphemic word ending (e.g. freeze – free). For native speakers, significant priming was found both for transparent and opaque conditions but not for form controls. As for the bilingual groups, even though they were much slower than the native speakers and the facilitation effect was smaller, large facilitation for transparent pairs, intermediate facilitation for opaque forms and significantly smaller facilitation in the form condition were obtained. Although the researchers' main purpose was not to look for L1 effects on L2 processing, it was found that L2 speakers with different L1 backgrounds behaved similarly. On the whole, the findings of both bilinguals and native speakers did not demonstrate any significant differences, confirming the researchers' hypothesis that bilinguals broadly employ the same processing mechanisms as native speakers and constricting the hypothesis that bilinguals depend more on lexical storage than decompositional processing (Silva & Clahsen, 2008; Ullman, 2005).

CHAPTER 3

EXPERIMENT 1: MASKED PRIMING IN L1 TURKISH

This chapter first presents the morphological background for Experiment 1. This is followed by the research questions and the predictions specific to Experiment 1. The third section presents the methodology and the results of Experiment 1. The final section discusses the results with specific reference to earlier studies in the literature.

3.1 Background to Experiment 1

As has been reviewed in the previous chapters, earlier research into the processing of morphologically complex word forms has mainly focused on the inflectional paradigm (e.g. regular/irregular past tense forms in English, German participles and German plural formation). In the same vein, most of the morphological processing theories established to date have had inflectional morphology as their main focus, while research into the processing of derivational structures has largely been neglected. Although derivational morphology has recently also begun to receive a considerable amount of interest, the number of these studies is still very limited and their scope is restricted to a handful of languages such as English, German, Polish, and Finnish. Thus, there is an obvious need to examine typologically different languages so as to be able to arrive at potentially generalizable findings. The morphology of Turkish, a non-Indo-European language with an agglutinating morphology, is a valuable ground to scrutinize for this purpose as also suggested by Frauenfelder and Schreuder (1992, p. 181). There is a serious lack of research in terms of morphological processing in Turkish since very few research studies employing an experimental psycholinguistic methodology have been conducted so far (e.g., Gürel, 1999; Kırkıcı, 2010; Kırkıcı & Clahsen, 2013).

Based on the above observations, the purpose of Experiment 1 is to investigate the way derived words are processed in L1 Turkish. Hence, the broad question to be answered is how native speakers of Turkish process morphologically complex (derived) word forms in Turkish and whether they decompose them into their morphological constituents or access them as unanalysed full-forms during word recognition.

Linguistic Background: Turkish Derivation

Unlike English, but similar to Finnish, Turkish has rich and productive morphology, which allows speakers of Turkish to form new words by means of its agglutinating morphology. It is further different from Finnish in that affixes in Turkish are phonologically more transparent and segmentable than Finnish affixes (Anderson, 1988). With the help of a variety of productive derivational affixes added to the verbal root, it is possible to form many different forms out of a single root. To illustrate, Aksan (1987, p. 27-30) lists approximately 100 derived words derived from the verbal root *sür*- “to continue” alone.

In the Turkish derivational system, it is possible to derive adjectives, nouns, verbs, and adverbs from words which belong to different word categories by means of various affixes (Kornfilt, 1997). Derivational affixes are mostly suffixes since prefixation is very rare in Turkish. Reduplication, which entails the copying and repeating of (a part of) the underlying stem and the insertion of one of the following consonants into the stem (/p/, /m/, /s/, /r/), is one of the few instances of prefixation in Turkish (e.g. pembe → pe+s+pembe= pespembe).

Allomorphy in the Turkish morphological system is rather limited to phonologically predictable changes due to Vowel Harmony (Kornfilt, 1997). For instance, the Turkish nominalization suffix –lIk has four variants because of Vowel Harmony, which are exemplified below:

Example 1

uygar → uygar – lık	*"civilized – civilization"*
geniş → geniş – lik	*"wide – width"*
yorgun → yorgun - luk	*"tired – tiredness"*
özgür → özgür – lük	*"free – freedom"*

Besides the changes caused by Vowel Harmony, suffixation does not induce any other unpredictable phonological changes to the stems and roots of complex words, but to affixes.

Experiment 1 will specifically examine the processing of the Turkish suffixes *–lI* (attributive affix) and *– sIz* (privative affix), which derive adjectives from nouns. The suffix *–lI* is equivalent to the suffix *–ful* in English, and means "possessing the object or quality expressed by the basic morpheme" (Kornfilt, 1997, p. 457). The suffix *–sIz,* on the other hand, can be taken as the Turkish counterpart of the *–less* suffix in English and had the opposite meaning of the suffix *–lI*. The suffix *–sIz* means "without a quality or something" (Kornfilt, 1997, p. 457). The two suffixes hold a clear semantic contrast and construct antonyms from the same root without causing any phonological changes.

Both of these suffixes bear surface forms due to the rules of Turkish Vowel Harmony. The surface variants of *–lI* and *-sIz* suffixes are *–lı, –li, -lu, -lü* and *–sız, –siz, -suz, -süz,* respectively. Yet, these suffixes do not induce any root changes.

Table 2 The surface variants of –lI and -sIz suffixes

Category / Examples		
Attributive Affix	güç + *lü*= güçlü	*"powerful"*
(*-lI, -li, -lu, -lü*)	kullanış + *lı*= kullanışlı	*"useful"*
Privative Affix	güç + *süz*= güçsüz	*"powerless"*
(*-sIz, -siz, -suz, -süz*)	kullanış + *sız*= kullanışsız	*"useless"*

There are a few reasons why these affixes were selected for analysis. First of all, they are transparent since they do not create any orthographic/phonological change in the root that they are attached to. In addition, these suffixes are highly productive in that they can be readily applied to many existing or novel roots to coin new words. As defined by Plag (2003, p. 44), productivity is "the property of an affix to be used to coin new complex words." According to data from Uzun (2006), the suffix *-lI* is the second and the suffix *–sIz* is the fifth most productive suffix in Turkish. These highly productive suffixes were selected since it is stated in the literature that the productivity of suffixes affects the storage and decomposition features of derived words and computation takes place only if affixes possess a certain degree of productivity (Laudanna & Burani, 1995; Vannest et al., 2002). Also, *-lI* and *–sIz* are relatively frequent suffixes. Akşehirli (2013) reported that the number of words derived with the suffixes *–lI* and *–sIz* is 1704 and 844, respectively. Since the two suffixes create new word forms which are semantically opposite to each other, the effect of semantic contrast on the processing of words derived by using them can be investigated.

Finally, these Turkish suffixes are *diaforms,* i.e. forms which are identified consistently as the same in two languages (Sebüktekin, 1971), with English *–ful* and *–less* affixes. Therefore, their counterparts in English, *–ful* (attributive; e.g. *careful, harmful*) and *– less* (privative; e.g. *careless, harmless*) will be tested with English L2 speakers using identical methodologies in the second experiment so as to arrive at a clearer picture of similarities/differences between native and non-native language processing.

3.2 Research Questions and Predictions

1. How do adult native speakers of Turkish process words derived with *–lI* and *–sIz* suffixes?
    - Are complex word forms derived using *–lI* and *–sIz* processed as full-forms or decomposed into morphological units during word recognition?
2. Does the semantics of the two suffixes have any effect on morphological processing?

- Can differences between the processing of -*lI* and –*sIz* suffixes if any, be attributed to the semantic contrast they display?

If native speakers of Turkish process derived words by parsing them into their root and suffixes, it is predicted that reaction times to target words in the Test condition will be shorter than in the Unrelated condition in a masked priming task, yielding significant priming effects. In this technique, the Test condition included adjectives derived with the suffixes –*lI* and –*sIz* as prime words whereas the Unrelated condition contained words that did not have any relationship with the target as prime words. On the other hand, if derived words are accessed as wholes without any decomposition, then no reaction time differences would be expected between the Test and Unrelated conditions (no priming).

In relation to the second research question, it is expected that the semantics of the two suffixes under investigation will have no effect on the processing of target words derived with them. Semantic transparency studies in the literature have shown that native speakers do not make use of the semantic properties of words during early visual word recognition (Rastle et al., 2004; Marslen-Wilson et al., 2008), which makes it therefore rather unlikely that the semantic contrast between the suffixes under investigation will play a distinguishing role. If no reaction time differences between the two related conditions with different suffixes are found, it can be stated that the semantic contrast that the suffixes display have no effect on the way derived words are processed during the early phases of processing.

3.3 Experimental Methodology

The experimental technique utilized for both experiments reported in this study was the masked priming paradigm, in which a prime word (e.g. *helpful*) is presented on the screen for a very short time (usually between 30 – 80 ms) and is followed by a target word (e.g. *help*) on which participants are required to perform a word/non-word decision. The crucial feature of this paradigm is that prime words are masked with a string of symbols (e.g. XXXXXXXX or ########) so that participants are unaware of the prime words. Besides, prime words are presented in lower case and target words are presented in upper case in order to prevent visual overlap between the words.

The masked priming paradigm taps into very early processes of visual word recognition (Forster & Davis, 1984). It is an appropriate tool for the purpose of the present study since it is often stated that morphologically complex words are unconsciously and automatically decomposed during the early stages of word recognition (Taft, 2004; Rastle et al., 2004; Boudelaa & Marslen-Wilson, 2005). Besides, masked priming experiments are thought to provide a clearer account of the activation of lexical representations by eliminating episodic memory effects as much as possible. In masked priming experiments, the time between the onset of the prime and the onset of the target, the "stimulus onset asynchrony" (SOA), is kept very brief (usually between 30 and 80 ms), which makes it possible to avoid memory traces and episodic effects as much as possible (Rastle et al., 2004). These short prime presentation durations do not make the primes visible to the participants so that participants do not consciously recognize them. The technique also reduces the possibility of developing any predictive strategies. Because of these reasons, masked priming draws a better and clearer picture of lexical representations and has been extensively employed in morphological processing studies for at least 30 years.

In this technique, priming occurs when the prime word facilitates the recognition of the target word. There are usually three conditions:

(1) Identity (help – HELP)
(2) Test (helpful – HELP)
(3) Unrelated (life – HELP)

The difference between conditions (2) and (3) is taken as a measure of priming. Priming effects are obtained when the reaction times for test condition are longer than identity condition but shorter than unrelated condition. No priming occurs when the reaction times for test and unrelated conditions display no statistically significant difference. For instance, when a participant is presented with the prime word *helpful* and asked to perform a word/non-word decision on the target word *help*, faster response times are expected compared to the unrelated condition since it is hypothesized that the prime activates the lexical entry of the target word, thus making it easier and shorter to process the target word upon the presentation of the related prime word. However, the same activation and faster response times are not expected when the prime word *life* precedes the target word *help* (unrelated condition). Finally, the fastest response times to target words are expected for the identity condition, which would be an indicator of what is called 'repetition priming' – an expected priming pattern that is frequently reported in the literature.

The linguistic structure specifically scrutinized in this experiment was whether the presentation of the prime words such as *akıl-lı* or *akıl-sız* would facilitate the response latencies of the target word *akıl*. If this facilitative priming effect is observed, then it can be claimed that words derived with the suffixes *–lI* and *–sIz* in Turkish are decomposed into their components during word recognition. If no priming effect is obtained, it can be inferred that Turkish native speakers do not make use of morphological decomposition during the early processing of words derived using the suffixes under investigation.

3.3.1 Materials

The critical items for Experiment 1 consisted of a total of 40 item sets, for 20 of which the Test (related) prime was a denominal adjective derived with *–lI* and for the remaining 20 of which the test prime was a denominal adjective derived with *–sIz*. The targets, on the other hand, were the simple forms of the complex words, i.e. the noun forms (e.g. anlamlı – anlamsız – anlam; '*meaningful* – *meaningless* – *meaning*'). In addition to the test primes, an unrelated and an identity form were used as primes for each target. All items were selected from the METU Turkish Corpus (Say, Zeyrek, Oflazer & Özge, 2002). An example stimulus set is illustrated below:

Table 3 An example stimulus set

Related -lI	*Related -sIz*	*Identity*	*Unrelated*	*Target*
zararlı	zararsız	zarar	çözüm	ZARAR
harmful	harmless	harm	solution	harm

Unrelated primes were lexical items that had no obvious semantic, orthographic or morphological relationship with the target (e.g. çözüm “*solution*”- zarar “*harm*”). Furthermore, the primes in the related and unrelated conditions were matched in length and frequency. The mean word-form frequencies, mean number of syllables and mean number of letters of primes in the related and unrelated conditions are presented below:

Table 4 Mean word-form frequencies (per million), SD (in parenthesis) and length of primes (in letters and syllables)

	Mean word-form frequencies	Mean number of letters	Mean number of syllables
Related *–lI*	5.77 (3.7)	7.15	3.1
Related *–sIz*	5.77 (6)	8.15	3.1
Unrelated	5.77 (3.5)	7.65	3.15

The targets were the unmarked bare stems of derived word-forms and had a mean stem frequency of 34.63 in the METU Turkish Corpus. They were more frequent than the primes in the related and unrelated conditions and had a mean length of 5.2 letters and 2.1 syllables.

