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

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

DUYGU FATMA ŞAFAK

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF ARTS
IN
THE DEPARTMENT OF ENGLISH LANGUAGE TEACHING

AUGUST 2015

Approval of the Graduate School of Social Sciences

Prof. Dr. Meliha Altunışık
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Arts.

Assoc. Prof. Dr. Nurten Birlik
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Arts.

Assoc. Prof. Dr. Bilal Kırkıcı
Supervisor

Examining Committee Members

Assoc. Prof. Dr. Martina Gracanin Yüksek (METU, FLE)
Assoc. Prof. Dr. Bilal Kırkıcı (METU, FLE)
Assoc. Prof. Dr. Orhan Murat Koçak (Kırıkkale U., MED)

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last Name: Duygu Fatma Şafak

Signature :

ABSTRACT

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

Şafak, Duygu Fatma
M.A., English Language Teaching
Supervisor: Assoc. Prof. Dr. Bilal Kırkıcı

August 2015, 127 pages

The present study aims at examining how inflected and derived words are processed during the early stages of visual word recognition in a native language (L1) and in a second language (L2). A second aim of the study is to find out whether or not the semantic and surface-form properties of morphologically complex words affect early word recognition processes.

Two masked priming experiments were conducted to investigate morphological processing in L1 Turkish and in L2 English. In the first experiment, 40 L1 speakers of Turkish were tested on the processing of Turkish inflected verbs with the evidential suffix *-mIş* and Turkish derived nouns with the agentive suffix *-(y)IcI*. The second experiment examined the processing of English inflected verbs with the regular past tense suffix *-ed* and English derived nouns with the agentive suffix *-er*. This experiment was performed with 44 high-proficiency Turkish learners of L2 English.

The findings indicated that native speakers of Turkish decomposed inflected and derived words into stems and suffixes during visual word recognition in both L1 Turkish and L2 English, and that these morphological processes were not influenced by semantic relatedness between inflected/derived words and their stems. However, this parallelism was not observed when the L1 and L2 processing were compared on the effects of orthographic relatedness. While early word recognition processes in L1 were purely morphological, L2 processing was dependent on both morphological and surface-form properties. Thus, this study concluded that L2 learners rely on non-native-like processing mechanisms even at an advanced level of proficiency.

Keywords: Second Language Morphological Processing, Inflectional/Derivational Processing, Masked Priming, Orthographic Relatedness, Semantic Relatedness

ÖZ

D1 TÜRKÇEDE VE D2 İNGİLİZCEDE ÇEKİMLENMİŞ VE TÜRETİLMİŞ SÖZCÜKLERİN BİÇİMBİLİMSEL İŞLEMLENMESİ

Şafak, Duygu Fatma
Yüksek Lisans, İngiliz Dili Öğretimi
Tez Yöneticisi: Doç. Dr. Bilal Kırkıcı

Ağustos 2015, 127 sayfa

Bu çalışma, çekimlenmiş ve türetilmiş sözcüklerin anadildeki (D1) ve ikinci dildeki (D2) görsel sözcük tanıma sürecinin erken aşamalarında ne şekilde işlemlendiklerini incelemeyi amaçlamaktadır. Çalışmanın ikinci bir amacı da biçimbilimsel olarak karmaşık sözcüklerin anlamsal ve yüzey-biçim özelliklerinin erken sözcük tanıma süreçleri üzerinde herhangi bir etkisi olup olmadığını ortaya çıkarmaktır.

Biçimbilimsel yapıların D1 Türkçe ve D2 İngilizcedeki işlemlenmesini araştırmak amacıyla iki maskelenmiş hazırlama deneyi yürütülmüştür. Birinci deneyde, anadilleri Türkçe olan 40 katılımcı öğrenilen geçmiş zaman eki *-mIş* ile çekimlenmiş Türkçe eylemlerin ve kılıcı eki *-(y)IcI* ile türetilmiş Türkçe adların işlemlenmesi üzerine test edilmiştir. İkinci deney ise İngilizcedeki düzenli geçmiş zaman eki *-ed* ile çekimlenmiş eylemlerin ve kılıcı eki *-er* ile türetilmiş adların işlemlenmesini incelemiştir. Bu deney, anadilleri Türkçe ve İngilizce ikinci dil seviyeleri yüksek olan 44 katılımcıya uygulanmıştır.

Bulgular, Türkçenin anadil konuşucularının çekimlenmiş ve türetilmiş sözcükleri hem D1 Türkçedeki hem de D2 İngilizcedeki görsel sözcük tanıma süreci esnasında köklerine ve eklerine ayrıştırdıklarını ve bu biçimbilimsel süreçlerin çekimlenmiş/türetilmiş sözcüklerle kökleri arasındaki anlamsal ilişkiden etkilenmediğini göstermiştir. Ancak bu benzerlik, D1 ve D2 işlemlenmeleri ortografik ilişkinin etkileri üzerine kıyaslandığında gözlenmemiştir. D1'de erken sözcük tanıma süreçleri tamamen biçimbilimsel iken, D2 işlemlenmesi hem biçimbilimsel hem de ortografik özelliklere bağlı olmuştur. Böylece bu çalışma ikinci dil konuşucularının, ileri düzey dil yeterliliğinde bile, anadil konuşucularından farklı işlemleme mekanizmaları kullandıkları sonucuna ulaşmıştır.

Anahtar Sözcükler: İkinci Dilde Biçimbilimsel Yapıların İşlemlenmesi, Çekimsel/Türetimsel İşlemleme, Maskelenmiş Hazırlama, Ortografik İlişki, Anlamsal İlişki

To My Family

ACKNOWLEDGEMENTS

First of all, I would like to wholeheartedly express my gratitude to my excellent supervisor, Assoc. Prof. Dr. Bilal Kırkıcı, for his immeasurable amount of guidance and encouragement that he has provided throughout both this thesis process and my entire graduate education. Although I cannot find any word to express the depth of my indebtedness to him, I can say for sure that I have always felt fortunate to know such an understanding person and work under his inspiring supervision. Without his never-ending support, I would possibly not have studied in a field that I would love to immerse myself in, and might not have written this thesis.

I would like to extend my sincere gratitude to Assoc. Prof. Dr. Martina Gracanin Yüksek for examining this thesis with great care and making invaluable comments and suggestions. I would also thank Assoc. Prof. Dr. Orhan Murat Koçak for being in my jury and for his constructive feedback. All remaining errors in this thesis are my sole responsibility. Additionally, a special thank goes to Assoc. Prof. Dr. Çiğdem Sağın Şimşek for being a great source of encouragement to me throughout my undergraduate studies.

I would like to offer my further thanks to The Scientific and Technological Research Council of Turkey (TÜBİTAK) for the financial support within the scope of the 2210-National Scholarship Programme for Master’s Students. This thesis was developed as part of the TÜBİTAK – BMBF jointly funded project entitled “Experimental Studies on German-Turkish Multilingualism” (Project No: 113K458).

I am also obliged to my colleagues and friends, especially to Zeynep Aysan, Banu Çiçek Başaran, Merve Aydoğdu, Fatma Gümüşok, Özlem Arslan and Esranur Efeoğlu, for their friendship and support.

Last but not least, I would like to express my deepest gratitude to my beloved family; to my parents, Necla and Yaşar Bekir Şafak, and to my brother, İsmail Şafak, who have always stood by me with their endless love, unwavering faith in me and extraordinary patience.

This thesis was approved by Middle East Technical University (METU) Human Subjects Ethics Committee in December 2014 (see Appendix A).

TABLE OF CONTENTS

PLAGIARISM iii
ABSTRACT iv
ÖZ vi
DEDICATION viii
ACKNOWLEDGEMENTS ix
TABLE OF CONTENTS xi
LIST OF TABLES xiv
LIST OF FIGURES xvi
LIST OF ABBREVIATIONS xvii
CHAPTER
1. INTRODUCTION 1
1.1 Background to the Study 1
1.2 Rationale of the Study 4
1.3 Morphological Focus 6
1.4 General Research Questions 7
2. REVIEW OF LITERATURE 9
2.1 Inflectional and Derivational Processes 9
2.1.1 Introduction 9
2.1.2 Is There a Distinction between Inflection and Derivation? 10
2.2 Models of Morphological Processing and Representation in L1 11
2.2.1 Single-Mechanism Models 12
2.2.1.1 Associative Accounts 12
2.2.1.2 Rule-Based Accounts 15
2.2.2 The Dual-Mechanism Model 17
2.2.2.1 The Declarative/Procedural Model 19
2.3 Approaches to Morphological Processing and Representation in L2 20

2.3.1 Same Cognitive Mechanisms for L1 and L2 20
2.3.2 Different Cognitive Mechanisms for L1 and L2 23
2.4 Previous Studies on Morphological Processing... 24
2.4.1 Inflectional Processing 24
2.4.2 Derivational Processing... 31
2.4.3 The Effects of Semantic and/or Orthographic Information on Morphological Processing 36
3. EXPERIMENT 1: THE PROCESSING OF MORPHOLOGICALLY COMPLEX WORDS IN TURKISH... 44
3.1 Background to Experiment 1 44
3.2 Research Questions and Predictions 46
3.3 Experimental Methodology 48
3.3.1 Participants 50
3.3.2 Materials... 50
3.3.3 Procedure.. 56
3.3.4 Data Analysis 57
3.4 Results.. 58
3.4.1 Morphological Items 58
3.4.2 Orthographic Items... 60
3.4.3 Semantic Items 61
3.4.4 Summary 62
4. EXPERIMENT 2: THE PROCESSING OF MORPHOLOGICALLY COMPLEX WORDS IN ENGLISH 63
4.1 Background to Experiment 2 63
4.2 Research Questions and Predictions 65
4.3 Experimental Methodology 67
4.3.1 Participants 67
4.3.2 Materials.. 68
4.3.3 Procedure... 75
4.3.4 Data Analysis 75

4.4 Results 76
4.4.1 Morphological Items 76
4.4.2 Orthographic Items 77
4.4.3 Semantic Items 78
4.4.4 Pseudo-Suffixed Items 79
4.4.5 Summary 80
5. DISCUSSION AND CONCLUSION 82
5.1 Summary of the Study and Discussion 82
5.1.1 Discussion of L1 Results 83
5.1.2 Discussion of L2 Results 85
5.2 Suggestions for Further Research 89
REFERENCES 91
APPENDICES
APPENDIX A: Ethics Committee Approval 105
APPENDIX B: Morphological Items in Experiment 1 106
APPENDIX C: Orthographic Items in Experiment 1 107
APPENDIX D: Semantic Items in Experiment 1 108
APPENDIX E: Participant Consent Form 109
APPENDIX F: Morphological Items in Experiment 2 110
APPENDIX G: Orthographic Items in Experiment 2 111
APPENDIX H: Semantic Items in Experiment 2 112
APPENDIX I: Pseudo-Suffixed Items in Experiment 2 113
APPENDIX J: Turkish Summary 114
APPENDIX K: Tez Fotokopisi İzin Formu 127