In addition to the experimental items, a set of 200 filler pairs was included in order to prevent participants from forming opinions about the actual intent of the experiment and generating strategies and expectations about the order of the items. 80 filler pairs were real - real word pairs, and 120 were real – unreal word pairs. Besides filler pairs, 20 orthographically related control items were incorporated into the experiment (see discussion below). With the inclusion of 20 critical items in each list of the experiment, the total number of prime – target pairs in each list was 240, half of which required a “yes” answer while the other half required a “no” answer. The critical pairs accounted for 8.3 % of the total experimental items.

All word pairs were distributed over four experimental lists so that each target appeared only once in each list and each participant encountered the same target only once. All word pairs were also pseudo-randomized in order to preclude unwanted priming effects and to prevent the existence of semantic associations between consecutive items.

The reason why orthographic control pairs were incorporated into the experimental items was to observe whether any priming effects obtained in the experimental items could be attributed to the orthographic overlap between prime and target words. Since words that share morphemes also tend to share orthographic properties, the observed priming effect might be due to formal overlap or a combination of orthographic and morphological relations between prime-target pairs. Thus, in order to reach reliable conclusions about the processing of morphologically complex words, such confounding factors must be ruled out. For this reason, 20 semantically and morphologically unrelated but orthographically overlapping prime-target pairs were selected. The stimuli for the orthographic control lists were borrowed from Kırkıcı and Clahsen (2013). An example set of orthographic items is demonstrated below:

Table 5 An example stimulus set of orthographic items

Related	*Unrelated*	*Target*
ilgi	konuşma	il
"interest"	"conversation"	"province"

In the example stimulus list, the words *ilgi* and *il* are both semantically and morphologically unrelated to each other since *–gi* is not an existing suffix in Turkish. The critical targets in the orthographic control list had a mean length of 2.9 words and a mean frequency of 36.07 (per million) in the METU Turkish Corpus. The test primes had a mean frequency of 36.74 (per million) and were between four and six letters long. The unrelated primes had a mean frequency of 36.39 (per million) and a mean length of 5.05 letters.

The unreal words were borrowed from Kırkıcı and Clahsen (2013) and constructed by changing one letter of an existing word and forming strings of letters which were phonotactically legal forms in Turkish.

3.3.2 Participants

63 native speakers of Turkish (mean age: 18.95, SD: 0.99, range: 17-23, 39 males) were tested. The participants were selected from Yıldırım Beyazıt University, School of Foreign Languages. The participants were not paid but participated in the experiment voluntarily. All participants reported to have started learning Turkish from birth and only one classified himself as bilingual (Turkish-Kurdish).

All participants were naive with respect to the purpose of the experiment. When they were asked to describe what they had seen on the screen after the experiment, no participant, except one, reported seeing the prime words. However, the participant who realized the existence of prime words was unable to state any prime word correctly.

The experiments were reviewed and approved by the METU Ethics Committee before the data collection procedure started (see Appendix A for the approval)

3.3.3 Procedure, Data Scoring and Analysis

The experiment was conducted on an ASUS laptop computer with a 15.6 inch monitor, controlled by E-Prime psychological software Version 1.2 (Schneider, Eschman & Zuccolotto, 2002) and responses were collected and recorded through a Logitech gamepad.

The experiment was piloted on 8 subjects and necessary modifications were made to the experiment based on the participants' answers, reaction times, and feedback.

Prior to the real experiment, the participants were given a consent form and a background questionnaire which asked for general background information (see Appendix B for the consent form and C for the participant background questionnaire). Then, a brief, oral description of the experiment was provided and the participants were instructed to respond as quickly and accurately as possible and to decide whether a letter string on the screen was a real Turkish word or not. They were informed that there would be a brief practice session of 20 prime-target word pairs before the real experiment and that they could ask any questions regarding the experiment after the practice session. Upon the completion of the experiment, participants were asked to give a description of the experiment and of what they saw on the screen during the experiment. No break was offered and the procedure took approximately 20 minutes to complete. Each participant was tested individually in a silent room dedicated for experimental purposes. No participant took part in more than one experiment.

Each trial began with an asterisk in the middle of the screen for 500 ms followed by a blank screen and a forward mask consisting of hashes (#s), which was also the fixation point. The forward mask stayed on the screen for 500 ms. Then, it was followed by the prime which was presented for 41 ms and the target item for 750 ms. After the target disappeared, participants had further 1200 ms to respond by pressing the left or right button of a gamepad. Primes and targets were presented in white letters against a black background in Courier New 26 point and in different cases in order to reduce the amount of visual priming.

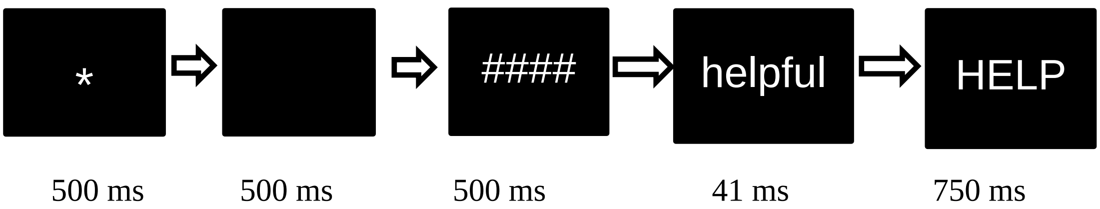

Figure 5 Visual representation of Masked Priming procedure

Incorrect responses and timeouts were not included in any further analyses. Outliers, which were defined as extreme reactions times, higher than two standard deviations from a participant’s mean per condition, were also excluded. These exclusions accounted for 8.51 % of the critical items in Experiment 1. The data were submitted to an analysis of variance (ANOVA), followed by planned comparisons. The p-values of all analyses were Greenhouse-Geisser corrected for non-sphericity whenever applicable.

3.3.4 Results

Table 6 displays mean reaction times (RTs), SDs, and error rates for the morphologically related (separately for *–lI* and *–sIz* suffixes), identity, and unrelated conditions. The table shows that participants had the highest number of errors in the unrelated condition whereas the lowest number of errors was obtained in the Related *–sIz* condition. As for the RTs, participants responded to the words in the Identity condition faster than in all the other conditions. The unrelated condition, on the other hand, elicited the longest mean RTs among these four conditions.

Table 6 Mean RTs (in ms), SDs (in parentheses), error rates (in %) and priming effects in Experiment 1

	RTs	Errors	Priming Effect
Related *–lI*	554.81 (86)	1.79	46.4
Related *–sIz*	558.23 (80)	1.25	42.9
Identity	538.95 (79)	2.26	62.2
Unrelated	601.17 (70)	3.20	

An ANOVA with the factor Prime type (Related *-lI*, Related *–sIz*, Unrelated) on the error data yielded no main effect (F_1(2.3, 32)=1.83, p>.05; F_2(3, 27)= .90, p> .05). These results demonstrate that the incorrect responses did not significantly differ according to different prime types. For the RT data, a repeated measures analysis of variance revealed a significant main effect of prime type (Related *-lI*, Related *–sIz*, Unrelated) both in the participant and item analysis (F_1(3, 186)= 19.27, p< .0001; F_2(3, 57)=13.12, p< .0001). In order to examine the main effect further, planned comparisons were carried out (

Table 7). The results revealed significant priming effects in both the related *–lI* and related *–sIz* conditions since the RTs in these conditions were significantly shorter than those in the unrelated condition. Besides, the RTs to the targets in the related *–lI* and related *–sIz* conditions were very similar with a 3.42 ms difference; therefore, no significant differences were found between these two related conditions (p=.80).

Table 7 Pairwise comparisons of the mean RTs in Experiment 1

	L1 Derivation
Related –*lI* – Unrelated	t(62)= 4.71, p< .0001
Related -*sIz* – Unrelated	t(62)= 5.27, p< .0001

Results of Orthographic Control

As explained above, the purpose of integrating morphologically and semantically unrelated but orthographically related prime-target pairs into the experiment was to determine whether the priming effects observed in Experiment 1 could be attributed to the formal overlap between prime-target pairs. By including such prime-target pairs, it was possible to eliminate sources for priming effects other than morphology and determine whether the priming effects were solely morphological in nature or not.

Table 8 displays mean RTs, standard deviations, and error rates of the targets for the identity, related, and unrelated conditions in the Orthographic Control subset. The table shows that participants had the highest number of errors in the unrelated condition whereas the lowest number of errors was obtained in the related condition. As for the RTs, participants responded to the targets in the identity condition faster than to those in the related and unrelated condition.

Table 8 Mean RTs (in ms), SDs (in parentheses), and error rates (in %) of orthographic control pairs

	RTs	Errors
Identity	538.26 (66)	2.73
Related	571.50 (89)	1.87
Unrelated	589.61 (81)	3.82
Priming Effect (Related-Unrelated)	18.1	-

An ANOVA with the factor Prime type (Identity, Related, Unrelated) on the error data of orthographic control items showed no main effect in either participant or item analysis (F_1(1.8, 33)= .59, p>.05; F_2(2, 24)= 1.40, p>.05). This demonstrates that the error rates did not significantly differ according to different prime types. For the RT data, the ANOVA demonstrated a significant main effect of prime type (Identity, Related, Unrelated) both in the participant and item analysis (F_1(2, 124)= 19.66, p< .0001; F_2(2, 38)= 19.04, p<.0001). The results of planned comparisons showed that the participants had significantly faster reaction times in the Identity condition than in the other two conditions, yielding repetition priming effects (Identity – Unrelated: t(62)= 7.26, p< .0001, Identity – Related: t(62)= 4.15, p< .0001). Yet, there was no significant difference between the mean RTs in the orthographically related prime-target pairs and the Unrelated condition (t(62)= 1.87, p > .05). This set of findings demonstrates that the orthographically related prime words did not facilitate the recognition of the target words. In other words, the participants did not respond to the target word *il* “province” faster upon encountering the prime word *ilgi* “interest”. Thus, orthographic overlap cannot be responsible for the priming effects elicited in the main experiment. Given these findings, it is feasible to rule out the possibility that the priming effects obtained in Experiment 1 may be due to the formal overlap between prime and target words. Instead, it can be asserted that the observed priming effects are due to the morphologically structured relationship between the word pairs.

3.4 Discussion

Experiment 1 focused on the processing of derived word forms in L1 Turkish by employing a masked priming experiment on complex words derived with the suffixes *–lI* and *–sIz*. Similar to earlier derivation studies reported in the literature, priming effects were observed in the morphologically related prime-target pairs, which are thought to be indicative of morphological decomposition (Marslen-Wilson et al., 1994; Marslen-Wilson, 2007; Silva & Clahsen, 2008). Since the potential effect of orthographic relatedness was ruled out by means of the findings from formal overlap pairs, the results of this experiment can be taken as evidence for the automatic morphological parsing of L1 Turkish derived words during visual word recognition.

Rather than the full-form storage of the derived word forms, native speakers of Turkish appear to depend on morphologically structured representations of these words during early processing. Therefore, it can be stated that the recognition of a complex word such as *başarılı* (successful) or *sağlıksız* (unhealthy) involves a decomposition process in which the morphological constituents (i.e. stems '*başarı*, *sağlık'* and derivational suffixes '*-lI*, *-sIz'*) are extracted and each constituent is separately accessed from the associated lexical entry, which further facilitates the processing of the target stem through repeated stem activation.

As discussed earlier, the processing of derived words is hypothesized to be dependent on the linguistic properties of the suffixes that are investigated (e.g., affix frequency, homonymy, productivity, length). Earlier studies comparing two distinct groups of suffixes with different properties (productive, frequent, and transparent suffixes vs. unproductive, infrequent, and opaque suffixes) indicate that the processing of different derived words can be explained in the framework of the Dual Mechanism model (Ullman et al., 1997; Clahsen et al., 2003; Clahsen & Neubauer, 2010; Havas, Rodríguez-Fornells, & Clahsen, 2012). Whereas words derived with productive, frequent, and transparent suffixes have been found to be decomposed into constituent morphemes, words derived with unproductive and infrequent suffix with a semantically opaque meaning have been shown to be processed as full-forms and retrieved from the mental lexicon without any decomposition.

The two suffixes investigated in this experiment hold comparable properties (i.e. both of them are productive, frequent, and transparent). Thus, the results of Experiment 1 cannot contribute to the above-mentioned claim that the processing of derivational morphology might involve both the decomposition and storage route depending on the natural properties of the affixes under investigation. However, on the basis of the findings from Experiment 1, it is evident that native speakers of Turkish employ decomposition strategies during the recognition of derived words which carry suffixes that are transparent in meaning, highly productive and frequently used. The question whether unproductive, infrequent, and opaque derived words are decomposed into units or stored as single forms in the mental lexicon might be a valuable direction to scrutinize for further research.

As expected, no significant RT or priming differences were obtained for the processing of words derived with the suffixes *–lI* and *–sIz* (RTs: 554 ms and 558 ms and priming effects: 46.4 and 42.9 respectively), which is in line with the findings of semantic transparency studies. The studies in the semantic transparency literature demonstrated that semantic properties of words are not made use of during early visual word recognition at very short SOAs (Rastle et al., 2004). An early *blind* decomposition has been thought to occur whenever a word ends with a real suffix or morpheme-like suffix. No statistically significant difference was found between the processing of semantically transparent (e.g. cleaner – clean) and opaque pairs (e.g. corner – corn) in Rastle et al. (2004), which showed native speakers of English are not aware of the semantic relationship between prime-target pairs. In the same vein, native speakers of Turkish did not display any RT differences for these suffixes and words derived with these suffixes were decomposed into a stem and an affix to the same extent irrespective of the semantic contrast they present.

CHAPTER 4

EXPERIMENT 2: MASKED PRIMING IN L2 ENGLISH

This chapter consists of five sections. The first section introduces the morphological background of Experiment 2. This is followed by the research questions and the predictions specific to Experiment 2. The third section provides the necessary information regarding the methodology. The fourth section reports the results of Experiment 2. The final section discusses the results with specific reference to earlier studies in the literature.

4.1 Background to Experiment 2

L1 derivational processing has thus far been investigated from a variety of different perspectives such as the role of semantic transparency, the impact of affixal properties or within the framework of the storage vs. decomposition debate. L2 derivational processing studies, on the other hand, are highly restricted in terms of both number and the variety of target languages that have been examined, some of which are English (Silva & Clahsen, 2008; Rehak & Juffs, 2011; Diependale et al., 2011), German (Clahsen & Neubauer, 2010), and Turkish (Kırkıcı & Clahsen, 2013). Thus, the literature largely lacks theories specifically designed to account for the L2 processing of derivational morphology. For these reasons, the purpose of Experiment 2 is to determine how derived words are processed in L2 English by Turkish native speakers and to contribute to the scarce L2 derivational processing literature by testing a group of participants whose native language is rich in derivational morphology. Besides, processing similarities and/or differences between L1 Turkish and L2 English are to be uncovered. Lastly, the potential influence of different L2 proficiency levels on the processing of derived words is analysed.

What is unique about this study is that it is possible to observe how participants with a morphologically rich native language (i.e. Turkish) process a second language which is morphologically less productive (i.e. English) and analyze whether the mechanisms employed for L1 processing (tested in Experiment 1) are transferred to their L2 processing.

Linguistic Background: English Derivation

Similar to Turkish, it is possible to derive nouns, adjectives, verbs, and adverbs with a number of different suffixes and prefixes in English, which is a very common and productive way of forming new words in English. Different from Turkish, prefixes are commonly used in English to form derived words, some of which are *re*-, *un*-, *dis*-, *ex*-.

There are two classes of suffixes in English derivational morphology, neutral and non-neutral suffixes. Whereas neutral suffixes such as *–ness* or *–ful* create a transparent meaning and do not alter the stress or the spelling of the root when they are added to a stem, complex words derived with non-neutral suffixes such as *–ity* or *–ive* do not hold a transparent meaning to that of the stem and these suffixes usually cause changes of stress and pronunciation in the stem to which they attach (Kiparsky, 1982).

Adjectives in *–ful* and *–less*, which constitute the critical experimental items in Experiment 2, have the tendency to come in pairs although the exact correspondence might not exist every time. To illustrate, there are words existent in English such as *peaceful*, *successful*, or *homeless*, but not *peaceless*, *successless*, or *homeful* as their counterparts even though the meanings of these potential complex words could be easily predicted with the help of decomposition into stem and affix. It is more frequent for the adjectives with the suffix –less not to have the corresponding adjective with the suffix *–ful* (e.g. sleepless, homeless, penniless, worthless, endless, countless).

The reason why the suffixes *–ful* and *–less* were investigated in Experiment 2 are as follows: First of all, these two suffixes can be taken as the diaforms of Turkish suffixes *–lI* and *–sIz*, which were analysed in Experiment 1, and would therefore make it possible to make a closer one-to-one comparison between the processing mechanisms employed in L1 and L2. In addition, similar to their Turkish diaforms, these suffixes are transparent since they do not create any orthographic/phonological change in the root that they are attached to. They are also highly productive in that they can be readily applied to almost every existing or novel root to coin new words. Since the existing literature reports that the productivity of suffixes affects the storage and decomposition features of derived words and computation takes place only if affixes possess a certain degree of productivity (Laudanna & Burani, 1995; Vannest et al., 2002), these highly productive suffixes were selected to see whether it would be possible to observe computational effects in L2 processing. Finally, they are very frequent. As Hay (2001) pointed out, the degree of decomposability of a given word depends crucially on the relative frequency of the derived word and its base. Hence, the suffixes *–ful* and *–less* were selected to investigate the nature of L2 morphological processing.

4.2 Research Questions and Predictions

1. How do L1 Turkish users of L2 English process words derived with suffixes *–ful* and *–less*?
    - Are complex word forms derived using *–ful* and *–less* processed as full-forms or decomposed into morphological units during word recognition?
2. Does the L2 processing of derived words differ as a function of L2 language proficiency?
3. Does the semantics of the two suffixes have any effect on L2 morphological processing (in contrast to L1 processing, where this was not the case)?
    - Can potential differences between the processing of *-ful* and *–less* suffixes be attributed to the semantic contrast that they display?

If L1 Turkish users of L2 English process derived words by decomposing them into their constituents, it is predicted that reaction times to target words in the test condition will be shorter than to those in the unrelated condition (i.e., priming). On the other hand, if they process derived words as unanalysed wholes without any decomposition, then no reaction time differences are expected (no priming). The latter pattern could then be taken as evidence for Single Mechanism accounts, which theorize that complex word forms are listed as full-forms without any computation in the mental lexicon.

In relation to the second research question, it is predicted that different priming effects will be obtained for high and low proficiency L2 speakers since it is postulated that the proficiency level of L2 speakers influences the dependence on the mechanisms employed during the processing of L2 and increased L2 proficiency results in the usage of procedural memory to a greater extent than the declarative memory (Ullman, 2005). Thus, according to the Declarative/Procedural Model, it is expected that the highly proficient L2 speakers will depend on the procedural memory more and produce stronger priming effects than the lower proficiency group if they decompose complex forms into morphological constituents. Less proficient L2 speakers, on the other hand, are expected to rely on the declarative memory more and store words derived with the suffixes *–ful* and *–less* as full-forms

Finally, similar to Experiment 1, no reaction time differences between *–ful* and *–less* suffixes are expected since it is hypothesized that the semantic contrast between the two suffixes under investigation will have no effect on the processing of target words derived with them. If no RT differences between the two related conditions are found, then it can be concluded that the semantic properties of words might not influence the early word processing at the SOA of 41 ms in L2, which further supports the general conclusion arrived from most of the semantic transparency studies that have been conducted in the domain of L1 morphological processing.

4.3 Experimental Methodology

The same experimental methodology as employed in Experiment 1, namely the masked priming paradigm (Forster & Davis, 1984), was used in Experiment 2 as well.

4.3.1 Procedure and Apparatus

The experiment was conducted on a TOSHIBA laptop computer with a 15.6 inch monitor, controlled by E-Prime psychological software Version 1.2 (Schneider, Eschman & Zuccolotto, 2002) and responses were collected and recorded through the keyboard of the computer.

The experiment was piloted on 9 subjects before the data collection procedure started and necessary modifications were made prior to the actual experiment.

Prior to the real experiment, the participants were given a consent form in which they accepted that they voluntarily participated in the experiment and a background questionnaire which asked for general personal information. In addition, the Oxford Placement Test (OPT) (Allan, 1992) was administered to test the proficiency levels of the participants.

Before the experiment, a written description of the experiment was provided along with the detailed instructions in both Turkish and English. On the instruction sheet, participants were instructed to respond as quickly and accurately as possible and to decide whether a letter string on the screen was a real English word or a non-word. After reading the instructions silently, participants were asked whether they understood the procedure. They were further informed that there would be a brief practice session of 10 prime-target word pairs before the real experiment and that they could ask any questions regarding the experiment once the practice session finished. After the experiment finished, the participants were given a vocabulary test based on the items tested in the experiment, in which they were supposed to circle the words that they did not know. If participants indicated one of the critical items as an unknown word, that item was discarded for that particular participant and not included in any further analysis. Finally, when they were asked to describe what they had seen on the screen, no students reported seeing the prime words.

No break was offered to the participants and the procedure took approximately 50 minutes to complete (including the answering of the test and the filling out of the questionnaires). Each participant was tested individually in a silent room dedicated for experimental purposes.

4.3.2 Materials

Experiment 2 incorporated a total of 204 prime-target pairs, 17 of which were the experimental items with either the suffix *–ful* or *-less*. The remaining were different kinds of filler items to distract participants' attention and 34 orthographic control pairs to test for the effect of formal overlap (see also Experiment 1). The critical pairs accounted for 8.3 % of the experimental items. The critical items were selected from the SUBTLEX-UK corpus (Van Heuven, Mandera, Keuleers, & Brysbaert, 2014), which is a British subtitle-based corpus of 201.3 million words from 45,099 BBC broadcasts. The word-form frequencies are presented as Zipf-values, which is a new measure of word frequency proposed by Van Heuven et al. (2014). The authors state that frequency counts depend on the size of each corpus, thus lacking a standardized measure of frequency. Since the most common standardized frequency measure "frequency per million" has been thought to result in an inaccurate understanding of word frequency effect, this new measure has been created. In the Zipf scale, values 1-3 correspond to low frequency words whereas values 4-7 are assigned to high frequency words. The word form frequencies of the critical items are presented as Zipf-values below.

The experimental items encompassed four different prime – target conditions. The critical primes were adjectives with the suffix *–ful* and their antonyms with the suffix *–less* whereas the targets were the simple forms of the complex words, i.e. in noun forms. (e.g. '*careful – careless – care*'). For this reason, adjectives which have both *–ful* and *–less* forms in pairs were involved in Experiment 2. Besides the test (related) condition, an unrelated (control) and identity conditions were also incorporated. An example stimulus set is illustrated below (Table 9).

Table 9 An example stimulus set

Related -ful	*Related –less*	*Identity*	*Unrelated*	*Target*
fearful	fearless	fear	exile	FEAR

Unrelated primes were selected so that they would have no obvious semantic, orthographic and morphological relationship with the target (e.g. exile – fear). Furthermore, the primes in the related and unrelated conditions were matched in length and frequency. The mean word-form frequencies and length of primes in the related and unrelated condition are presented below:

Table 10 Mean word-form frequencies (in Zipf values), SDs (in parenthesis), and length of primes (in letters and syllables)

	Mean word-form frequencies	Mean number of letters	Mean number of syllables
Related *–ful*	3.04 (0.7)	7.58	2.29
Related *–less*	2.79 (0.5)	8.58	2.29
Unrelated	2.91 (0.5)	7.76	2.40

All targets were the unmarked bare stem of derived word-forms and had a mean stem Zipf value of 4.61 in the SUBTLEX-UK corpus. They were more frequent than the primes in the related and unrelated conditions. They had an average length of 4.58 letters and 1.23 syllables.

In addition to the experimental items, a series of filler pairs was included in order to prevent participants from generating strategies and forming expectations about the order of the pairs. Of the 204 total prime – target pairs, half required a "yes" answer while the remaining half required a "no" answer. All prime-target pairs were distributed over four experimental lists so that each target appeared only once in each list and each participant encountered the same target only once. All word pairs were also pseudo-randomized in order to preclude unwanted priming effects and to prevent the existence of semantic association between consecutive items.

Non-words were constructed by using the pseudoword generator software named *Wuggy* (Keuleers & Brysbaert, 2010). Wuggy generates polysyllabic pseudowords that are within the phonological constraints of a given language. When a number of words are given to the program as input, it generates up to 10 possible non-word candidates according to its algorithm. The most suitable non-word candidate can then be selected. Generally the most frequent way of creating pseudowords in psycholinguistic experiments has been to change any single letter in a real word (e.g. milk) and form a non-word (e.g. pilk). In this way, researchers rely on their own judgments to evaluate the phonological legality of the created pseudoword, which is far from being objective and reliable. Since the nature of non-words has been thought to hold an important impact on lexical decision performance, creating non-words that conform to the orthographic and phonological patterns of a language plays an important role in psycholinguistic experiments. Therefore, non-words were formed with the help of this program.