LIST OF TABLES

TABLES

Table 1: Sample set of related prime-target pairs in Marslen-Wilson et al. (1996) 32

Table 2: Three typical types of prime-target pairs in masked priming experiments 49

Table 3: Sample set of morphological stimuli in Experiment 1 51

Table 4: Mean length (in letters) and word form frequencies (per million) for related primes, unrelated primes and targets for morphological item set in Experiment 1 52

Table 5: Sample set of orthographic stimuli in Experiment 1 52

Table 6: Mean length (in letters) and word form frequencies (per million) for related and unrelated primes as well as targets for orthographic item set in Experiment 1 53

Table 7: Sample set of semantic stimuli in Experiment 1 54

Table 8: Mean length (in letters) and word form frequencies (per million) for related and unrelated primes as well as targets for semantic item set in Experiment 1 55

Table 9: Mean RTs (in ms), SDs (in parentheses), and error rates (in percent) for morphological items in Experiment 1 58

Table 10: Mean RTs (in ms), SDs (in parentheses), and error rates (in percent) for orthographic items in Experiment 1 60

Table 11: Mean RTs (in ms), SDs (in parentheses), and error rates (in percent) for orthographic items in Experiment 1 61

Table 12: Sample set of morphological stimuli in Experiment 2 68

Table 13: Mean length (in letters) and word form frequencies for related and unrelated primes as well as targets for morphological item set in Experiment 2 70

Table 14: Sample set of orthographic stimuli in Experiment 2 70

Table 15: Mean length (in letters) and word form frequencies for related and unrelated primes as well as targets for orthographic item set in Experiment 2 71
Table 16: Sample set of semantic stimuli in Experiment 2 72
Table 17: Mean length (in letters) and word form frequencies for related and unrelated primes as well as targets for semantic item set in Experiment 2 73
Table 18: Sample set of pseudo-suffixed stimuli in Experiment 2 74
Table 19: Mean length (in letters) and word form frequencies for related and unrelated primes as well as targets for pseudo-suffixed item set in Experiment 2 74
Table 20: Mean RTs (in ms), SDs (in parentheses), and error rates (in percent) for morphological items in Experiment 2 76
Table 21: Mean RTs (in ms), SDs (in parentheses), and error rates (in percent) for orthographic items in Experiment 2 78
Table 22: Mean RTs (in ms), SDs (in parentheses), and error rates (in percent) for semantic items in Experiment 2 79
Table 23: Mean RTs (in ms), SDs (in parentheses), and error rates (in percent) for pseudo-suffixed items in Experiment 2 80

LIST OF FIGURES

FIGURES

Figure 1: The basic structure of the Rumelhart and McClelland (1986) Model 13

Figure 2: A simplified representation of the dual-mechanism model (taken from Kırkıcı, 2005) 19

Figure 3: Schematic representation of the masked priming procedure in Experiment 1 57

LIST OF ABBREVIATIONS

AAM	Augmented Addressed Morphology
ANOVA	Analysis of Variance
AoA	Age of Onset of Acquisition
CEFR	Common European Framework of Reference for Languages
ERP	Event-Related Potential
fMRI	Functional Magnetic Resonance Imaging
L1	Native Language
L2	Second Language
M	Morphology
MRM	Morphological Race Model
ms	Millisecond
O	Orthographic
OPT	Oxford Quick Placement Test
RT	Reaction Time
S	Semantic
SD	Standard Deviation
SOA	Stimulus Onset Asynchrony
SSH	Shallow Structure Hypothesis
SL	Substituted Letter
TICLE	the Turkish International Corpus of Learner English
TL	Transposed Letter

CHAPTER 1

INTRODUCTION

This chapter consists of four sections. The first section presents the theoretical background to this study and introduces the main morphological processing models available. The second section discusses the rationale and aims of the present study, while the third section presents an overview of the inflectional and derivational phenomena that will be addressed to examine native (L1) and second language (L2) processing. Finally, the fourth section outlines the research questions and the outcomes predicted on the basis of the findings of earlier studies.

1.1 Background to the Study

Language comprehension has long been a core issue in psycholinguistic research. Humans store the knowledge of thousands of words and are able to retrieve this knowledge in a highly automatic and effortless way when they are exposed to written or spoken language. Furthermore, considering that many people learn a second (and often even a third or fourth) language, it is of great interest to understand how such a vast number of words from various sources is represented in the mental lexicon. Hence, in order to explain the organization of the lexicon, the morphological structures and processing of words have been intensively investigated over the last decades.

Among many issues related to the organization of the mental lexicon, the question whether the processing of morphologically complex words entails a single process or a series of processes has been a source of long-standing debate. This debate, which is known as "the past-tense debate" (Pinker & Ullman, 2002), has predominantly revolved around inflectional morphology and particularly around the English past tense inflection. The reason for this wide interest in the English past tense is the fact that it offers a sharp contrast between regular verbs, which require a rule-like process and irregular verbs, which require an unpredicted idiosyncratic process. As will be further discussed in the forthcoming chapters, three main theoretical models of morphological processing have been developed to account for the mechanism(s) underlying the processing of regular and irregular complex word forms: single mechanism rule-based accounts, single-mechanism associative accounts, and the dual mechanism model. In single mechanism rule-based accounts (Ling & Marinov, 1993; Yang, 2002), the (de)composition of all complex words is accounted for in terms of rules that are assumed to be explicitly represented in the human mind. For regular past forms, the rule is the attachment of the affix *-ed* to any base verb form (e.g. *join* + *-ed* → *joined*), whereas for irregular past forms a few rules can be come up with according to different verb classes (e.g. no change rule: *hurt* → *hurt*, vowel changes: *drink* → *drank*). On the other hand, single mechanism associative accounts (e.g. Rumelhart & McClelland, 1986) argue against the psychological reality of linguistic rules in language processing. Associative accounts posit that all words, without any distinction between morphologically simple and complex forms, are stored as morphologically unanalyzed whole units. Lastly, between these two extreme single mechanism accounts lies the dual mechanism model, which is embodied as a combination of rule-based computation and whole-word recognition (e.g. Pinker, 1999). In the declarative/procedural model, which has been proposed as an extension of the dual mechanism model, morphological processing hinges upon the use of two brain memory systems, the declarative memory and the procedural memory (Ullman, 2005). While the declarative memory is taken as an associative system in which irregular inflections are retrieved as full forms, the procedural memory is presented as a combinatorial system in which regular inflections are decomposed into their morphological constituents.

As mentioned above, morphological processing models have generally focused on the processing of inflected word forms. This has raised an important question, especially for realization-based theories of morphology which draw a strong distinction between derivational and inflectional processes: how can we explain the processing of derived word forms? According to proponents of realization-based morphology (Matthews, 1991; Anderson, 1992), derivational morphemes produce new words that have their own syntactic and semantic categories (e.g. *employ* → *employee*) while inflectional morphemes create different forms of the same word (e.g. *employ* → *employed*), and therefore these lexeme-formation and lexeme-preserving processes are not similarly represented in the mental lexicon. Marslen-Wilson (2007) argues that the productivity and transparency of derivational morphemes play a key role in determining whether a derived word form has a stored or decomposed representation. The morphemes *-ness* and *-ity*, for example, both derive a noun from an adjective, but they differ in important properties like productivity and transparency. The suffix *-ness* is productive because it can be applied to a wide range of words and is also phonologically transparent because a derived form like *kindness*, for example, is transparently related to the adjective stem *kind*. The suffix *-ity*, on the other hand, is less productive as it cannot be attached to many adjectives and is also less transparent since a derived form like *hostility* requires a vowel change in the adjective stem *hostile* (see Silva, 2009, for further details).

Inflectional processes bear similarities to derivational processes in terms of productivity and transparency. The regular past tense pattern (i.e. the suffix *-ed*) is productively and transparently applied to most verbs and even to nonce verbs (e.g. *spow* → *spowed*) as shown in Berko's (1958) famous "wug-test", while the irregular past tense pattern is less productive and also less transparent due to the idiosyncratic relationships between verb stems and their irregular past forms (e.g. *know* → *knew*). Yang (2005) suggested that the regular/irregular inflection distinction can be regarded as difference in productivity, and that the storage versus composition debate regarding regular and irregular inflection can be extended to productive and less productive derivation. As such, morphological processing models can be employed to account for both inflectional and derivational processes.

More recently, the debate has expanded to encompass L2 morphological processing and the question whether or not L2 learners are able to achieve native-like processing in their non-native language has been investigated in many studies. Two main approaches have emerged that compare L2 morphological processing with L1 morphological processing. One approach is the so-called "shared-systems" view, which postulates that L1 and L2 processing are essentially executed in the same way, though L2 processing might be affected by some factors such as L1 transfer, lower processing speed, and higher working memory demands (e.g. Perani et al., 1998). The other approach maintains that L2 processing is fundamentally different from L1 processing. The aforementioned declarative/procedural model, for example, ascribes the processing of regulars and irregulars in an L1 to two different long-term memory systems (procedural and declarative). Regarding L2 processing, the declarative/procedural model proposes that L2 learners store both irregulars and regulars because of their reliance on the declarative system (Ullman, 2005). Ullman also points out that the high level of L2 proficiency might trigger L2 learners' use of the procedural system by reducing their reliance on the declarative system.

1.2 Rationale of the Study

The broad purpose of the present study is to provide a picture of morphological processing in a native language and in a non-native language. To be more specific, this study aims at examining inflectional and derivational processes in L1 Turkish and in L2 English for the following reasons.

First, although the number of studies dealing with L2 morphological processing has dramatically increased in recent years, it is still an issue of controversy whether or not L2 learners employ the same processing mechanisms as L1 speakers. Some researchers have adopted the position that L2 learners have access to similar mechanisms as L1 speakers (e.g. Perani et al., 1998; McDonald, 2006). Others have assumed that L1 and L2 processing involve qualitatively different mechanisms, and that L2 learners rely less on the use of grammatically-based mechanisms and more on the use of the lexically-based mechanisms than L1 speakers do (e.g. Ullman, 2005; Clahsen & Felser, 2006a). Considering these controversial views, the findings of this study may contribute to the ongoing debate regarding whether L2 morphological processing differs from L1 morphological processing or not.