34 orthographic control pairs were incorporated into the experiment to observe whether any priming effects obtained in the experimental items could be attributed to the orthographic overlap between prime and target words. 17 semantically and morphologically unrelated but orthographically overlapping pairs (form pairs) and 17 morphologically and orthographically related but semantically unrelated pairs (opaque pairs) were selected. An example set of orthographic items is demonstrated below:

Table 11 An example set of orthographic control pairs

	Related	**Unrelated**	**Target**
Form Pairs (-M, -S, +O)	harmony	insect	harm
Opaque Pairs (+M, -S, +O)	number	addict	numb

In the example stimulus list, the words in the Form Pairs "*harmony – harm*" are both semantically and morphologically unrelated to each other since *–ony* is not an existing suffix in English and there is only surface overlap between these word pairs. On the other hand, the Opaque Pairs "*number – numb*" are morphologically and orthographically related but semantically unrelated to each other. The critical targets in the orthographic control list were borrowed from the experimental stimuli of Rastle et al. (2004) and Marslen-Wilson et al. (2008). Since the semantic transparency studies in the literature are divergent on whether semantically opaque pairs produce facilitative priming effects during word recognition or not, they were included into the orthographic control list along with the form-overlap pairs.

4.3.3 Participants

A total of 60 L2 speakers of English (Mean age: 19.73, SD: 1.79, Range: 19-26, 22 males) participated in Experiment 2. All participants were native speakers of Turkish. They were selected from the undergraduate population of Middle East Technical University. Two groups of participants, high proficiency and low proficiency, were formed on the basis of their OPT scores. The mean OPT score was 49.93 (SD: 2.22) for the high proficiency and 40.90 (SD: 2.73) for the low proficiency group out of a maximum score of 60. The mean OPT score difference between the two groups was statistically significant ($p < .05$). Whereas the low proficiency group corresponds to the Upper-Intermediate interval (scores between 40-47, B2, according to the Common European Framework) the high proficiency group corresponds to the Advanced level (C1, scores between 48-54) according to the interpretation scale of the OPT. All of the L2 participants reported to have first been exposed to English after the age of 11 in a classroom setting.

The participants were not paid and took part in the experiment voluntarily. The same participant did not take part in more than one experiment or experimental list. The experiments were completed over a two-month period. All participants were naive with respect to the purpose of the experiment.

4.3.4 Data Scoring and Preliminary Analysis of Errors

Similar to Experiment 1, the data were cleaned from incorrect responses and outliers before the analyses were carried out. All incorrect responses to existing words and extreme reaction times were removed from further analysis, which led to the exclusion of 4.62 % of the data points in Experiment 2. Besides, an additional 3.38 % of the data paints were excluded due to the mistakes which participants made in the post vocabulary test. The reaction time (RT) and error data were submitted to analyses of variance (ANOVA) with the factors Prime type (Identity, Related, Unrelated), Condition (-*ful* suffix and –*less* suffix), and L2 Proficiency (high and low). The p-values of all analyses were Greenhouse-Geisser corrected for non-sphericity whenever applicable.

4.4 Results

Experiment 2 aimed at revealing how morphologically complex forms derived with suffixes –*ful* and –*less* are processed by L2 speakers of English and whether complex forms are accessed as full forms or through decomposition into morphemic parts. In addition, the effect of L2 proficiency level on the processing of derived words was investigated, so two groups of participants (high and low proficiency) were formed. The results for each group of participants are presented separately below.

4.4.1 High Proficiency L2 Subjects

Table 12 shows mean RTs, standard deviations, and error rates for the targets in all four conditions (identity, related –*ful*, related –*less*, and unrelated). As can be seen, the number of errors is the highest in the unrelated condition while it is the lowest in the related –*ful* condition. As for the RTs, the participants responded to the target words in the related -*less* condition faster than the other conditions whereas the longest mean RT was obtained in the unrelated condition. Besides, the mean RT difference between the related –*ful* and the related –*less* conditions is 8 ms.

Table 12 Mean RTs (in ms), SDs (in parentheses), and error rates (in %) in Experiment 2

	RTs	Errors	Priming Effect
Identity	564.10 (94)	0.48	39.5
Related –*ful*	570.11 (60)	0.28	33.5
Related –*less*	562.11 (70)	0.38	41.5
Unrelated	603.60 (67)	0.57	-

ANOVAs with the factor Prime Type (Identity, Related *–ful*, Related *–less* and Unrelated) on the error data revealed no significant main effects (F_1(3, 6)= .413, p>.05; F_2(3, 12)=.81, p>.05), which shows that the incorrect responses did not significantly differ according to different prime types either in the participant or item analysis. For the RT data, a repeated measures analysis of variance revealed a significant main effect of prime type (Related *–ful*, Related *–less*, Unrelated) both in the participant and item analysis (F_1(3, 174)= 14.48, p< .0001; F_2(3, 48)= 7.18, p< .0001).

Planned comparisons were carried out between different conditions in order to examine the main effect further (Table 13). The results revealed significant priming effects for both the related *–ful* and related *–less* conditions since the RTs in these conditions were significantly shorter than those in the unrelated condition. As found in almost all studies, repetition priming effects were also obtained as a result of the significant RT difference between the Identity and Unrelated condition.

Table 13 Pairwise comparisons of the mean RTs in Experiment 2.

	L2 Derivation
Related *–ful* – Unrelated	t(29)= 3.88, p< .0001
Related *–less* – Unrelated	t(29)= 4.15, p< .0001
Identity – Unrelated	t(29)= 3.69, p< .005

This pattern of findings might be taken as evidence for the fact that highly proficient L2 speakers decompose morphologically complex word forms during word recognition rather than storing and retrieving them as full-forms, in the same way they do during the recognition of complex words in their native language Turkish. It can be put forward that they compute the derived words "on the fly" during comprehension and production. However, the question whether these priming effects are morphological in nature or they are the outcomes of a combination of morphological and orthographical overlap between prime-target pairs should be answered before these findings can be interpreted and a general conclusion can be reached.

Results of Orthographic Control

As mentioned above, two types of orthographic control pairs, form and opaque, were incorporated into the experimental stimuli so as to dissociate the effects of orthographic overlap from morphological effects on the priming patterns. Since the planned comparisons of form and opaque pairs did not yield any statistically significant difference ($t(60) = 1.79$, $p > .05$), analysis were not carried out separately for each type of orthographic control pairs. Instead, both types of orthographic pairs were conjoined and then analyses were made on this conjoined data.

Table 14 presents mean RTs, standard deviations, and error rates of the targets for the identity, related, and unrelated conditions. The table shows that the highest number of errors occurred in the identity condition whereas the lowest number of errors was obtained in the related condition. As for the RTs, participants responded to the targets in the identity condition faster than those in the related and unrelated condition. Participants also responded to the targets in the related condition faster than to the ones in the unrelated condition.

Table 14 Mean RTs (in ms), SDs (in parentheses), and error rates (in %) of Experiment 2 orthographic control pairs.

	RTs	Errors
Identity	556.24 (86)	1.77
Related	589.73 (93)	1.34
Unrelated	617.09 (91)	1.69
Priming Effect (Related – Unrelated)	27.36	-

ANOVAs with the factor Prime type (Identity, Related, Unrelated) on the error data of orthographic control showed no main effects ($F_1(2, 46) = .114$, $p > .05$; $F_2(2, 34) =$

.98, p>.05). These results demonstrate that the error rates did not significantly differ according to different prime types either in the participant or item analysis. For the RT data, the ANOVA demonstrated a significant main effect of prime type (Identity, Related, Unrelated) both in the participant and item analysis (F_1(2, 118)= 28.96, p< .0001; F_2(2, 66)= 6.66, p< .05). Accordingly, the results of planned comparisons yielded repetition priming effects (Identity – Unrelated: t (30) = 6.19, p< .0001) with faster RTs in the identity than in the unrelated condition and significant priming effects (Related – Unrelated: t (30) = 2.17, p= <.05), with faster RTs in the related than in the unrelated condition. These significant priming effects between orthographically related but semantically and morphologically unrelated prime-target pairs clearly indicate that the priming patterns which were obtained for the experimental items in Experiment 2 for highly proficient L2 speakers might be facilitated by the formal overlap between prime-target pairs.

4.4.2 Low Proficiency L2 Subjects

Table **15** displays mean RTs, standard deviations, and error rates for the targets in all four conditions (identity, related *–ful*, related *–less*, and unrelated). The error rate is the highest in the unrelated and related *-less* condition while it is the lowest in the related *–ful* condition. As for the RTs, the participants responded to the target words in the identity condition faster than those in the other conditions, whereas the longest mean RT was obtained in the unrelated condition. Besides, the mean RT difference the *–ful* and *–less* conditions was 13.53 ms.

Table 15 Mean RTs (in ms), SDs (in parentheses), and error rates (in %) in Experiment 2

	RTs	Errors	Priming Effect
Identity	540.04 (83)	0.57	66.5
Related *–ful*	571.44 (75)	0.38	35.0
Related *–less*	584.97 (83)	0.96	21.5
Unrelated	606.53 (84)	0.96	

An ANOVA with the factor Prime Type (Identity, Related *–ful*, Related *–less* and Unrelated) on the error data yielded no significant main effect ($F_1(3, 9)= 1.64$, $p>.05$; $F_2(2, 32)=.33$, $p>.05$), which shows that the incorrect responses did not significantly differ according to different prime types in either the participant or item analysis. For the RT data, a repeated measures analysis of variance revealed a significant main effect of prime type (Related *–ful*, Related *–less*, Unrelated) ($F_1(3, 87)= 13.99$, $p< .0001$; $F_2(2, 66)= 20.08$, $p< .0001$).

The results of planned comparisons (Table 16) exhibited repetition priming since the RTs in the identity condition were significantly shorter than the RTs in the unrelated condition. Priming effects were obtained only for the related *–ful* condition whereas no priming was found for the related *–less* condition.

Table 16 Pairwise comparisons of the mean RTs in Experiment 2

	L2 Derivation
Related *–ful* – Unrelated	t(29)= 3.20, p< .01
Related *–less* – Unrelated	t(29)= 1.61, p >.05
Identity – Unrelated	t(29)= 4.80, p< .0001

Given these findings, it can be stated that, similar to high proficiency L2 group, less proficient L2 speakers rely on morphologically structured representations for words derived with the suffix *–ful*. They decompose the prime (e.g. *meaningful*) into the stem (*meaning*) and the suffix (-*ful*), which later facilitates the recognition of the target stem. However, in contrast to the high proficiency L2 group, the low L2 proficiency participants appear to store complex words derived with the suffix *–less* as undecomposed forms in the mental lexicon and retrieve them as full-forms rather than applying morphological computation during processing. However, the results of orthographic control pairs should be taken into consideration before a firm conclusion can be made.

Results of Orthographic Control

Table 17 displays mean RTs, standard deviations, and error rates of the targets for the identity, related, and unrelated conditions. The table shows that the highest number of errors was obtained in the unrelated condition whereas the lowest number of errors occurred in the related condition. As for the RTs, participants responded to the targets in the Identity condition faster than to targets in the related and unrelated conditions with a mean RT difference of 15.58 ms and 48.84 ms, respectively. The participants responded to the targets in the related condition faster than to the ones in the unrelated condition with mean RT difference of 33.26 ms.

Table 17 Mean RTs (in ms), SDs (in parentheses), and error rates (in %) of Experiment 2 orthographic control pairs

	RTs	Errors
Identity	549.56 (82)	1.73
Related	565.14 (71)	1.51
Unrelated	598.40 (74)	2.08
Priming Effect (Related – Unrelated)	33.26	-

An ANOVA with the factor Prime type (Identity, Related, Unrelated) on the error data of orthographic control showed no main effect ($F(2, 48)= .324$, $p>.05$), which means that the error rates did not significantly differ according to different prime types. For the RT data, the ANOVA demonstrated a significant main effect of prime type (Identity, Related, Unrelated) ($F(2, 118)= 28.96$, $p< .0001$). Accordingly, the planned comparisons of conditions yielded repetition priming effects (Identity – Unrelated: $t(29)= 5.70$, $p< .0001$) with faster RTs in the identity than in the unrelated condition. A significant priming effect (Related – Unrelated: $t(29)= 2.76$, $p< .05$) was also obtained with faster RTs in the related than the unrelated condition.