Second, realization-based models of morphology speculate that inflected and derived word forms have separate lexical representations, but this inflection-derivation dissociation has not received much attention in previous research, especially in the L2 processing literature (with the exception of a few studies like Silva & Clahsen, 2008; Kırkıcı & Clahsen, 2013). Therefore, the present study directly compares inflectional and derivational processes in an attempt to explore representational differences (if any) between inflection and derivation.

Third, this study also seeks to examine the role of semantics and orthography in the recognition of morphologically complex word forms by using the masked visual priming technique, thus allowing for a better understanding of the precise nature of L1 and L2 morphological processing. Finally, there is a large body of research that has been done on morphological processing in languages such as English, German, and Dutch. The number of studies that have focused on inflectional and derivational phenomena in typologically different languages, however, is rather small. In this regard, Turkish, a non-Indo-European agglutinative language with rich morphology, provides a unique opportunity to investigate inflected and derived words. Given the fact that Turkish is a typologically distinct and, more importantly, under-researched language, the present study will make a valuable contribution to the literature by examining the L1 processing of morphologically complex words in Turkish.

1.3 Morphological Focus

In this study two morphological phenomena are analyzed: past tense morphology and deverbal nominalizations. Experiment 1 addresses how L1 speakers of Turkish process perfective verb inflection with the evidential suffix *-mIş* (e.g. *dinle – dinlemiş,* "listen" – "listened") and deverbal nominalizations derived with the agentive suffix *-(y)IcI* (e.g. *sat – satıcı,* "sell – seller"). Experiment 2, on the other hand, deals with the L2 processing of English past tense verb inflection with the regular past suffix *-ed* (e.g. *play – played*) and English deverbal nominal derivation with the agentive suffix *-er* (e.g. *employ – employer*).

The inflectional and derivational suffixes (i.e. *-mIş* and *-(y)IcI* in Experiment 1, *-ed* and *-er* in Experiment 2) to be analyzed within the scope of this study have been selected for a number of reasons. They are all relatively frequently used and constitute phonologically highly transparent structures. Importantly, the morphological structures to be compared in the respective languages add the same amount of letters to verbal stems, thereby creating comparable processing load and allowing for a one-to-one comparison between inflection and derivation. Additionally, the morphemes to be examined in Turkish and English can be taken as counterparts of each other; while the inflectional suffixes produce regular past participle forms of verbs, the derivational suffixes productively create deverbal nouns that express people or things performing a particular activity. These similarities between the Turkish and English morphemes to be investigated may therefore lead to a more accurate identification of similarities and differences between L1 and L2 processing.

1.4 General Research Questions

The present study attempts to answer the following research questions:

1) Are inflected and derived words decomposed into constituent morphemes or accessed as whole units during early stages of visual word recognition in L1 Turkish and in L2 English?
2) Are early stages of visual word recognition in L1 and L2 influenced by semantic and/or orthographic relatedness between morphologically complex words and their base forms?
3) Do advanced Turkish learners of L2 English employ the same mechanisms in L2 processing as native Turkish speakers do in L1 processing?

In relation to L1 processing, it is expected that native speakers of Turkish will process both inflected and derived words in a morphologically structured format. One reason for this expectation is that morphological decomposition effects have been found for inflectional and derivational processes in different native languages, including Turkish (Kırkıcı & Clahsen, 2013). Another reason is based on the rich and productive morphology of Turkish. Hankamer (1989) estimates that Turkish words contain 4.8 morphemes on average, which implies that multimorphemic Turkish words are easily formed through affixation as illustrated in the nineteen-morpheme word *muvaffak-iyet-siz-leş-tir-ici-leş-tir-iver-e-me-yebil-ecek-ler-imiz-den-miş-siniz-cesine (as if you were one of those we cannot easily make a maker of unsuccessful ones)* formed only through suffixation. On this basis, Hankamer argues that "…the FLH [full listing hypothesis] cannot be seriously maintained for such languages [languages with agglutinative suffixation] because of the size, the complexity, and the sheer number of words" and concludes that "…for agglutinative languages at least, human word recognition does involve parsing…" (p. 401); thus, this conclusion promotes the expectation of decompositional processing in L1 Turkish. Considering the findings of L1 studies (e.g. Rastle, Davis, Marslen-Wilson & Tyler, 2000; Marslen-Wilson, Bozic & Randall, 2008), it is also anticipated that early word recognition processes will be independent of semantic and orthographic relatedness.

With respect to L2 morphological processing, previous studies have failed to present conclusive findings (e.g. Perani et al., 1998; Ullman, 2005). If the same mechanisms are indeed employed in L1 and L2 processing, advanced Turkish learners of L2 English are expected to display processing patterns indicative of morphologically decomposed representations for both inflected and derived words in L2. Furthermore, their morphological processing is expected to proceed independent of semantic and orthographic overlap between inflected/derived words and their stems.

On the other hand, if L1 and L2 processing depend on different mechanisms, Turkish speakers' ability to make use of combinatorial processing will be reduced in their L2. In the light of earlier results (Silva & Clahsen, 2008; Kırkıcı & Clahsen, 2013), it is predicted that derived word forms, but not inflected forms, will be recognized in a decomposed fashion during L2 processing, and that orthographic information will not play any role during early morphological processing. A further prediction is that the initial stages of morphological processing will not be constrained by semantic information and, hence, the decomposition of derived word forms will be purely morphological in nature.

CHAPTER 2

REVIEW OF LITERATURE

This chapter encompasses four main sections. The first section provides an overview of inflectional and derivational phenomena. In the second section, L1 morphological processing models are presented under two headings, namely single mechanism models and the dual mechanism model. The third section contains a discussion of controversial approaches to L2 morphological processing. Finally, in the fourth section, previously conducted L1 and L2 studies are reviewed.

2.1 Inflectional and Derivational Processes

2.1.1 Introduction

While some claim that the "word" is the basic unit of language (e.g. in Word Grammar developed by Hudson (1984)), others assert that the unit of language recognition is the "morpheme" which has been defined as the smallest meaningful unit of language (Bloomfield, 1933) or the smallest unit of grammatical analysis (Lyons, 1968). According to the morpheme-based approach, words such as *horses*, *disgrace* and *teapot* have complex structure since they are composed of two morphemes (*horse* + *s*, *dis* + *grace* and *tea* + *pot*). The processes involved in morphologically complex word formation are often divided into three categories as inflection, derivation, and compounding. Inflection and derivation are linguistic processes whereby an inflectional affix or derivational affix attaches to a stem (e.g. *horse* + *s* → *horses*, *dis* + *grace* → *disgrace*). Compounding, on the other hand, is a linguistic process resulting in a combination of stems (e.g. *tea* + *pot* → *teapot*), and in this process language users cannot randomly put any two stems together because there are certain constraints on compound formation. It would be of interest to examine the role of these constraints in morphological processing; however, as the current study aims to investigate how inflected and derived words are processed, compounding is not included in the research focus of this study.

2.1.2 Is There a Distinction between Inflection and Derivation?

Although inflection and derivation are taken to be distinct processes in existing discussions and in this study, the question of whether inflection and derivation are two separate phenomena is still a controversial one. On the one hand, it is argued that there is no substantial need to distinguish inflection from derivation and that, in contrast, the morphology of inflection and derivation bears similarities. For example, Bochner (1992, p. 14) points out that the same types of affixation operations (prefixation, suffixation, and infixation) are involved in both inflectional and derivational uses across languages. Aronoff (1994, p. 127) also underlines the unity of inflectional and derivational morphology by noting that some affixes (e.g. *-ing* in English) might serve as both inflectional and derivational morphemes. Furthermore, Distributed Morphology approaches do not make any explicit distinction between inflectional and derivational processes (Harley & Noyer, 1999).

On the other hand, linguistic descriptions of morphological processes typically draw a distinction between inflection and derivation. Inflection is described as a "lexeme-preserving" or "paradigmatic" process which produces different word-forms of a particular lexeme, while derivation is traditionally described as a "word formation" process which creates new lexemes (Blevins, 2006). In this sense, word-form producing inflection (e.g. *friends* is a form of *friend*) functionally differs from lexeme producing derivation (e.g. *friendship* and *friend* are separate lexemes/lexical entries). Based on this functional difference between inflection and derivation, realization-based theories of morphology assert that inflected and derived words have different morpholexical representations in the mental lexicon (Matthews, 1991; Anderson, 1992).

In addition to the definitional distinction between inflectional and derivational processes, Stump (1998) presents five criteria to be used in distinguishing these two morphological systems from each other. First of all, inflectional processes preserve lexical meaning and syntactic category of the stems, whereas derivational processes often undergo changes in terms of lexical meaning and syntactic category (e.g. *equality* is a noun derived from the adjective *equal*). Second, inflectional affixes are syntactically relevant; that is, the use of a particular inflectional word-form is largely dependent on the syntactic context of a given lexeme (e.g. *She is *write/*writes/writing/*wrote/*written a letter*). On the other hand, derivational affixes are syntactically irrelevant because a grammatical context does not require a lexeme to be morphologically simplex (e.g. *pupil*) or morphologically complex (e.g. *learner*).

The third criterion is that of productivity. While inflectional processes are productively used (e.g. *mothers*, *fathers*, *daughters*, *sons*), derivational processes have a limited range of usage (e.g. *motherhood*, *fatherhood*, **daughterhood*, **sonhood*). Another criterion is that of semantic regularity. Inflection is semantically more regular than derivation. The past tense suffix *-ed*, for example, always refers to the past no matter which verb it attaches to. However, if we take the derivational suffix *-ize*, its semantic effect is variable (e.g. *vaporize*: cause something to become vapor, *hospitalize*: put somebody into a hospital). Lastly, unlike derivation, inflection closes words to further derivation (e.g. *booklets* is grammatical, while *bookslet* is not grammatical).

2.2 Models of Morphological Processing and Representation in L1

Two competing views have emerged as to how morphologically complex words are processed in a native language. The first one posits that morphological processes are executed by a single system, while the second one argues for two distinct systems employed during morphological processing. Below, these two positions will be discussed.

2.2.1 Single-Mechanism Models

Depending on whether morphologically complex words are processed through whole-word-based or rule-based representations, single-mechanism models are categorized into two classes: single-mechanism associative (connectionist) models and single-mechanism rule-based models.

2.2.1.1 Associative Accounts

Associative models of morphological processing hypothesize that morphological rules (and rules in general) are simply descriptive tools which have no mental representations. Therefore, associative models of morphology do not draw any categorical distinction between morphologically simple and complex word forms, instead proposing that all word forms are represented as whole units in a single connectionist system. This system is built upon a network of associative connections between words, the weights of which are adjusted based on factors like phonological similarity and frequency of occurrence. On account of the fact that word forms sharing phonological features exhibit "gang effects", i.e. strong lexical relations, phonologically similar forms are accessed easily (Stemberger & MacWhinney, 1988). In a similar vein, highly frequent word forms establish stronger associative relations and are retrieved faster relative to low frequency forms (Alegre & Gordon, 1999).

Rumelhart and McClelland's (1986) parallel distributed processing model, which is one of the most prominent associative models, has laid significant groundwork for later models (e.g. MacWhinney & Leinbach, 1991; Plunket & Marchman, 1993). Simulating the acquisition of the English past tense, the Rumelhart and McClelland model is comprised of three parts: an encoding network, a pattern associator and a decoding network (see Figure 1). Of particular importance is the pattern associator in which all learning occurs. The pattern associator consists of an input pool and an output pool, each of which includes 460 units that represent Wickelfeatures (triplets of phonetic features) such as fricative, voiced, nasal, etc. The input units represent the base forms of verbs, while the output units represent the patterns that the model produced as the past tense correspondences of the base forms.

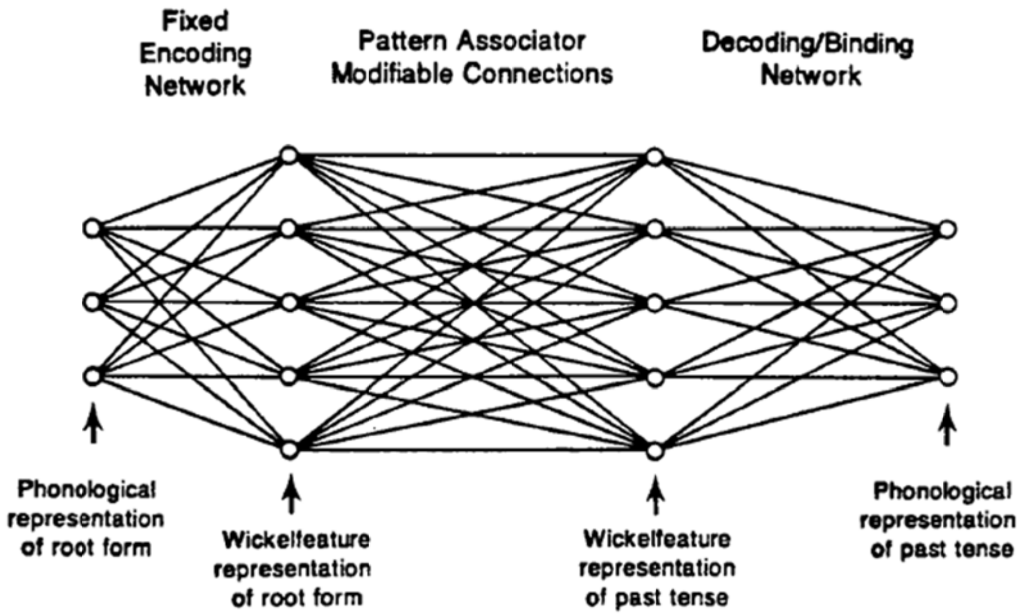

Figure 1: The basic structure of the Rumelhart and McClelland (1986) Model

In the pattern associator, each input unit is connected to each output unit. At first all these connections are set to 0, which means that there is no effect of the input units on the output units. However, the strengths of these connections can be changed as a result of the comparison of the output patterns generated by the model with the correct past tense forms. When the model produces the correct forms, there is no need for any adjustment. If the model produces an incorrect form, then the connection weights for the correct output units are strengthened. This adjustment process continues until the correct past tense forms are achieved. As for the encoding and decoding networks, the former converts phonemes into featural representations of the base forms of verbs, and the latter converts featural representations of the past tense forms into phonemes.

With the purpose of simulating the early stages of past tense acquisition, the Rumelhart and McClelland model was trained in two stages. In the first stage, 10 high frequency verbs (2 regular and 8 irregular verbs) and 10 training cycles were introduced, and the model was able to produce correct past tense forms for both regular and irregular verbs. In the second stage, the model was provided with additional 410 medium frequency verbs (334 regular and 76 irregular verbs) and 190 training cycles. For regular verbs, the model performed correctly. For irregular verbs, on the other hand, the model overregularized irregular verbs at the beginning of the training cycles but then correctly produced irregular past tense forms. Thus, the model exhibited almost perfect performance on both regular and irregular verbs at the end of the training cycles. Based on these findings, Rumelhart and McClelland (1986) suggest that the overall learning pattern displayed for irregular verbs (accurate production, overregularization, and again accurate production) reflects the U-shaped learning-curve effect observed in children, and that regular and irregular past tense forms can be learned without any need for inflectional rules.

However, Pinker and Prince (1988) pointed out a serious problem with this model, namely generalization problem with regular verbs. Immediately after the training stages that ended with successful performance on both regular and irregular past tense verbs, Rumelhart and McClelland presented 86 lower frequency verbs (72 regular and 14 irregular verbs) to the model. Yet, the model overall failed to generate correct past tense outputs for the new regular verbs. As noted by Pinker and Prince (1988), the model produced incorrect outputs for 24 regular verbs and no outputs for 6 regular verbs (out of 72). Unlike with regulars, the model performed correctly with the new irregular verbs. This generalization problem with regular verbs is taken as indicative of the fact that single-mechanism associative models of morphology are inadequate to account for the processing of regularly inflected word forms. To overcome this shortcoming, additional associative models have been developed. However, the details of these models with varying degrees of success are beyond the scope of the current study.

2.2.1.2 Rule-Based Accounts

Rule-based accounts propose that morphologically complex words are processed in a single combinatorial mechanism, and that all complex word forms are decomposed into their constituents. Taft and Forster (1975), for example, argue that prefixed words are recognized after they are segmented into their prefixes and stems (e.g. *reprint* → *re* + *print*), and in this respect, their prefix stripping model represents an early attempt to draw attention to the role of morphology in language processing.

More recently, Yang (2002) put forward the rules-and-competition model, which is a continuation of the generative phonological account developed by Halle and Mohanan (1985) and Halle and Marantz (1993). According to this model, the rule-based approach is employed for the past tense verb forms in English regardless of whether the verb forms are regular or irregular. Regular verbs form their past tenses by the default *-ed* rule, whereas irregular verbs form their past tenses by phonological rules such as those illustrated in (1).

(1) {feed, shoot …} ⇨ Vowel Shortening
{lose, sleep, …} ⇨ *-t* Suffixation & Vowel Shortening
{bring, think, …} ⇨ *-t* Suffixation & Rime → a

Yang (2002) assumes that language users learn the default and irregular rules, not the past tense forms, of each verb. A further assumption is that there is a competition between the default and irregular rules, as suggested by the name of the model. Each irregular verb is assigned to a particular rule class. If a given verb does not belong to any irregular rule class, then the verb forms its past tense by the default rule. Using the corpus from Marcus et al. (1992), who examined young children's past tense production, the model also offers two important predictions about the effects of frequency on the rate of correct usage. First, if two verbs belong to the same rule class, the verb with higher frequency will display a higher rate of correct usage as seen in (2) (taken from Don, 2014, p. 187). Second, if two verbs from two different rule classes are matched in frequency, the verb from the class with higher frequency will have a higher rate of correct usage as shown in (3) (taken from Don, 2014, p. 188). In addition, it is expected that the higher rate of correct usage irregular verbs have, the less prone to overregularization they are.

(2)	Verb	Verb frequency in corpus	Correct use in corpus
	put	2,248	95.2%
	hit	66	90.8%
	hurt	25	86.6%
	cut	21	71.1%

(3)	Rule class	Verb	Correct use in corpus
	[-Ø + No Change]*	*hurt, cut*	80.4%
	[-Ø + Rime → u]	*know, throw*	49.1%

* The rule class *(-Ø + No Change)* has a relatively higher frequency.

As noted by Silva (2009), the rules-and-competition model has some problems with the irregular rule classes. Regarding the influence of frequency on the irregular rules, Yang (2002) compares the rates of correct usage and concludes that high frequency leads to more accuracy for the irregular verbs; however, he makes such predictions without any statistical findings. For example, the frequency of the verb *hit* is considerably lower than the frequency of the verb *put*, as presented in (2), but these two verbs might not differ significantly in their rates of correct usage. Also, all the verbs in the irregular class *(-Ø + Backing Ablaut)* do not consistently display the same phonological changes (e.g. *take* → *took*, *win* → *won*, *write* → *wrote*). More importantly, this model cannot successfully explain the U-shaped developmental pattern of the irregular past tense forms, though it attributes overregularization rules to the frequency of irregular verbs. Taken together, all these problems imply that irregular word forms might not be accurately accounted for by rule-based models of morphological processing.

2.2.2 The Dual-Mechanism Model

Single-mechanism models hold that all complex word forms (regulars and irregulars) are represented in and processed by a uniform mechanism. However, as has been pointed out in the previous section, these models have been found insufficient in accurately presenting the whole picture of morphological processing. Single-mechanism associative accounts appear to be unsuccessful in explaining the processing of regular forms but offer potentially useful models of the processing of irregular forms. By contrast, single-mechanism rule-based accounts seem to be unsuccessful in dealing with the processing of irregulars, even though they constitute potentially successful models of the processing of regulars. As a result, Pinker and collaborators (Pinker, 1991, 1999; Pinker & Ullman, 2002) have proposed the dual mechanism model in order to account for the entirety of morphological processes.

The dual mechanism model consists of two basic systems: a mental lexicon (i.e. associative memory system), which includes arbitrary sound-meaning mappings underlying morphemes and simple words, and a mental grammar (i.e. rule system), which contains productive and combinatorial operations forming complex words and phrases (Pinker & Ullman, 2002). Thus, in relation to morphological processing, this hybrid model posits that irregular word forms are stored as full-form representations in the mental lexicon, while regular word forms are computed by rules in the mental grammar.

Although the computation of regular forms is achieved by a rule-based process, this does not mean that regular forms can never be accessed as whole words. Regular forms may also be stored in the mental lexicon under certain circumstances, depending on the frequency of regular forms and the existence of alternative irregular forms. For example, Alegre and Gordon (1999) reported that English regular word forms with a frequency higher than 6 per million tend to be stored undecomposed in the associative memory, indicating that the more frequently a regular form is computed, the more likely it is to be stored in the lexicon as a whole. Similarly, Berent, Pinker and Shimron (1999) suggested that if regular word forms have alternative irregular forms (e.g. *dive-dived/dove*, *smell-smelled/smelt*), the full-form storage of those regular forms may be required since the availability of their irregular alternatives (e.g. *dove, smelt*) can block the rule-based mechanism (see below).