This significant priming effect for orthographically related pairs raises serious doubts about the nature of the priming effects elicited in the main experiment. Since morphologically unrelated prime words like *scandal* facilitated the recognition of the target stem *scan* as effectively as the morphologically related prime-target pairs did (e.g. *harmful – harm*), the priming effect between morphologically related prime-target pairs cannot be merely attributed to their morphological relationship. The observed priming effects between derived word primes and their stems might have arisen as a result of a mixture of the morphological and orthographical relationships that were present between prime-target pairs. Thus, it would be misleading to assert that L2 speakers of English make only use of the morphological structure of complex word forms during processing when these orthographic priming effects are observed in the orthographic control data.

4.5 Discussion

In Experiment 2, the L2 processing of complex words derived with the transparent, productive and frequent suffixes *–ful* and *–less* was investigated by means of a masked priming experiment to ascertain whether the recognition of a stem is facilitated by the prior presentation of a derived word containing the stem. The experiment was conducted on two groups of L1 Turkish learners of L2 English who were categorized as possessing either high L2 English proficiency or low L2 English proficiency users.

First of all, the results of the main experiment showed a discrepancy between the proficiency levels. Whereas priming effects were observed for both related *–ful* and *–less* conditions in highly proficient groups, less proficient L2 users displayed significant priming effects only for the derived words ending in *–ful* and no priming for the related *–less* condition. These results, taken on their own, might imply that highly proficient L2 users rely on morphological structure for processing both of these suffixes. Low proficiency L2 users, on the other hand, showed a clear disparity between the two suffix forms, which might promote the conclusion that they tend to store complex forms derived with the suffix *–less* as single units and retrieve them from the mental lexicon by direct look up, whereas words with the suffix *–ful* are processed by morphological computation into constituents. However, this is not the full story as discussed below.

Given the priming effects in Experiment 2, these tentative inferences and conclusions are indeed compatible with the existing literature. However, the aforementioned observations about L2 processing turn out to be more intricate and misleading when the results of the orthographic control experiment are taken into consideration. Surprisingly, the results of the orthographic control data revealed priming effects regardless of the proficiency level. Thus, the priming effect observed in the main experiment may not be due simply to the morphological relationship between prime-target pairs, but it can be simultaneously influenced by both the formal overlap and the morphological relation. In addition, both high and low proficiency L2 users make use of orthographic features of complex words during early visual word recognition regardless of their proficiency level.

This finding was entirely unexpected since priming effects due to formal overlap have been almost non-existent in the literature of non-native derivational processing. To illustrate, Kırkıcı and Clahsen (2013) did not observe any priming effects in L2 Turkish derivational processing with highly proficient L2 speakers from different L1 backgrounds. When the L2 participants in their study were tested, they had been living in Turkey for a mean of 8.5 months and had been receiving intensive Turkish language education, which suggests that they were exposed to naturalistic input, though only to a certain extent, as well as formal input. Likewise, Silva (2009) did not find any priming effects for the orthographically related pairs during the derivational processing of L2 English. Her Chinese and German participants were advanced language users and their length of stay in the UK was an average of 11.2 and 19 months, respectively, at the time of the testing. Whereas the participants in both of these studies were exposed to natural and classroom input at the same time, the L2 participants of the present study reported that they had learned their L2 exclusively in formal classroom contexts and they did not have a chance to live in the target country. This difference in the participant profile might be a possible explanation for the observed orthographic priming effects in Experiment 2.

On the other hand, there have been a few studies which reported a certain amount of priming effects for form related pairs (Frost, Kugler, Deutsch, & Forster, 2005; Feldman, Kostic, Basnight-Brown, Durdevic, & Pastizzo, 2010; Diependaele et al., 2011; Jacob & Kırkıcı, forthcoming) during L2 processing. Feldman et al. (2005) examined the native and non-native processing of inflectional morphology with L1 Serbian L2 English participants who had never lived in an English speaking country for more than 4 weeks by means of a forward masked priming task and a cross modal priming experiment. The participants did not take a standardized proficiency exam and rated their reading skills as "good" or "very good" and listening skills as "fair" or "good". The results of the masked priming experiment demonstrated that both morphological and orthographic primes facilitated the recognition of the target word equivalently, which means that L2 speakers were unable to differentiate prime–target pairs that shared morphology from pairs that shared only form. Even though this orthographic facilitation might be explained in terms of the participants' low proficiency skills and the unreliable method of determining the proficiency level, it might still provide a deeper insight into the way L2 users process the language.

Another example comes from Diependaele et al. (2011), who scrutinized the role of semantic transparency effects during the early word recognition process on Spanish-English and Dutch-English bilinguals (see above for the details). Diependaele et al. (2011) obtained priming effects for the form condition even though the amount of the priming effect was significantly smaller when compared to the transparent and opaque conditions. Since there was no sufficient participant background information provided to understand whether the participants had ever been to an English speaking country, it is unclear whether they have been exposed to natural input or not.

Finally, a recent study conducted by Jacob and Kırkıcı (forthcoming) revealed an interesting set of results for heritage speakers of Turkish who live in Germany. The processing of the same Turkish structures used in Kırkıcı and Clahsen (2013) (derivational suffix *-lIk* and the Aorist inflection) was investigated with the same materials and the same experimental design (see previous chapters). Although the results demonstrated that heritage speakers decompose both derived and inflected words in a similar way to native speakers of Turkish, the results of an orthographic control experiment revealed formal overlap priming effects, unlike with the native speakers of Turkish. It is argued that heritage speakers were affected by the surface form properties of words as well as the morphological structure during the processing of the heritage language. A possible, though cautious, explanation, put forward by Jacob and Kırkıcı (forthcoming), was that there might be extra processing constraints on the processing of surface-form properties on the processor during early visual word recognition since the written input the participants receive in Turkish was reported to be comparatively impoverished.

The common point of all these studies, including the present one, is that the orthographic properties of prime-target pairs might influence the way morphologically complex words are processed in L2 during early visual word recognition. Interestingly, orthographic priming effects have been observed only in L2 studies in which second language learners have been exposed to only classroom input or an insufficient amount of naturalistic input. On the other hand, studies with L2 speakers who were exposed to both formal instruction and naturalistic input to a high extent did not reveal surface-form overlap effects. Thus, it might be plausible to claim that the amount and type of L2 input play a determining role in the L2 processing of derived words.

There are two types of L2 exposure: *naturalistic exposure,* in which learning occurs in a second language environment and *classroom exposure,* where formal instruction takes place in a structured way in a foreign language environment (Munoz, 2008). L2 speakers are usually exposed to highly structured and selected input for a limited amount of time in a classroom setting. They do not have a genuine need to interact and communicate in the target language in a classroom setting and they do not have sufficient opportunity to use the L2 in natural communication situations. All of these properties of a foreign language learning setting might lead to impaired processing of the L2. On the other hand, in naturalistic contexts, L2 speakers have a chance to encounter rich and varied input and there exists a real need for oral communication. Besides, L2 speakers in aforementioned studies were reported to receive formal input in a classroom context along with the input in naturalistic context, which extensively contributes to the amount and quality of their L2 input. As Flege (2009) also pointed out, extensive L2 input in naturalistic exposure may affect L2 processing. Thus, it might be claimed that the input L2 speakers have been exposed to in classroom/formal settings with artificial and *inauthentic* materials might be deficient to develop a processing mechanism similar to the L2 speakers' native language and L2 speakers feel a need to rely on another mechanism for the processing to take place.

There has not been any research conducted on the influence of exposure type on the L2 processing of morphologically complex forms (to the researcher's knowledge). However, some studies carried out on different domains of L2 processing (e.g. Flege & Liu, 2001 for phonological processing; Frenck-Mestre, 2002 for relative clause processing) clearly ascertained that exposure type can have an impact on the L2 processing strategies. Thus, further research can be conducted on the effect of type and amount of L2 exposure on the L2 processing strategies, specifically on the morphological processing.

Finally, it can be unequivocally stated that the absence of priming effects for words derived with the suffix *–less* in Experiment 2 makes it implausible that all priming effects observed in L2 groups might be due to reliance on formal overlap. If formal overlap alone were responsible for the observed effects, then priming effects would be elicited for complex words with *–less* suffix similar to its counter suffix (*-ful* suffix). Yet, the observed priming effects might arise in a time frame during word recognition when morphemic activations are purely morpho-orthographic in nature rather than purely structural decomposition.

CHAPTER 5

GENERAL DISCUSSION AND CONCLUSION

This chapter, first, presents a general discussion which has been drawn on the basis of the results. It is followed by a brief summary of the present study and conclusion regarding the processing of L1 Turkish and L2 English.

5.1 General Discussion

The primary purpose of the present study was to investigate how morphologically complex words are processed by L1 Turkish and L2 English speakers and to what extent the processing mechanisms they employ overlap between L1 and L2 processing. It was also explored whether the semantics of the suffixes under investigation would create any processing differences during L1 and L2 word recognition. The final purpose was to examine whether L2 proficiency was a determining factor in the processing of L2 derivational morphology.

In the following sections, the overall results of the experiments will be discussed with regard to the general research questions and purposes of the present study.

5.1.1 Storage vs. Decomposition in L1 and L2

With respect to L1 Turkish processing, the findings of Experiment 1 demonstrated priming effects for the morphologically related prime-target pairs with a priming magnitude of 46.4 and 42.9 for the related *-lI* and *–sIz* conditions respectively. The observed priming effects were proved to be independent from orthographic overlap since the amount of priming obtained in the orthographic control items was not statistically significant (18.1). These results can be taken as evidence for automatic morphological decomposition of L1 Turkish derived words during visual word recognition. These findings are in line with a variety of the derivational processing studies on different languages, which support the claim that transparent and productive derived words with a frequent suffix are processed and accessed through decomposition into morphological units (Clahsen & Neubauer, 2010 for German; Silva & Clahsen, 2008 for English; Kırkıcı & Clahsen, 2013 for Turkish). The findings of this experiment are also supportive of the findings reported in Kırkıcı and Clahsen (2013), who observed priming effects for Turkish prime – target pairs with another phonologically transparent and frequent derivational suffix (-*lIk* nominalization suffix). Lastly, the claim that languages which have morphological properties similar to Turkish must boost combinatorial processing (Frauenfelder & Schreuder, 1992; Hankamer, 1989) seems to be further affirmed with this experiment along with Kırkıcı and Clahsen's (2013) findings for L1 Turkish and L2 Turkish.

As for L2 English processing, clear-cut conclusions as in Experiment 1 could not be formulated due to the results of the orthographic control items. First of all, priming effects were obtained for the related *–ful* condition in both high proficiency and low proficiency L2 speakers, whereas priming effects for the related *–less* condition were available for only the high proficiency L2 group. However, the orthographic control items revealed priming effects irrespective of L2 proficiency. Taken together, this pattern of results might indicate that L2 speakers rely on both morphological and orthographic properties of complex words regardless of their proficiency level and the obtained priming effects can be the outcomes of shared form and morphological relation. The reasons for the differences between L1 and L2 morphological processing will be discussed in the next section.

5.1.2 Same or Different Mechanisms in L1 and L2 Processing

The results of Experiment 1 and Experiment 2 point to an obvious distinction between the native and non-native processing of morphologically complex forms. The L2 speakers of this study did not make use of the same L1 mechanisms or information during the processing of derived words. Experiment 1 revealed that native speakers of Turkish rely on words' morphological structure during the early visual processing of complex words derived with the suffixes *–lI* and *–sIz*. Since the native speakers did not produce any priming effects for orthographically related pairs, the observed facilitation between prime-target pairs was inferred to be morphological in nature. On the other hand, Experiment 2 showed that L2 speakers made use of surface-form properties of complex forms more than native speakers during the early visual word recognition. As Feldman et al. (2010) also stated, L2 participants of this study had difficulty in differentiating prime-target pairs which are morphologically related (e.g. *helpful – help*) from the pairs that are only orthographically related (e.g. *freeze – free*). Even though both groups of L2 users (high and low proficiency) demonstrated priming effects for words derived with the suffix *–ful* and only high proficiency group produced priming effects for words with the suffix *–less*, these priming effects cannot be reliably taken as evidence for decomposition when surface-form overlap effects are present. Thus, it is important to be cautious about the claim that non-native speakers are sensitive to morphological relatedness in the same way as native speakers (Diependaele et al., 2011). In contrast to this claim, it appears that, unlike native language processing, non-native processing is affected by the morpho-orthographic properties of words during the early visual word recognition. This observed difference between L1 and L2 morphological processing might be accounted for in terms of the context L2 is acquired and the type of input L2 speakers are exposed to during L2 acquisition as the significance of L2 input as one of the vital elements for L2 success is also remarked by Cook (2001).