A further important point is that the dual mechanism model employs a blocking mechanism in order to prevent overregularization errors. When an irregular form or its stem is retrieved from the lexicon, an inhibitory signal is sent to the combinatorial system and the attachment of a regular suffix is blocked (see Figure 2). This blocking mechanism prevents the production of forms like **singed* or **sanged*. However, when no irregular form can be retrieved from the lexicon, the rule system cannot be blocked, thus allowing for the application of the default regular rule (e.g. as in the cases of non-existing verbs like *wug-wugged* and novel verbs like *fax-faxed*).

It is also worth noting that the dual mechanism model has different variants which are broadly classified as dual route models. According to dual route models, morphologically complex words are recognized either through prelexical morphological parsing which is based on decomposition of orthographic/spoken input into smaller morphological units or through a direct access route which is based on stored whole-word representations (Clahsen, 2004). Yet, dual route models make different assumptions concerning how these two lexical access routes operate. In the Augmented Addressed Morphology model (AAM), for instance, whole-word access is the preferable route for all known words, and the parsing route is used as a back-up mechanism for rare or novel morphologically regular forms (Caramazza, Laudanna

& Romani, 1988; Chialant & Caramazza, 1995). On the other hand, the Morphological Race Model (MRM) claims that the parsing route and the direct route are activated in parallel from the very beginning of word recognition process. Which of these two routes is to be taken is determined by various factors such as lemma frequency, surface-form frequency, neighborhood size, and phonological and semantic transparency (Schreuder & Baayen, 1995; Baayen, Dijkstra & Schreuder, 1997).

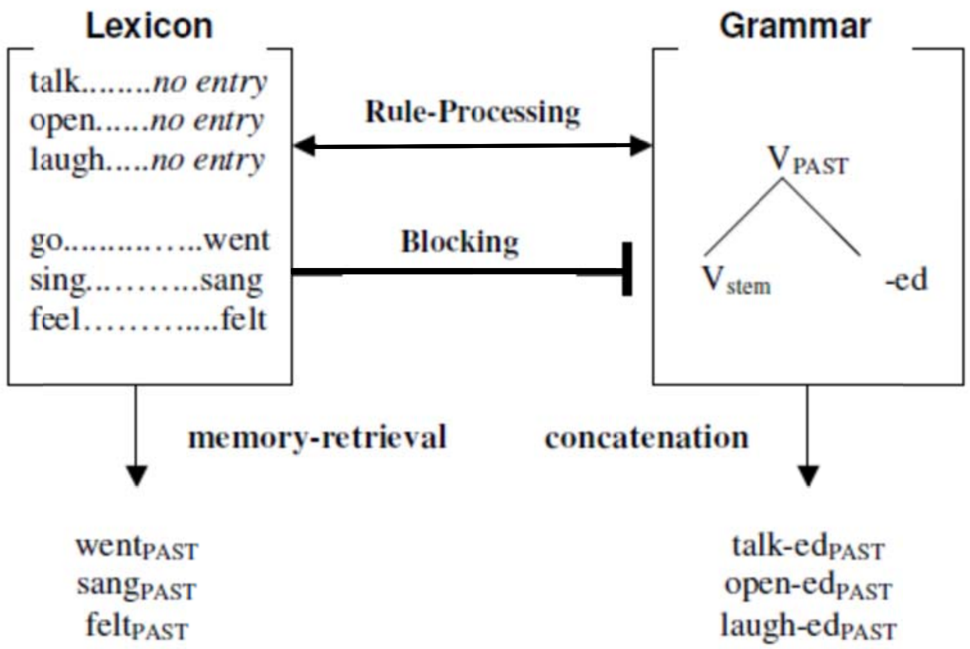

Figure 2: A simplified representation of the dual-mechanism model (taken from Kırkıcı, 2005)

2.2.2.1 The Declarative/Procedural Model

Extending the dual mechanism model, Ullman (2001a, 2001b) proposed the declarative/procedural model which is essentially based on the distinction between two brain memory systems. The declarative memory system is rooted in medial temporal lobe structures that have been implicated in the learning and conscious use of knowledge about facts and events, and in the learning of arbitrarily related information – that is, in the associative binding of phonological, semantic or other memorized information related to words (Ullman, 2004). On the other hand, the procedural memory system is hypothesized to be rooted in frontal/basal-ganglia structures and to be specialized for "the learning of new, and the control of established, sensori-motor and cognitive habits, skills and other procedures, such as riding a bicycle and skilled game playing" (Ullman, 2004, p. 237). In other words, it is hypothesized that the declarative memory system subserves the mental lexicon and plays a role in the learning of morphological transformations involving phonological changes (e.g. irregular complex words), while the procedural memory system subserves the mental grammar and undertakes the non-conscious learning of morphological transformations involving rule-based processes (e.g. regular complex words) (Ullman, 2001a). In addition, the declarative/procedural model postulates that these two memory systems operate in parallel to compute a morphologically complex form, but that rule-based computation in the procedural memory system is blocked when the complex form is successfully retrieved from the declarative memory system.

2.3 Approaches to Morphological Processing and Representation in L2

Although there has recently been growing interest in non-native language processing, it still remains unclear how L2 learners process the target language in comparison to L1 speakers. To date, two main views have been set forth concerning whether L2 learners apply the same or different mechanisms for language processing as L1 speakers.

2.3.1 Same Cognitive Mechanisms for L1 and L2

To investigate whether or not L2 processing is achieved through the same neural mechanisms that underlie L1 processing, Abutalebi (2008) presents an overview of functional neuroimaging studies and concludes that L1 and L2 processing share the same neural systems. Similarly, Perani et al. (1998) and Indefrey (2006) maintain that L2 processing activates the same cortical regions as L1 processing.

In relation to differences observed between native speakers and L2 learners, the shared-systems view claims that the reported L1/L2 differences can be accounted for as the effects of various factors on L2 acquisition and processing. For instance, Tokowicz and MacWhinney (2005) found L1 transfer effects in their event-related brain potential (ERP) study. The study addressed whether English (L1) speakers were sensitive to violations in L2 (Spanish) for syntactic constructions that were formed in three different conditions: *matching constructions* that are formed similarly in English and Spanish (i.e. auxiliary marking), *mismatching constructions* that differ between the two languages (i.e. determiner number agreement where English makes use of the same determiner (*the*) for both singular and plural nouns, whereas Spanish requires different determiners (*el* vs. *los*) for singular and plural nouns), and *no-matching constructions* that apply only in L2 (i.e. determiner gender agreement). When presented with three types of grammaticality violations, L2 learners of Spanish displayed sensitivity to violations for the matching constructions. However, they were not sensitive to violations for L2 constructions that were formed differently in their L1. These findings demonstrated that depending on the similarity between L1 and L2, L2 learners can successfully execute L2 syntactic processing even in their early stages of learning.

In a similar vein, Wartenburger et al. (2003) showed evidence of the influence of age of onset of acquisition (AoA) of a second language on L2 processing by using functional magnetic resonance imaging (fMRI). In their study, L1 and L2 grammatical processing were compared in two groups of L1 Italian-L2 German bilinguals – early acquisition and late acquisition bilinguals – who differed in their AoA of German. In the early acquisition bilinguals, their grammatical judgments in Italian and German elicited a similar degree of activation in language-related regions of the brain. In the late acquisition bilinguals, on the other hand, their L1 and L2 grammatical judgments yielded significant language-specific differences as a result of greater activation in L2 German. These results proposed that the AoA can play a key role in determining how grammatical processes in L1 and L2 are represented in the neural system.

According to Hasegawa, Carpenter and Just (2002), reduced automaticity in L2 processing is another potential factor that can lead to L1/L2 differences. Hasegawa and colleagues investigated the neural structures that were employed during L1 and L2 comprehension, by taking fMRI measures of cortical activation that occurred while L1 Japanese-L2 English learners listened to affirmative (structurally easy) and negative (structurally difficult) sentences. Listening comprehension in the L1 Japanese and the L2 English activated an (to a great extent) overlapping network of cortical areas, which was taken as an indication that both L1 and L2 processing rely on the same neural mechanisms. Nonetheless, the English sentences produced a larger magnitude of activation than the Japanese sentences did. In addition to the overall stronger activation in the L2 English, the learners showed greater activation for structural difficulty in their L2. The higher volume of activation in English, contrary to in Japanese, suggested that L2 processing might require more computational effort than L1 processing, and that this demanding effort might result in comparatively lower automaticity in L2 processing. Also, McDonald (2006) pointed out the effects of low L2 working memory capacity, insufficient L2 decoding skills and slow L2 processing speed on late L2 learners' poor performance (relative to native speakers).

Overall, the view of "same cognitive mechanisms for L1 and L2" advocates that essentially similar mechanisms are involved in L1 and L2 processing, and that differences found between L1 and L2 processing are due to the influence of some variables (i.e. L1 transfer, late age of onset of acquisition, decreased automaticity, limited L2 working memory capacity, poor L2 decoding skills, and slowness of L2 processing speed) on L2 processing.

2.3.2 Different Cognitive Mechanisms for L1 and L2

Proponents of “different cognitive mechanisms for L1 and L2” hold the view that L2 processing fundamentally differs from L1 processing, especially for late L2 learners. To illustrate, Clahsen, Felser, Neubauer, Sato and Silva (2010) provide a detailed overview of previous studies examining the processing of morphologically complex words in highly proficient adult L2 learners and conclude that there are clear differences between the L1 and L2 processing of inflectional, derivational and morphosyntactic phenomena. Even though Clahsen et al. do not reject the effects of a number of factors mentioned in the previous section (e.g. influence from L1, speed of processing) on L2 processing, they argue that such factors are not sufficient to fully account for the L1/L2 processing differences.

Although the declarative/procedural model has mainly been developed to explain morphological processing and representation in L1 (see Section 2.2.2.1), the model makes a set of predictions about L2 processing as well. It is basically predicted that L2 learners, particularly those who started to learn their L2 after puberty, rely largely on declarative memory “even for functions that depend upon the procedural system in L1” and thus “tend to memorize complex linguistic forms (e.g. *walked*) that can be computed compositionally by L1 speakers (e.g. *walk* + *-ed*)” (Ullman, 2005, p. 152). For late L2 learners, this overreliance on declarative memory may be caused by maturational changes that produce estrogen at increasing levels during puberty; as such, the higher levels of estrogen may improve declarative memory as well as suppress procedural memory (Ullman, 2004, 2005).