As already discussed above (see section 4.5), there are very few L2 processing studies in the literature which were controlled for orthographic overlap and thus integrated orthographic control pairs into the experimental stimuli. On the other hand, not all of those studies which were controlled for orthographic effects obtained priming effects. Therefore, it is not possible to discuss the current results extensively with specific reference to the literature. However, when the characteristics of previous studies that integrated orthographic control pairs into the experimental design are taken into consideration, it is still likely to arrive at a pattern of conditions when orthographic priming effects can be observed.

The first group of studies, which did not elicit orthographic control priming effects in L2 processing, are characterized by the profile of participants who received different amounts of L2 input both in classroom context and naturalistic context for different lengths of time (Silva, 2009; Kırkıcı & Clahsen, 2013). It can be said that the input the first group of L2 speakers were exposed to might be richer and more varied since they found a chance to be exposed to L2 in the target community along with the formal education they received. The second group of studies, on the other hand, obtained orthographic priming effects with L2 speakers who either received only formal language education or were exposed to meager amount of L2 input (Feldman et al., 2005; Jacob & Kırkıcı, forthcoming). Although it is not possible to adequately measure the amount of input L2 speakers are exposed to, it is unequivocal that the participants in the first group of studies were at a much more advantageous position than the ones in the second group of studies due to the authentic language exposure and contact with native speakers in the target community.

The L2 speakers of this present study, on the other hand, reported not to have been to an English speaking country to learn L2 at the time of testing. Therefore, and they showed affinities with the participants in the second group of studies. Given that they received formal instruction with exercises focusing on forms, drills, and memorization and they did not have opportunities for oral interaction with native speakers, it might be claimed that the L2 input they have been exposed to is deficient to develop native-like attainment of the target language. As also put by Lightbown (2000), limited contact with the target language in a classroom setting is the underlying reason of deficient L2 acquisition (as cited in Piske & Young-Scholten, 2009). This low quality of input the L2 speakers have been exposed to might lead to the development of a processing style different from that of both native speakers of the second language and their own native language. As a result, their L2 processing can be hypothesized to be driven by both morphological and surface-form properties of complex words during early visual word recognition unlike the processing of their L1 and the native language processing of English.

The observed orthographic priming effects in L2 speakers might also stem from the type of orthography of participants' native language. Turkish and English are orthographically different languages in that the correspondence between the spelling and pronunciation of words is transparent and consistent in Turkish (i.e. *shallow* *orthography*) whereas that correspondence is not consistent in English (i.e. *deep orthography*). As L1 speakers of Turkish are used to *shallow orthography* and are not competent enough in the target language as the native speakers, they might need extra mechanisms which they rely on to process the target language more effectively during visual word recognition. In the case of this study, they might have depended on the orthographic features of the target language along with the morphologically structured relationship between prime-target pairs. However, this claim cannot go beyond an immature speculation and it should be further investigated in a future study.

5.1.3 The Effects of L2 Proficiency Level

The Declarative/Procedural Model (Ullman, 2001) proposes that the same mental mechanisms hypothesized to be at work for L1 processing, are also responsible for L2 processing though the L2 reliance on the proposed mechanisms may show variation depending on the proficiency level of L2 speakers.

Since different priming effects were observed for the related *–ful* and *–less* conditions in different L2 proficiency groups in Experiment 2, these results partially corroborate the Declarative/Procedural Model in that the proficiency level of L2 speakers was found to influence the way they process complex forms. On the one hand, the high proficiency L2 speakers rely on the procedural memory to process derived words during L2 word recognition similar to native speakers of Turkish. Less proficient L2 users, on the other, displayed priming effects for the related *–ful* condition but no priming for the related *–less* condition. This pattern of priming effects suggests that low proficiency L2 speakers make use of the declarative memory to process words derived with *–less* since they are accessed as unanalysed wholes. The procedural memory, on the other hand, is employed only for the processing of words derived with the suffix *–ful* by low proficiency group as they are stored in a decomposed manner and processed by parsing into morphological constituents. This dissociation between groups of L2 speakers might be attributed to their different proficiency levels, which is in agreement with the Declarative/Procedural Model. Less proficient L2 speakers rely less on the procedural memory than highly proficient L2 speakers, which might be partially due to the frequencies of prime words. Prime words with *–less* suffix are slightly less frequent than the ones with *–ful* suffix (2.79 and 3.04 respectively) although the difference is not statistically significant. It might be possible that less proficient L2 speakers tend to store infrequent word forms as full-forms in the mental lexicon because they were not exposed to those words enough to develop a rule-based computational route for their process.

5.1.4 The Effects of the Semantics of the Suffixes

As previously expected, the two suffixes under investigation in Experiment 1 did not present any processing differences in L1 word recognition although they bear a semantic contrast. The related conditions with *–lI* and *–sIz* suffixes elicited similar RTs (554 ms for *–lI* suffix and 558 for *–sIz* suffix) and similar priming magnitudes (46.4 and 42.9 respectively). This is not a surprising finding given that semantic transparency studies in the literature have already shown that native speakers do not make use of the semantic properties of words during early visual word recognition (Rastle et al., 2004; Marslen-Wilson et al., 2008). Therefore, L1 Turkish processing did not favor one suffix over another and both of them were processed similarly by L1 Turkish speakers. As for the L2 speakers, although a dissociation of processing suffixes *–ful* and *–less* was found in the low proficiency groups, it cannot be solely attributable to the semantic contrast as the effects of proficiency also have a major role on this processing difference as discussed above (see 5.1.3). The effects of semantic properties of the suffixes on L1 and L2 morphological processing might be investigated in future studies with different suffix pairs.

5.2 Limitations and Suggestions for Further Research

This study is not without its own limitations that can be improved in future studies. First of all, critical items for Experiment 2 were chosen from the corpus (SUBTLEX-UK), which was originally constructed for L1 speakers of English. Given that the input L2 speakers are exposed to can be particularly different from L1 input, the frequency and/or productivity of words might change in a corpus for L2 speakers. To illustrate, -ful and –less suffixes might not be frequent and productive in a corpus for L2 speakers whereas they are in the L1 corpus SUBTLEX. For this reason, an L2 corpus should be utilized during the selection of critical items. Secondly, the unrelated items were not properly controlled for the formal overlap they presented between prime - target pairs. Although particular attention and effort was placed on finding unrelated items which did not carry the initial and last letters of target words, the letters in the middle of words were not controlled systematically. In the future studies, this orthographic overlap between unrelated items and targets can be calculated and/or even investigated whether it has a distinguishing effect as a variable. Finally, selection of the critical items in Experiment 2 might have been done more effectively. Since one of the purposes of this study was to investigate the role of semantic properties of prime-target pairs on morphological processing, adjectives that tend to come in pairs (e.g. careful – careless) were chosen as related primes. Finding such pairs in English was rather difficult than Turkish. Therefore, the frequency of critical items in Experiment 2 was lower.

Based on the limitations of this study, some suggestions for further research can be put forward. To begin with, masked priming experiments can be designed to test the role of semantic transparency in both L1 Turkish and L2 English morphological processing in order to dissociate form, morphology, and meaning. It is especially worthy to study it in L2 English because of both the restricted number of semantic transparency studies in L2 speakers and the observed orthographic control priming effects in Experiment 2. Besides, a cross modal priming experiment can be designed to test the same linguistic structures (the suffixes *–lı*, *-sız*, *-ful*, and *–less*) in order to avoid the effects of formal overlap between prime-target pairs. The same study can be replicated with different participant groups as well. Since it was claimed that the type and amount of L2 input might have had a central role on the processing differences of L1 and L2 speakers (see discussion), two groups of L2 speakers who are exposed to either *formal input* or *naturalistic input* for similar length of time can be formed. The findings of the experiments can provide an answer to the aforementioned claims related to the input quality.

Furthermore, in order to examine the reasons of the observed orthographic priming effects in L2 speakers in more detail, the processing of formal overlap pairs can be explored in languages which have shallow orthography (i.e. the correspondence between the sounds of spoken language and written symbols is simple and regular) such as Serbian. Since Turkish is also one of those languages, it might be likely that L1 Turkish L2 English participants of this study might fall back on the orthographic properties of word pairs. By studying such languages, it can be possible to determine whether the type of orthography to which languages belong has an impact on the way languages are processed.

In addition, the finding that the processing of suffixes *–ful* and *–less* was different in different proficiency groups of L2 speakers can be investigated in more detail with a lexical decision task. Since a lexical decision task probes into the frequency effects of words, it can be examined whether the existing processing difference can be attributed to the frequency differences of these suffixes or not. Finally, the processing of different suffixes which possess the same properties (frequency, productivity, and transparency) can be scrutinized instead of restricting the study to four suffixes only. This will provide a more general and unequivocal picture of the processing of derivational morphology.

5.3 Conclusion

On the whole, several conclusions can be drawn from the results of the experiments in this thesis. First of all, L1 Turkish, a productive and morphologically rich language, is accessed through a morphological decomposition route for the processing of derived words with a transparent, frequent, and productive suffix and the processing is facilitated only by the morphological properties of word forms, not the orthographic or semantic properties. Thus, it can be concluded that early visual word recognition in L1 Turkish is characterized by a process at which complex words are decomposed into their constituents irrespective of their orthographic and semantic properties. Secondly, it can be stated that L2 English processing is fundamentally different from L1 Turkish processing in that early visual word recognition involves a process at which both orthographic and morphological properties of complex words are employed. In addition, the proficiency level of L2 speakers might influence the way derived words are fully stored or processed into morphemic units. All in all, the processing of L1 Turkish and L2 English seems to have major differences that might be accounted by the proficiency level of L2 speakers and the nature and amount of input they have been exposed to.

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APPENDIX A: ETHICS COMMITTEE APPROVAL

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
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14.04.2014

Gönderilen : Doç. Dr. Bilal KIRKICI
İngiliz Dili Eğitimi

Gönderen : Prof. Dr. Canan Özgen
IAK Başkanı

İlgi : Etik Onayı

Danışmanlığını yapmış olduğunuz İngiliz Dili Eğitimi Bölümü öğrencisi Pınar Gacan'ın "Türkçe ve İngilizce'deki Benzer Türemiş Yapıların Anadili Türkçe Olan ve İkinci Dil Olarak İngilizce Öğrenen Öğrenciler Tarafından İşlenmesi" isimli araştırması "İnsan Araştırmaları Komitesi" tarafından uygun görülerek gerekli onay verilmiştir.

Bilgilerinize saygılarımla sunarım.

Etik Komite Onayı

Uygundur

14/04/2014

Prof.Dr. Canan Özgen
Uygulamalı Etik Araştırma Merkezi
(UEAM) Başkanı
ODTÜ 06531 ANKARA

APPENDIX B: PARTICIPANT CONSENT FORM

ORTA DOĞU TEKNİK ÜNİVERSİTESİ

Gönüllü Katılım Formu

İzlenecek yöntem ve çalışma içeriği ile ilgili bilgiler edindikten sonra ben,

……………………………………………………………………………………

(Ad ve Soyad)

kendi rızamla *Dr. Bilal Kırkıcı* ve *Pınar Gacan*'ın yürütmekte oldukları aşağıda işaretli deneylerinin birinde katılımcı olarak yer almayı kabul ediyorum.

☐ Göz Takip Deneyi

☐ Yanıt Süresi Deneyi

Aşağıdaki koşulları biliyorum ve bunları kabul ediyorum:

- Elde edilen verilerin anonim bir biçimde (katılımcı numarası atayarak) elektronik olarak işlemlenmesi ve bilimsel amaçlar için kullanılması
- Elde edilen verilerin anonim bir biçimde değerlendirilmek ve arşivlenmek üzere kaydedilmesi
- Elde edilen verilerin anonim bir biçimde üniversite derslerinde, araştırma kongrelerinde ve bilimsel yayınlarda kullanılabilmesi.

Onayımı istediğim anda, sebep sunmadan geri çekebileceğimi biliyorum.

Ankara, …………………………………

(tarih)

……………………………………………………………………………………

(İmza)

(*Katılımcıya Verilecek Suret*)

APPENDIX C: PARTICIPANT BACKGROUND QUESTIONNAIRE

Kişisel Bilgiler		Kod:	
Soyadın:	Adınız:	Bugünün Tarihi:	
Doğum Tarihi	Cinsiyetiniz: Kadın ( ) Erkek ( )		
Yazarken hangi elinizi kullanırsınız? Sol ( ) Sağ ( )			
Şu anki mesleğiniz?			
En yüksek tahsiliniz (veya muadili) (lütfen işaretleyiniz)	Ortaokul ( )	Lise ( )	Üniversite Derecesi ( )
	Mesleki Eğitim ( )	Diğer?	
Anne-babanızın en yüksek tahsili?(anne ve/ya baba)? (lütfen yuvarlağa alınız)	Ortaokul ( )	Lise ( )	Üniversite Derecesi ( )
	Mesleki Eğitim ( )	Diğer?	