Along similar lines, Clahsen and Felser (2006a) highlight qualitative differences in L1 and L2 processing. Their shallow structure hypothesis (SSH) postulates that compared to native speakers, adult L2 learners underuse grammatically-based information and rely heavily on lexical-semantic information sources during grammatical processing.

Taken together, the central claim made by Clahsen, Ullman and their associates is that L2 learners exhibit different processing patterns from native speakers. However, it is important to note that this does not mean that L2 learners can never reach native-like levels of processing. Increased L2 proficiency, for instance, may promote a shift towards the use of procedural memory for computation of complex forms (Ullman, 2005, 2012; Morgan-Short & Ullman, 2011). Furthermore, as a consequence of increasing practice and experience, L2 learners may achieve native-like neurocognition (Paradis, 2009; Clahsen & Felser, 2006b).

2.4 Previous Studies on Morphological Processing

Using different psycholinguistic methods and techniques, e.g. lexical decision, priming, self-paced reading, and ERPs, numerous studies have been conducted to investigate how morphologically complex words are processed by native and/or non-native speakers of various languages (e.g. English: Pliatsikas & Marinis, 2013; Turkish: Kırkıcı & Clahsen, 2013; German: Hahne, Mueller & Clahsen, 2006; Spanish: Bowden, Gelfand, Sanz & Ullman, 2010; Swedish: Portin, Lehtonen & Laine, 2007; French: Longtin, Segui & Hallé, 2003; Hebrew: Frost, Deutsch, Gilboa, Tannenbaum & Marslen-Wilson, 2000). This section will summarize the findings of previous studies concerning the processing of inflected and derived words. It should be recognized, however, that the main focus will be on the results obtained from earlier priming experiments because the current study employs the masked visual priming technique.

2.4.1 Inflectional Processing

The question of whether the representation of and access to morphologically complex words involve holistic (word-based) or combinatorial (morpheme-based) processes has been a fundamental issue in theoretical accounts of morphological processing. To settle this storage/composition debate, a good many studies have been conducted on the English past tense which allows for both idiosyncratic irregular and rule-based regular forms; the findings of these studies have led to the development of three alternative models of morphological processing (each of which is described in more detail in Section 2.2). One such model is the single mechanism rule-based model, which assumes that all the past tense forms are constructed with the application of rules, e.g. the attachment of the suffix *-ed* to verb bases (Ling & Marinov, 1993). Another model is the single mechanism associative model. According to this connectionist model, both regular and irregular forms are accessed as unanalyzed wholes (Rumelhart & McClelland, 1986; McClelland & Patterson, 2002). The third alternative is the dual mechanism model which accepts rule-governed accounts for the regular forms and connectionist accounts for the irregular forms (Pinker, 1999; Ullman, 2001a).

Although it still remains controversial which of these models (if any) presents the most accurate account of morphological processing, a considerable number of studies have supported the dual mechanism model in terms of the distinction between regular and irregular inflections. In this regard, one of the most important studies has been carried out by Marslen-Wilson and Tyler (1997), who looked into the processing of regular and irregular forms of the English past tense by brain-damaged aphasic patients. The study used an auditory priming task which requires participants to make a timed lexical response (a word or a nonword) to a spoken target word immediately preceded by a spoken prime word. Two groups of aphasic patients whose neurological damage was located in different parts of the brain were involved in the experiment. It was found that while one group had difficulty only in processing irregular past forms, the other group had difficulty only in processing regular past forms. This dissociation between regular and irregular forms has been taken as an indication of two separate mechanisms underlying English past tense morphology.

In a more recent study, Morris and Stockall (2012) used the visual masked priming paradigm and ERP recordings to compare the processing of regular and irregular past tense forms in English. According to the behavioral data obtained from the masked priming paradigm, native English speakers displayed shorter reaction times to respond to the verb stem targets which were preceded by identical primes than to those which were preceded by unrelated control primes, suggesting a repetition priming effect. Regularly inflected prime-target pairs also showed the same facilitation as the identical prime-target pairs (i.e. a full priming effect); however, irregularly inflected prime-target pairs revealed less facilitation than the identical pairs (i.e. a partial priming effect). As regards to the results of the ERP data, regular and irregular inflections did not differ in the time courses of their priming effects. Also using the visual masked priming paradigm and ERP recordings, Rastle, Lavric, Elchlepp and Crepaldi (2015) investigated priming effects for regularly inflected third-person singular present tense forms as well as for irregularly inflected past tense forms. Their behavioral data indicated full priming effects for regular inflections, but partial priming effects for irregular inflections. On the other hand, their ERP data showed that priming effects for regulars arose at a time window reflecting up to 250 ms post target onset, whereas priming effects for irregulars emerged at a 400-600 ms time window. When these findings are combined with those by Morris and Stockall (2012), it does not seem to be clear whether priming effects are observed for regular inflections earlier than for irregular inflections. Nevertheless, the evidence that the magnitude of regular inflectional priming is greater when compared to irregular inflectional priming seems to be in support of the dissociation between regular and irregular inflections.

Another related study has been performed by Sonnenstuhl, Eisenbeiss and Clahsen (1999), who examined the processing of regular and irregular past participles plus noun plurals by native speakers of German. This study employed the cross-modal priming paradigm, in which an auditory prime is followed by a visually presented target. The authors found priming differences between regularly and irregularly inflected forms such that regular inflections, i.e. *-t* participles and *-s* plurals, exhibited full priming effects while irregular inflections, i.e. *-n* participles and *-er* plurals, yielded partial priming effects. Hence, Sonnenstuhl et al. (1999) provided further evidence of a dual mechanism system that dissociates regularly inflected forms from irregularly inflected forms for a language other than English. The observed priming differences were explained in the following way: "-s plurals and -t participles are based on affixation rules, they can be decomposed into stem + affix, and can thus prime their base stem directly. Irregular plurals and participles, however, access full-form entries stored in memory and cannot directly activate their corresponding base entries; therefore the priming route is less direct" (p. 228). However, it is important to underline that priming effects are suggestive of decomposition, thus partial priming effects are morphological in nature and should be interpreted not simply as indicative of whole-word storage, but as indicative of less reliance on combinatorial processes (Silva & Clahsen, 2008). Overall, the priming studies reported above are indicative of the dual nature of inflectional morphology and seem to be compatible with the conclusion that regularly inflected words are parsed into their morphological constituents during native language processing.

With respect to the decompositional processing of regularly inflected words, additional supporting findings have been obtained from studies on frequency effects. For example, in line with the idea that frequency effects are suggestive of storage and full-form representations, Prasada et al. (1990) and Ullman (1999) reported that frequency effects were found for irregular but not regular past tense verbs in English. However, these results should not be taken to imply that stored regular forms are never accessed, e.g. lexical decision tasks might tap into stored representations for high frequency regular forms (Pinker & Ullman, 2002, p. 458). In this respect, Alegre and Gordon (1999) provided empirical support by showing that native English speakers produced whole-word frequency effects for regularly inflected forms with high frequencies.

In another study, by Portin et al. (2007), the non-native processing of Swedish inflected nouns and monomorphemic words was investigated in three frequency ranges (low, medium, and high) by using a visual lexical decision task. Two proficiency groups [1] of L1 Finnish-L2 Swedish learners participated in the experiment, and the results showed a similar pattern for both low and high proficiency groups. In the low-frequency range, L2 learners displayed longer reaction times for inflected nouns than for monomorphemic control words; that is, there was a processing cost indicating morphological decomposition for low-frequency inflected words. In contrast, no significant differences were found between reaction times observed for inflected and monomorphemic words in either the medium-frequency range or the high-frequency range, suggesting full-form representations for both medium- and high-frequency inflected nouns. Portin et al. (2007) pointed out that these L2 findings were in parallel with those of Lehtonen et al. (2006), who investigated how native Swedish speakers and early Finnish-Swedish bilinguals processed inflected and monomorphemic words in different frequency ranges (low, medium, and high) and found the pattern of decompositional processing only for low-frequency inflected words.

A further study, which reported the same processing patterns in native and non-native speakers, was conducted by Pliatsikas and Marinis (2013). This study examined how English regular and irregular past tense forms are processed when they are presented in sentence contexts rather than in isolation, and whether the nature of L2 exposure affects L2 learners' processing performance. Advanced L2 learners of English with Greek as L1, half of whom had been learning English in a naturalistic environment and the other half of whom had been exposed to English in a classroom setting, and native English speakers were tested in a self-paced reading task. It was found that regularly inflected past tense verbs yielded longer reaction times than irregular verbs; this was argued to be due to the additional processing cost

[1] The assignment of junior and senior students to proficiency groups was based on their self-evaluations of language skills and the length of their university studies.

that the decomposition of regularly inflected forms did cause. More interestingly, however, these results also held true for native speakers and for both groups of L2 learners, indicating that highly proficient L2 learners could make use of the same processing mechanisms as native speakers, irrespective of the type of L2 exposure.

Although some processing studies, including those by Portin et al. (2007) and Pliatsikas and Marinis (2013), show no essential difference between native and non-native speakers, findings from other studies challenge the view of same mechanisms for L1 and L2 processing. To illustrate, Neubauer and Clahsen (2009) probed the processing of regular and irregular German participles in native speakers and advanced L1 Polish learners of L2 German by running a lexical decision task and a masked priming task. In the lexical decision task, L1 speakers showed frequency effects for irregular *-n* participles, but not for regular *-t* participles. Yet, L2 learners of German displayed frequency effects for both regular and irregular participles. In the masked priming task, the authors found a full priming effect for regulars and a partial priming effect for irregulars in L1 speakers, thereby replicating the results of Sonnenstuhl et al. (1999). In L2 learners, on the other hand, regular participles produced no priming effect while irregular participles exhibited a partial priming effect. Thus, L2 learners differed from L1 speakers in their processing of regularly inflected participles by showing frequency effects but not priming effects, which corroborates Clahsen and Felser's (2006a) hypothesis that L2 processing depends more on lexical storage than on morphological decomposition.