Hangi dil(ler)i, hangi sırayla öğrendiniz? (anadiliniz dahil)			
Dil	Hangi yaştan itibaren?	Ne kadar süreyle?	Öğrendiğiniz yer? (evde, okulda, başka) Lütfen belirtiniz.
1.			
2.			
3.			
4.			

Dil Kullanım Örüntüsü
(Haftalık yüzde olarak)

Birinci sıraya lütfen günlük hayatınızda kullandığınız dilleri yazınız. Lütfen aşağıdaki tabloda yazılı olan kişilerle veya faaliyetler sırasında konuştuğunuz dillerin yaklaşık kullanım yüzdesini belirtiniz. Her sıradaki kullanım yüzdesinin toplamı %100 olmalıdır.

Aşağıda yazılı olan kişilerle hangi dilde iletişim kurarsınız?	Dil 1: …………..	Dil 2: ……………	Dil 3: ……………..	Dil 4: ……………..	Dil 5: ……………..
Eşinizle/partnerinizle					
Çocuklarınızla?					
Anne/babanızla?					
Akrabalarla?					
Arkadaşlarla?					
İşte/okulda?					
Hangi dilde TV izlersiniz?					
Hangi dilde müzik/radyo dinlersiniz?					
Hangi dilde gazete, kitap vs. okursunuz?					

APPENDIX D: CRITICAL ITEMS IN EXPERIMENT 1

Condition	Related - LI	Related - SIZ	Unrelated	Target
	haberli	habersiz	salata	haber
	“informed”	“uninformed”	“salad”	“information”
	kusurlu	kusursuz	terbiye	kusur
	“imperfect”	“perfect”	“manners”	“flaw”
	ahlaklı	ahlaksız	patlıcan	ahlak
	“well-behaved”	“immoral”	“aubergine”	“morality”
	şüpheli	şüphesiz	muhasebe	şüphe
	“doubtful”	“undoubted”	“accounting”	“doubt”
	hesaplı	hesapsız	karakter	hesap
	“economical”	“uneconomical”	“character”	”account”
	imkanlı	imkansız	sertifika	imkan
	“possible”	“impossible”	“certificate”	“possibility”
	önemli	önemsiz	mikrofon	önem
	“important”	“unimportant”	“microphone”	“importance”
	pürüzlü	pürüzsüz	tecrübe	pürüz
	“rough”	“smooth”	“experience”	“roghness”
	talihli	talihsiz	muhabbet	talih
	“lucky”	“unlucky”	“conversation”	“luck”
	kablolu	kablosuz	yetenek	kablo
	“cabled”	“cordless”	“ability”	“cable”
	kaliteli	kalitesiz	mercimek	kalite
	“of good quality”	“of poor qulity”	“lentil”	“quality”
	coşkulu	coşkusuz	kariyer	coşku
	“enthusiastic”	“calm”	“career”	“enthusiasm”
	kontrollü	kontrolsüz	romatizma	kontrol
	“controlled”	“uncontrolled”	“rheumatism”	“control”
	gürültülü	gürültüsüz	tekerlek	gürültü
	“noisy”	“quiet”	“tyre”	“noise”
	mantıklı	mantıksız	kontenjan	mantık
	“rational”	“irrational”	“quota”	“rationale”
	gururlu	gurursuz	tercüman	gurur
	“proud”	“undignified”	“interpreter”	“pride”
	koşullu	koşulsuz	diploma	koşul
	“conditional”	“unconditional”	“certificate”	“condition”
	şekerli	şekersiz	tesisat	şeker
	“sugary”	“sugar-free”	“facility”	“sugar”
	namuslu	namussuz	kadayıf	namus
	“honest”	“dishonest”	“a kind of dessert”	“honor”
	ölçülü	ölçüsüz	heyelan	ölçü
	“measured”	“unmeasured”	“landslide”	“measure”

APPENDIX E: ORTHOGRAPHIC CONTROL ITEMS IN EXPERIMENT 1

Related Prime	Unrelated	Target
devre	dev	üslup
“period”	“giant”	“style”
hapis	öğle	hap
“prison”	“midday”	“pill”
ilgi	konuşma	il
“interest”	“conversation”	“province”
kulak	ağaç	kul
“ear”	“tree”	“humanbeing”
balık	pazar	bal
“fish”	“market”	“honey”
korku	iptal	kor
“fear”	“cancel”	“coal”
morg	teori	mor
“morgue”	“theory”	“purple”
kumaş	acemi	kum
“cloth”	“novice”	“sand”
kart	ahlaki	kar
“card”	“moral”	“snow”
bardak	paket	bar
“glass”	“package”	“bar”
yasak	heyet	yas
“prohibition”	“committee”	“mourning”
kuşak	ihlal	kuş
“generation”	“violation”	“bird”
çanta	leziz	çan
“bag”	“delicious”	“bell”
kaşık	zil	kaş
“spoon”	“bell”	“eyebrow”
suret	açılım	sur
“apperance”	“development”	“rampart”
terör	sistem	ter
“terrorism”	“system”	“sweat”
külah	bacak	kül
“cone”	“leg”	“ash”
topal	fizik	top
“lame”	“physics”	“ball”
zarf	torun	zar
“envelope”	“grandchild”	“dice”
otel	tanık	ot
“hotel”	“witness”	“grass”

APPENDIX F: CRITICAL ITEMS IN EXPERIMENT 2

Condition	Related -ful	Related -less	Unrelated	Target
	careful	careless	fountain	care
	doubtful	doubtless	journal	doubt
	effortful	effortless	exile	effort
	fearful	fearless	eternity	fear
	fruitful	fruitless	duration	fruit
	harmful	harmless	fragment	harm
	joyful	joyless	vapour	joy
	meaningful	meaningless	blizzard	meaning
	merciful	merciless	dialect	mercy
	shameful	shameless	intellect	shame
	tactful	tactless	insomnia	tact
	tasteful	tasteless	ailment	taste
	armful	armless	thesaurus	arm
	purposeful	purposeless	pullover	purpose
	mindful	mindless	cognition	mind
	pitiful	pitiless	parameter	pity
	artful	artless	heredity	art

APPENDIX G: ORTHOGRAPHIC CONTROL ITEMS IN EXPERIMENT 2

Condition	Related	Unrelated	Target
	antique	topic	ant
	harmony	insect	harm
	grammar	tool	gram
	napkin	carrot	nap
	textile	peace	text
	monkey	victory	monk
	scandal	bridge	scan
	against	equipment	again
	dialog	surgery	dial
	phonetic	protest	phone
	sight	gate	sigh
	surface	guard	surf
	electron	survey	elect
	extract	angel	extra
	freeze	ghost	free
	parenthesis	appearance	parent
	important	sentence	import
	sweater	palm	sweat
	department	article	depart
	hearty	advisor	heart
	irony	attendance	iron
	number	addict	numb
	planet	village	plan
	united	location	unit
	country	honey	count
	inventory	production	invent
	organic	breath	organ
	secretary	pencil	secret
	internal	legend	intern
	active	nail	act
	factory	calendar	factor
	archer	suicide	arch
	corner	teenager	corn
	nursery	ceremony	nurse

APPENDIX H: TEZ FOTOKOPİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü ☐

Sosyal Bilimler Enstitüsü ■

Uygulamalı Matematik Enstitüsü ☐

Enformatik Enstitüsü ☐

Deniz Bilimleri Enstitüsü ☐

YAZARIN

Soyadı : Gacan
Adı : Pınar
Bölümü : İngiliz Dili Eğitimi

TEZİN ADI (İngilizce) : The morphological processing of derived words in L1 Turkish and L2 English

TEZİN TÜRÜ : Yüksek Lisans ■ Doktora ☐

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir. ☐

2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir. ☐

3. Tezimden bir (1) yıl süreyle fotokopi alınamaz. ■

TEZİN KÜTÜPHANEYE TESLİM TARİHİ:

APPENDIX I: TURKISH SUMMARY

Giriş

İnsanoğlu, bir dili anlama, üretme ve işlemleyebilme gibi etkileyici kabiliyetlere sahiptir. Bu dil becerilerinin merkezinde ise sahip olunan biçimbilim bilgisi uzanmaktadır. Bir dilin nasıl işlemlendiği sorusu günümüzde ruhdilbilim araştırmacılarının ilgi odağı haline gelmişken, dilin işlemlenmesini sağlayan mekanizmalar ne yazık ki gözlemlenebilir değildir. Bundan dolayı, sözcüklerin biçimbilimsel yapıları ve bunların nasıl işlemlendiği üzerinde yürütülen çalışmalar, zihinsel sözlüğün düzenlenme biçimine yönelik tahminlerde bulunulmasına yardımcı olabilmektedir.

Diller, konuşucularına farklı sözcükler üretebilme imkanı sağlar. Dillerin sağladığı bu imkan ancak karmaşık yapıların biçimbirim öğelerinin konuşucuya erişilebilir olması ile mümkün olmaktadır (Libben, 2003). Bu sav sonucunda, hem tek biçimbirimli hem de çok biçimbirimli yapıların zihinsel sözlükte temsil edildiği şeklinde bir çıkarım yapmak olasıdır. Bu çıkarım aynı zamanda uzun zamandır süregelen, dillerin biçimbilimsel açıdan karmaşık yapıları ne şekilde işlemledikleri tartışmasını da başlatmıştır. Bu tartışma birbirine zıt iki tarafın ortaya çıkmasına sebep olmuştur. Butterworth'ün (1983) ortaya attığı görüşe göre basit veya türetilmiş tüm sözcükler morfolojik yapısına bakılmaksızın zihinsel sözlükte listelenmektedir. Bu görüşün tam tersi olarak da Taft ve Forster (1975) çok biçimbirimli yapıların zihinsel sözlükte ek ve köklere parçalanmış şekilde saklandığını önermiştir.

Mevcut tartışma, son dönemlerde yön değiştirmiş ve karmaşık yapıların anadil (D1) ve ikinci dilde (D2) anlaşılmasının bir dizi mekanizma mı yoksa tek bir işlem mi gerektirdiği sorusu üzerine yoğunlaşmıştır. Bu kapsamda D1 için ortaya atılan teoriler *tekli mekanizma - çağrışımcı modeller*, *tekli mekanizma - kurala dayalı modeller*, ve *ikili mekanizma modelleri* şeklinde üç başlık altında toplanabilir. *Tekli mekanizma - çağrışımcı modeller* (Örn: Rumelhart & McClelland, 1986) karmaşık yapıların bellekte bütüncül sözcük olarak kaydedildiğini ve farklı bağlantılar ile bir sözcüğün diğer biçimleri ile ilişkilendirildiğini savunmuştur. Bu modellere göre sözcüklerin biçimbilimsel yapısı sözcük tanımlama ve işlemlemede herhangi bir rol oynamaz. *Tekli mekanizma - kurala dayalı modeller* (Örn: Ling & Marinov, 1993) ise karmaşık yapıların oluşturulmasını biçimsel kurallar çerçevesinde açıklamıştır. Bu modeller birleşimsel sistem içerisinde, karmaşık yapıların ek ve köklerine ayrıştırıldığını ve zihinsel sözlükte bu şekilde gösterildiğini ileri sürmektedir. Son olarak *ikili mekanizma modelleri* (Örn: Pinker, 1991) biçimbilimsel işlemleme esnasında hem çağrışımcı hem de kurala dayalı işleyişlerin rol aldığını savunmuştur. En bilinen model olan ve ilk olarak Pinker tarafından ortaya atılan bu modelde çağrışımsal bellek zihinsel sözlüğün temelini oluştururken, kurala dayalı sistem zihinsel dilbilgisi kuralları ile ilişkilendirilmektedir.

Alanyazındaki çoğu araştırma D1 işlemlenmesi üzerine odaklandığı için, D2 işlemlenmesi için ortaya atılan teoriler D1'e kıyasla sayıca daha kısıtlı ve yetersizdir. Bazı araştırmacılar "paylaşımlı model" (Perani ve diğerleri, 1998) görüşünü ortaya atmışlardır. Bu görüşe göre D2 işlemlenmesi D1'e göre daha az güdümlüdür ve D2 konuşucularının anadil etkilerini taşır. Bu farklılıklar haricinde D2 işlemlenmesi D1 işlemlenmesinin aynısıdır. Bir diğer model ise Ullman (2005) tarafından önerilen Bildirimsel ve İşlemsel bellek modelidir. Bu modele göre farklı dilbilimsel yapıların işlemlenmesinden iki farklı bellek sistemi sorumludur. Bildirimsel bellek bütüncül sözcüklerin bellekte depolanması ve gerektiğinde bellekten bulup çıkartılmasından sorumlu iken, işlemsel bellek sözcüklerin dilbilgisi ve biçimbilim kuralları ile oluşturulmasında rol oynar. Bu model aynı zamanda D2 işlemlenmesinin büyük oranda bildirimsel belleğe dayandığını ve D2 yeterlik derecesi arttıkça İşlemsel belleğin rolünün de arttığını savunmaktadır.

Amaç ve Önem

Biçimbilimsel açıdan karmaşık kelimeler üzerine yapılan geçmiş araştırmalar ve sonrasında oluşturulan teoriler çoğunlukla çekimlenmiş sözcüklerin işlemlenme ve zihinsel gösterimi üzerine yoğunlaşmıştır. Türemiş kelimeler üzerine yapılan işlemleme araştırmaları son yıllarda bir ivme kazanmış olsa da, bu araştırmalar D1 ile kısıtlı kalmaktadır ve D2'de yok denecek kadar azdır. Aynı zamanda, D1 ve D2 işlemleme araştırmaları belirli dillerin dışına çıkmamakta ve bulguları genelleyebilmek için biçimsel açıdan farklı dillerde incelenmemektedir. Bu sebeplerden ötürü Türk dili, sondan eklemeli biçimbilimsel yapısı ve Ural Altay dil ailesine ait olması ile, incelemeye değer bir dildir. Buna ek olarak, D1 Türkçe'de daha önce ruhdilbilim deney yöntemleri kullanılarak yapılmış biçimbilimsel işlemleme araştırmaları yok denecek kadar azdır. Ayrıca türemiş sözcükler bakımından Türkçe, İngilizce'den daha üretken bir dildir. Bu araştırma deseni ile üretkenlik bakımından birbirinden farklı iki dil arasındaki işlemleme benzerlik ve/veya farklılıklarını ortaya çıkarmak mümkün olacaktır.

Bu çalışmanın ana amacı ruhdilbilimsel deneysel yöntemler kullanılarak, D1 Türkçe ve D2 İngilizce'de türetilmiş sözcüklerin biçimbilimsel açıdan işlemlenme örüntülerini ortaya çıkarmaktır. Bu çalışma ile cevaplanması hedeflenen daha özel soru ise anadili Türkçe olan konuşucuların D1 Türkçe'de ve D2 İngilizce'de benzer biçimbirim yapıları kullanılarak türetilmiş sözcükleri bütüncül sözcük olarak mı yoksa ek ve köklerine ayrıştırarak mı işlemlediklerididir. Buna ek olarak, farklı D2 İngilizce yeterlik seviyelerine sahip konuşucuların sergilediği gücül benzerlik ve farklılıkların belirlenmesi de amaçlanmıştır.

Denekler

Yukarıda belirtilen amaçlar doğrultusunda ilk deneyde anadili Türkçe olan 63 katılımcı yer almıştır. Katılımcılar anadillerinin Türkçe olduğunu doğrulamıştır ve Yıldırım Beyazıt Üniversitesi'nden seçilmiştir. Katılımcıların yaş ortalaması 18.95 ve aralığı 17-23'tür.

İkinci deneye ise ikinci dil olarak İngilizce konuşucusu 60 kişi katılmıştır. Tüm katılımcılar ODTÜ öğrenci nüfusundan seçilmiştir. Katılımcıların yaş ortalaması 19.73 ve aralığı 19-26'dır. Katılımcıların ikinci dil yeterlik seviyesini ölçmek için Oxford Yerleştirme Sınavı uygulanmıştır. Katılımcılar sınav sonucunda puanlarına göre "yüksek yeterlik seviyesi" ve "düşük yeterlik seviyesi" olarak iki gruba ayrılmıştır. Yüksek yeterlik seviyesi grubunun sınav sonucu ortalaması 60 üzerinden 49.93 iken düşük seviye grubunun ortalaması 40.90'dır. Avrupa Dilleri Ortak

Çerçeve Programı'na göre "yüksek yeterlik seviyesi" grubu ileri düzeye (C1) tekabül ederken "düşük yeterlik seviyes" grubu orta düzeye (B2) tekabül etmektedir. Tüm katılımcılar D2 İngilizce'yi sınıf ortamında 11 yaşından sonra öğrenmeye başladıklarını belirtmiştir.

Deney başlamadan önce katılımcılar deneyin amacı ve içeriği hakkında yazılı ve sözlü bir şekilde bilgilendirilmiştir. Her katılımcı deney öncesinde, deneye gönüllü katıldıklarını belirten bir rıza formu doldurmuştur. Ayrıca her katılımcı, eğitim ve yetişme durumları ile ilgili bilgiler soran katılımcı artalan sormacasını doldurmuştur. Katılımcılara herhangi bir ücret ödenmemiştir. Deneyler ODTÜ Etik Komitesi tarafından uygun görülmüş ve onaylanmıştır.

D1 Türkçe ve D2 İngilizce Üzerine Deneyler

Türkçe'de anlaşılır, yüksek sıklığa sahip, ve oldukça üretken olan *–lı* (niteleyici eki; güçlü) ve *–sız* (yoksunluk eki; güçsüz) ekleri ile İngilizcede aynı özelliklere ve anlama sahip olan *–ful* (Örn: careful "*dikkatli"*) ve *–less* (Örn: careless "*dikkatsiz"*) eklerinin işlemlenme yöntemleri maskelenmiş hazırlama deneyleri ile incelenmiştir. Bu eklerin seçilme sebepleri şu şekildedir. İlk olarak, bu ekler eklendikleri kökte ortografik ve/veya sesbilimsel değişikliklere yol açmamaktadır. Ayrıca, bu ekler oldukça üretken ve sıktır. Son olarak bu ekler Sebüktekin (1971) tarafından *diaform* olarak adlandırılmıştır. *Diaform* yapılar, iki dilde de mütemadiyen aynı özelliklere sahip olan yapılar olarak adlandırılabilir. Birbirinin aynı olan bu yapıların incelenmesi D1 Türkçe ve D2 İngilizce'nin işlemlenmesinde kullanılan mekanizmaların daha berligin bir biçimde karşılaştırılmasına olanak sağlamıştır.

D1 Türkçe ve D2 İngilizce'nin işlemlenmesini ortaya çıkaran iki farklı maskelenmiş hazırlama deneyi tasarlanmıştır. Bu yöntemde ilk olarak kısa bir süreliğine (genellikle 30 – 80 ms arası) hazırlama sözcüğü (Örn: faydalı) gösterilmektedir. Hazırlama sözcükleri her iki deneyde de ekranda 51 ms gösterilmiştir. Bu hazırlama sözcüğü bir hedef sözcük (Örn: fayda) tarafından takip edilmektedir. Katılımcılar bu kelimeyi gördükten sonra bir oyun kolu veya bilgisayar klavyesi kullanarak mümkün olduğunca hızlı ve doğru bir şekilde kelimenin gerçek veya gerçek olmayan kelime olduğuna karar vermek durumundadır. Katılımcıların tepki süreleri ve yanıtları E-prime (Schneider, Eschman, & Zuccolotto, 2002) yazılımı ile kaydedilmiştir ve analizler SPSS yazılımı ile yapılmıştır.

D1 Türkçe deneyin kelimeleri ODTÜ Türkçe Derlem'inden seçilmiştir (Say, Zeyrek, Oflazer & Özge, 2002). Deney için kullanılacak toplamda 240 kelime çifti seçilmiştir. Bunlardan yirmisi *–lı* veya *–sız* ile türetilmiş deneysel sözcüklerdir ve bu türemiş sözcüklerin sıklık ortalaması 5.77 dir. Bir diğer yirmisi ise ortografik denetleme için seçilen ve arasında herhangi bir biçimbilimsel veya anlambilimsel ilişki olmayan sözcük çiftleridir (Örn: ilgi – il). Geriye kalan 200 sözcük çiftinin ise asıl deney ile ilgisi bulunmamakla birlikte katılımcıların deneyin esas amacını anlamaması için seçilmiş sözcüklerdir. Bu kelime çiftleri Kırkıcı ve Clahsen (2013)'dan alınmıştır.

D2 İngilizce deneyin kelimeleri ise SUBTLEX-UK Derlem'inden seçilmiştir (Van Heuven, Mandera, Keuleers, & Brysbaert, 2014). İkinci deney için toplamda 204 sözcük çifti seçilmiştir. Bunlardan onyedisi *–ful* veya *–less* ekleri ile türetilmiş kelimelerdir ve bu kelimelerin ortalama sıklığı *–ful* kelime grubu için 3.04, *-less* kelime grubu için ise 2.79'dur. Otuzdört kelime çifti ortografik denetleme için dahil edilmiştir. Geriye kalan yüz elliüç kelime çiftinin ise asıl deney ile ilgisi bulunmamaktadır ve yukarıdaki belirtilen sebepten ötürü deneye dahil edilmiştir. Bu kelime çiftleri Wuggy programı ile oluşturulmuştur (Keuleers & Brysbaert, 2010).

Genel Sonuçlar

Deneylerden elde edilen bulgular anadili Türkçe olan konuşucular ve D2 yeterlik seviyesi yüksek olan konuşucular için benzer hazırlama etkileri ortaya çıkarmıştır. Bu hazırlama etkilerinden yola çıkarak, katılımcıların sözcük tanıma süreci esnasında, D1 ve D2'de türetilmiş sözcüklerin biçimbilimsel açıdan işlemlenmesinde ayrıştırma mekanizması kullandıkları çıkarımı yapılabilir. Diğer bir deyişle D1 Türkçe ve ileri seviye D2 İngilizce konuşucuları yukarıda belirtilen eklerle türetilmiş kelimeleri zihinlerinde işlemlerken kelimeleri bütüncül olarak saklamaktan ziyade ek ve kök olarak parçalara ayırmaktadır ve zihinsel sözlükte kelimeleri bu şekilde saklamaktadırlar. Öte yandan D2 seviyesi daha düşük olan konuşucularda hazırlama etkileri sadece *–ful* ile türetilmiş sözcüklerde gözlemlenmiştir. Başka bir ifadeyle düşük seviyeli D2 İngilizce konuşucuları *–ful* eki ile türetilmiş kelimeleri ek ve köklere parçalayarak işlemlerken, *-less* eki ile türetilmiş kelimeleri bütüncül kelime olarak zihinsel sözlükte saklamaktadır. Bu durumu D2 İngilizce konuşucularının dil yeterlik farkından veya yapım eklerinin taşıdığı anlambilimsel özelliklerden dolayı kaynaklanmış olabilir. İleriki araştırmalar bu işlemleme farkının sebeplerini araştırabilir.

Diğer yandan ortografik denetleme verilerinin analizleri göz önüne alındığında türetilmiş yapıların D2'de işlemlenmesinde sözcüklerin hem ortografik hem de biçimbilimsel özelliklerinden yararlanıldığı ortaya çıkmıştır. D2 işlemlenmesinin aksine, anadilde biçimbilimsel işlemlemenin sadece biçimbilimsel özellikler tarafından etkilendiği de elde edilen bulgular arasındadır. Bu sebeplerden dolayı, türetilmiş sözcüklerin D1 ve D2'de bir dereceye kadar farklı şekilde işlemlendikleri ileri sürülmüştür. Elde edilen bu farklılıkların sebebi ikinci dil konuşucularının maruz kaldığı ikinci dil girdisinin niteliği ile ilintili olabilir.

Bu araştırmadaki D2 İngilizce konuşucuları, ikinci dillerine sınıf ortamında maruz kalmıştır ve D2 İngilizce'nin konuşulduğu herhangi bir ülkede bulunmamışlardır. Türkiye'de sınıf ortamında maruz kalınan dil yetersiz ve yoksuldur. Ayrıca, öğrenciler çoğunlukla dili kullanmak için gerçek bir nedene sahip olmamakta ve bu yüzden D2 İngilizce'yi kullanarak mümkün olduğunca az iletişime geçmektedirler. Öte yandan alanyazındaki az sayıda araştırma da bazı D2 konuşucularının kelimelerin ortografik özelliklerinden yararlandığını ortaya çıkarmıştır. Bu az sayıdaki araştırmaların ortak noktası D2 konuşucularının farklı ortamlarda maruz kaldığı dil girdisinin yetersiz olmasıdır. Dil girdisinin kalitesinin düşük olması, D2 İngilizce konuşucularının D2 İngilizce'yi neden kendi anadillerinden farklı mekanizmalar kullanarak işlemlediğini açıklayabilmektedir. İleriki çalışmalar ikinci dil girdisinin kalitesi ve bunun işlemleme üzerine olan etkisi üzerine yoğunlaşabilir.