In a similar vein, Silva and Clahsen (2008) analyzed the L1 and L2 processing of regularly inflected English past tense verbs by conducting two masked priming experiments with native English speakers and highly proficient L2 English learners from different L1 backgrounds (Chinese, German, and Japanese). In the first experiment using a prime-presentation time of 60 ms, a full priming effect was found for regular inflections in native speakers whereas no priming effect was obtained in L1 Chinese and L1 German learners. These full versus no priming effects were also reported for native speakers and L1 Japanese learners in the second experiment in which the same materials used in the first experiment were employed, but with a shorter prime-presentation time of 30 ms. Overall, the lack of priming effects in the L2 groups indicates that, in contrast to L1 speakers, L2 learners do not employ early morphological decomposition processes during the processing of regularly inflected words. Besides, the same pattern of results observed in both experiments implies that the L1/L2 processing differences were not due to the influence of short prime duration. Considering that the German L2 learners showed non-native-like processing patterns despite similarities between their L1 German and L2 English, one might also conclude that the L1/L2 processing differences do not stem from the effects of L1 transfer. A further finding to note is that both L1 and L2 groups showed a repetition priming effect, though the L2 learners had overall longer reaction times than L1 speakers. That is, L2 learners showed facilitation effects for the identical prime-target pairs in a native-like manner, despite their low processing speed. Conversely, they did not show any facilitation effect for regularly inflected prime-target pairs; this means that the L1/L2 differences in processing inflected words cannot be explained as a consequence of slow speed of L2 processing either.

More recently, Kırkıcı and Clahsen (2013) carried out a study comparing the processing of inflectional and derivational morphology in Turkish as an L1 and an L2. In relation to the processing of inflected words, their study dealt with regular (Aorist) verb inflection via a masked priming experiment administered to native Turkish speakers and advanced L2 Turkish learners from various L1 backgrounds. Consistent with the results of Silva and Clahsen (2008), it was found that L1 speakers revealed significant priming effects for morphologically related prime-target pairs while L2 learners did not yield any facilitation effect. This contrast of priming effects indicates that highly proficient L2 learners, unlike native speakers, do not process regularly inflected words through the decompositional route during visual word recognition and hence offers strong support for the view of different mechanisms for L1 and L2 processing.

2.4.2 Derivational Processing

Although the issue of whether morphologically complex words are represented and accessed as full forms or as decomposed forms has given rise to a longstanding debate in the field of L1 and L2 morphological processing, the majority of the studies that have attempted to address this storage/(de)composition debate has revolved around inflectional morphology. As a result, models of morphological processing have been basically developed to account for the regular and irregular nature of inflectional processing (e.g. Rumelhart & McClelland, 1986; Pinker, 1999). However, as pointed out by Yang (2005), the regular/irregular inflection distinction actually reflects the difference in the productivity of rules: regular inflections are necessarily productive because of the extensive use of default rules (e.g. the attachment of the *-ed* suffix), while irregular inflections are not productive because of the limited applicability of unpredictable rules (e.g. vowel shortening in *choose-chose*). As such, it has been proposed that the regular/irregular distinction may also be established in derivational morphology, and the question of the extent to which the processing of productive and unproductive derived words involves whole-word storage and morphological decomposition has been raised in the psycholinguistic literature.

To address this question, Marslen-Wilson et al. (1996) explored the native processing of derivational prefixes and suffixes in English in terms of productivity. In this study utilizing the cross-modal priming paradigm, morphologically related primes and targets were different complex words sharing the same derivational affix (in four conditions: productive suffix, unproductive suffix, productive prefix, and unproductive prefix), as illustrated in Table 1. In the study, productive suffixes and prefixes yielded more robust priming effects as compared to unproductive suffixes and prefixes. These priming results were in line with those of Sonnenstuhl et al. (1999), which revealed full priming effects for German regular inflection plus partial priming effects for irregular inflection; this indicates that the regular/irregular distinction can possibly be generalized to productive and unproductive derivations.

Moreover, strong facilitation effects suggest that the recognition of productive affixes takes place early during visual word recognition, and thus provide evidence of the decompositional processing for productive derivation. On the other hand, the reduced facilitation effects of unproductive affixes are indicative of less dependence on combinatorial processes.

Table 1: *Sample set of related prime-target pairs in Marslen-Wilson et al. (1996)*

		Primes	Targets
Suffixes	Productive	darkness	toughness
	Unproductive	development	government
Prefixes	Productive	rearrange	rethink
	Unproductive	enslave	encircle

Additional evidence for the dissociation between productive and unproductive derivations comes from the study by Hagiwara, Sugioko, Ito, Kawamura and Shiota (1999) examining the processing of deadjectival *-sa* and *-mi* nominals in L1 Japanese. The suffixes *-sa* and *-mi* differ in their productivity and meanings: whereas the suffix *-sa* is applicable to a wide range of adjectives including novel words and has a predictable meaning which denotes the degree of X-ness or the state of being X, the *-mi* suffix can apply to only thirty adjectives and can produce unpredictable meanings ranging from feelings to locations. Based on acceptability ratings by aphasic patients with different lesions, this study found that the patients with a lesion in Broca's area had problems with *-sa* suffixations. The patients with damage in the left middle and inferior temporal areas, by contrast, had difficulties with *-mi* suffixations. Taking into consideration that Broca's area is responsible for rule-based processing, it seems that the productive suffix *-sa* entails a rule-governed processing mechanism. On the other hand, the processing of the unproductive suffix *-mi* seems to be dealt with by an associationist mechanism, given that the left middle and inferior temporal areas are responsible for the representation of lexical-semantic information in associative memory.

However, the findings of Hagiwara et al. (1999) are in contrast to the results of Clahsen and Ikemoto (2012), who investigated the same derivational phenomena, i.e. *-sa* and *-mi* suffixations, in L1 Japanese by employing an eye-movement reading experiment, a lexical decision task and a masked priming task. In the eye-movement experiment that examined the processing of deadjectival *-sa* and *-mi* forms in sentence contexts, *-mi* forms produced longer reading times than *-sa* forms. In the lexical decision task, frequency effects were found for both *-sa* and *-mi* forms. Similarly, in the masked priming experiment, equivalent priming effects were obtained for both forms. As regards the results of the lexical decision and masked priming tasks, it is evident that derived forms, irrespective of their productivity, are represented identically at the word-form level. Yet, when semantic properties are activated in context, *-mi* forms produce an additional processing cost because of their unpredictable meanings, which indicates that the productivity differences can be observed only at the meaning level. These findings are noteworthy for two reasons. First, they suggest that productive and unproductive derivations have the same type of form-level representation, and that the regular/irregular dichotomy cannot be extended to derivational morphology. Second, they demonstrate that both productive and unproductive derivations are stored as full-form representations like irregular inflections and, at the same time, are also accessed through combinatorial processes like regular inflections, thus implying that derivational processes are substantially different from inflectional processes.

Significant supporting evidence for the linguistic distinction between derivation and inflection has been provided by Clahsen, Sonnenstuhl and Blevins (2003). Using a cross-modal priming task and a visual lexical decision task, the authors looked into how native speakers of German processed deverbal *-ung* nominalizations and *-chen* diminutives, both of which are highly productive. They found that both *-ung* nominalizations and *-chen* diminutives produced full priming effects (suggestive of decomposition). Based on this priming pattern, the processing of productive derived words is compatible with the processing of regularly inflected words, e.g. *-s* plurals (Sonnenstuhl et al., 1999), but not with that of irregularly inflected words, e.g. *-er* plurals for which partial priming effects were found (ibid). Additionally, this study indicated that both *-ung* nominalizations and *-chen* diminutives showed frequency effects (suggestive of storage). In this sense, productive derivation is aligned with irregular inflection, e.g. *-n* participles in L1 German (Neubauer & Clahsen, 2009), but not with regular inflection, e.g. *-t* participles for which no frequency effects were displayed (ibid). Given these results, it has been suggested that derivation should be distinguished from inflection, and thus that the dual mechanism model should include three different elements classified as irregular, derived, and productively inflected forms (Clahsen et al., 2003, p. 127).

The processing of deverbal *-ung* nominalizations in L2 German was also investigated using a visual lexical decision task and a visual masked priming task (Clahsen & Neubauer, 2010). The two tasks were administered to L1 speakers of German and Polish learners of L2 German. In the lexical decision task, the L2 learners exhibited larger frequency effects than the L1 speakers. This means that although *-ung* derivations are represented as whole forms by both native and non-native speakers, the degree of reliance on storage is greater in L2 processing. Differences between L1 and L2 processing were also observed in the masked priming task: whereas the L1 speakers displayed full priming effects, the L2 learners did not reveal any priming effects, indicating that *-ung* derivations are not broken down into their morphological constituents in L2 processing. As such, the pairing of large frequency effects and no priming effects in L2 learners of German may be taken as support for the claim that L2 learners are heavily dependent on lexical storage in the processing of derived forms. On the other hand, the L1 findings of this study corroborate the earlier results reported in Clahsen et al. (2003).

Silva and Clahsen (2008) examined the L1 and L2 processing of deadjectival nominalizations with the productive suffix *-ness* and with the unproductive suffix *-ity* in English via a masked priming task conducted with native speakers of English and two groups of advanced L2 learners of English with German or Chinese as their L1. The results indicated that both *-ness* and *-ity* derivations yielded full priming effects in L1 speakers and a partial priming effect in the L2 groups. Thus, the demonstration that both *-ness* and *-ity* nominalizations produced the same type of priming effects confirms the finding of Clahsen and Ikemoto (2012), who argued that productive and unproductive derivations are represented in the same way at the word-form level. Additionally, the authors highlight the following conclusions from these priming patterns. First, the full versus partial priming effects obtained for L1 and L2 participants, respectively, imply that L2 learners depend less on the grammaticality-based processing than L1 speakers. However, it also needs to be noted that these reduced priming effects observed for the German and Chinese L2 learners are in contrast to the result of Neubauer & Clahsen (2010), who found no priming effects for morphologically derived prime-target pairs in L2 learners of German. Second, the fact that both German and Chinese L2 learners of English exhibited the same processing pattern indicates that they were not affected by the linguistic properties of their L1 during the processing of derived forms. Finally, recall that Silva and Clahsen (2008) also investigated the processing of regularly inflected past tense verbs and found no priming effects in the L2 groups but full priming effects in L1 speakers (as reported in the previous section). When the results obtained on derivational and inflectional processing are compared, it is clear that derived and inflected forms were processed differently in L2 (reduced priming vs. no priming). However, this finding has been interpreted in line with realization-based models of morphology which postulate that derived and inflected words have different morpholexical representations.

With the aim of investigating whether Silva and Clahsen's (2008) findings can be generalized to typologically different language, Kırkıcı and Clahsen (2013) explored the L1 and L2 processing of derived and inflected words in Turkish. In the study, native speakers of Turkish and highly proficient L2 learners of Turkish from different L1 backgrounds performed a masked priming task including deadjectival derivations with the productive nominalizer *-lIk* and regular (Aorist) verb inflections. In relation to the processing of *-lIk* derivations, both L1 and L2 speakers exhibited priming effects, reflecting facilitation for derived prime-target pairs in L1 and L2. Regarding the processing of inflected verbs, the results showed priming effects for L1 speakers but no priming for L2 learners (as presented in the previous section in more detail). Overall, it seems that inflected and derived forms are processed similarly through combinatorial mechanisms in L1 Turkish. On the contrary, L2 processing reveals differences between inflectional and derivational processes such that inflected forms are represented as full forms while derived forms are parsed into their morphemes. Thus, this study has extended the findings of Silva and Clahsen (2008) by demonstrating that inflected and derived forms may show representational differences in L2 Turkish.

2.4.3 The Effects of Semantic and/or Orthographic Information on Morphological Processing

A substantial amount of research has investigated how native speakers process morphologically complex words during visual word recognition. Most studies utilizing the visual masked priming paradigm have found that the recognition of a stem target is facilitated when preceded by a morphologically related prime, suggesting that morphologically complex words are decomposed into their constituent morphemes (e.g. Silva & Clahsen, 2008; Clahsen & Ikemoto, 2012; Kırkıcı & Clahsen, 2013). However, morphologically related primes may also share a semantic and an orthographic relationship with their stem targets, as in derivationally related prime-target pairs (e.g. *darkness-DARK*). In such cases, the facilitation obtained for derived words might be due to the influence of the semantic and/or orthographic overlap between primes and targets. This possibility has motivated many researchers to unravel the nature of derivational processing in different languages (e.g. Frost, Forster & Deutsch, 1997; Rastle et al., 2000; Marslen-Wilson et al., 2008; Boudalelaa & Marslen-Wilson, 2005; Diependaele, Sandra & Grainger, 2005; Kazanina, Dukova-Zheleva, Geber, Kharlamov & Tonciulescu, 2008).

In some studies, it has been demonstrated that the semantic similarity between derivationally related primes and targets does play a role in morphological priming effects. For example, Rastle et al. (2000) examined the effect and time course of morphological, orthographic, and semantic information in visual recognition of English derived words by conducting two sets of masked priming experiments. In the first set of experiments, five different prime-target conditions were tested: (1) transparent-derived condition where primes and targets shared a morphological, orthographic and semantic relationship (+M+O+S), e.g. *departure-DEPART*; (2) opaque-derived condition in which targets were preceded by morphologically and orthographically related, but semantically unrelated (+M+O-S), primes, e.g. *apartment-APART*; (3) form control condition where primes were orthographically related, but morphologically and semantically unrelated (-M+O-S), to targets, e.g. *electrode-ELECT*; (4) semantic control condition in which primes and targets were semantically related, but morphologically and orthographically unrelated (-M-O+S), e.g. *cello-VIOLIN*; (5) identity condition in which primes were identical to targets, e.g. *cape-CAPE*. The priming effects across these five conditions were analyzed in three prime-presentation time (SOA) conditions: 43 ms, 72 ms, and 230 ms. The priming effects for identity and transparent-derived pairs were equivalent and significantly greater than those for form and semantic control pairs at all SOAs, indicating that morphological priming effects could not be attributed to only orthographic relatedness or only semantic relatedness between primes and targets. Rastle et al. (2000) also concluded that semantic transparency did not affect the very first stages of morphological processing, considering that both transparent-derived and opaque-derived conditions yielded significant priming effects at the shortest SOA. However, it must not be overlooked that semantically transparent derived

(+M+O+S) pairs produced greater priming effects than semantically opaque derived (+M+O-S) pairs, since this difference in the amount of priming can be taken as evidence that semantic transparency influences (albeit does not fully govern) morphological decomposition processes.

In the second set of experiments, the prime-target conditions were the same as in the first experiment, except that the authors replaced the opaque-derived condition with one in which primes and targets were morphologically unrelated, but orthographically and semantically related (-M+O+S), e.g. *screech-SCREAM*, in order to investigate whether priming effects could be due to the summed effects of orthographic and semantic similarities. Priming effects were examined using the same three SOAs used in the first experiment: 43 ms, 72 ms, and 230 ms. Robust priming effects were found for the transparent-derived pairs across all SOAs, while no significant priming effects were observed for the form control pairs at any SOAs. The (-M+O+S) and (-M-O+S) prime-target pairs produced similar priming effects only at the longest SOA (230 ms), when the primes became consciously visible. These results confirmed the findings of the first experiment, indicating that semantic information could be activated at later stages of morphological processing whereas orthographic relatedness did not provide any facilitation during visual word recognition. An additional conclusion of the second experiment was that facilitation effects should be interpreted as the effects of morphological relatedness between primes and targets, not as the combination of orthographic and semantic effects. However, morphological relatedness seems to be insufficient on its own to explain why semantically transparent (+M+O+S) prime-target pairs generated more priming than semantically opaque (+M+O-S) pairs in the first experiment; therefore, this study overall implies that both morphological and semantic similarities lead to facilitation at the early stages of visual word recognition.

By comparing priming effects between semantically transparent and opaque prime-target pairs, Feldman, O'Connor and Moscoso del Prado Martin (2009) also studied whether semantic relatedness affects the decomposition into stems and affixes. In a masked priming experiment with an SOA of 50 ms, monolingual speakers of English showed reliable priming effects for transparent pairs while they exhibited smaller and non-significant priming for opaque pairs. Thus, these results suggested that the magnitude and pattern of priming effects can be governed by semantic transparency, and that this central influence can be observed even at the initial stages of decomposition processes.

In other studies, however, it has been demonstrated that priming effects obtained for derived words are independent of semantic transparency, and are purely driven by morphological relatedness between primes and targets (at least in visual masked priming experiments). Useful evidence in this respect comes from the study by Longtin et al. (2003), who explored the role of semantic transparency in the processing of French derived words via a masked priming task and an auditory-visual cross-modal priming task. For the two experiments, four prime-target conditions were created: (1) semantically transparent (+M+O+S) condition, (2) semantically opaque (+M+O-S) condition, (3) pseudo-derived[2] (+M+O-S) condition, and (4) orthographic form control (-M+O-S) condition. In the masked priming task with an SOA of 46 ms, significant and equivalent facilitation effects emerged in all the morphologically related conditions irrespective of the degree of semantic transparency, but the orthographic condition yielded marginal inhibition effects. In the cross-modal priming task, on the other hand, significant facilitation effects were found only for semantically transparent pairs. Collectively, different results were obtained from the two tasks: when both primes and targets were visually presented (i.e. in the masked priming task), the processing of French derived words was dependent on morphological decomposability, but not on semantic and orthographic relatedness; conversely, when primes were auditorily presented and targets were

[2] Longtin et al. (2003) defined 'semantically opaque' and 'pseudo-derived' pairs in the following way: although both opaque and pseudo-derived pairs consist of morphologically and orthographically related, but semantically unrelated, primes and targets, the difference between these two notions lies in that opaque pairs, unlike pseudo-derived pairs, share an etymological relationship as well (p. 314-316).

visually presented (i.e. in the cross-modal priming task), the derivational processing relied on semantic relatedness, rather than morphological and formal relatedness. These differences have been taken as indicative of a task effect, suggesting that auditory primes, contrary to visual primes, may be consciously recognized and hence may increase the effects of semantic transparency in word recognition.

In another masked priming study, Rastle, Davis and New (2004) investigated what information is activated to decompose a derived word into its stem and suffix at early stages of visual word recognition. Native speakers of English made lexical decisions to stem targets which were presented in three conditions: (1) semantically transparent condition, e.g. *cleaner-CLEAN*, (2) semantically opaque condition, e.g. *corner-CORN*, (3) form condition, e.g. *brothel-BROTH*. The results of this masked priming experiment with an SOA of 42 ms were compatible with the French findings of Longtin et al. (2003) in that the priming effects for transparent and opaque pairs were found to be significant and greater than for form control pairs. In addition, the amount of priming in the transparent and opaque conditions did not vary as a function of semantic transparency. Based on this "null" result, i.e. significant and equivalent priming effects for transparent and opaque pairs, Rastle et al. (2004) proposed a *morpho-orthographic segmentation* process, claiming that decompositional processes are purely morphological and do not involve any semantic or orthographic activation at the initial stages of visual word recognition.

Rastle et al.'s (2004) early morpho-orthographic segmentation mechanism has obtained significant supporting evidence from studies investigating the nature of morphological decomposition from different perspectives. Beyersmann, Castles and Coltheart (2011), for instance, examined transposed-letter (TL) effects to address whether an apparent morphological relationship is sufficient to segment a complex word into its constituents. Two masked priming experiments were conducted with native English speakers. In the first experiment, the aim was to test whether the participants were sensitive to the basic TL-effects. Therefore, monomorphemic real words were used as targets, and their TL-nonword primes were formed by transposing the second and third letters in target words (e.g. *wran-WARN*). Substituted-letter (SL) control primes were constructed by substituting different letters for the two transposed letters (e.g. *whun-WARN*). The analysis of reaction time data showed that the participants made significantly faster lexical decisions to a target word preceded by a TL-nonword than to a target word preceded by a SL-nonword, indicating that native speakers made use of orthographic overlap between nonword-primes and real-word targets, and produced robust TL-priming effects.

In the second experiment, the purpose was to determine whether morphologically complex and non-morphological TL-nonword primes could facilitate the recognition of target words in the same way. By using the same TL and SL prime-target pairs as in the first experiment, two conditions were created: (1) suffixed condition in which the TL and SL primes were combined with a real suffix, e.g. *wranish-WARN*, *whunish-WARN*; (2) non-suffixed condition in which the TL and SL primes were combined with a non-morphological ending, e.g. *wranel-WARN*, *whunel-WARN*. The results revealed significant priming effects for suffixed TL-nonword pairs (e.g. *wranish-WARN*) but no significant effects for non-suffixed TL-nonword pairs (e.g. *wranel-WARN*), thus suggesting that TL-priming effects cannot be simply due to orthographic relatedness between primes and targets, and that morpheme-based decomposition can occur regardless of semantic unrelatedness between nonword-primes and real-word targets.

McCormick, Brysbaert and Rastle (2009) also investigated whether all morphologically structured forms are processed in a decomposed way, irrespective of their surface frequencies. Native English speakers performed a masked priming task including three conditions of morphologically structured primes: (1) high-frequency primes, e.g. *government-GOVERN*, (2) low-frequency primes, e.g. *concretely-CONCRETE*, (3) nonword primes with no lexical frequency, e.g. *monkage-MONK*. The analysis of reaction time data revealed straightforward results such that all the conditions yielded significant priming effects of equal magnitude. In line with Rastle et al.'s (2004) arguments, these results demonstrated that the morpho-orthographic segmentation process could be automatically applied to all morphologically structured forms.

In summary, the L1 studies reviewed above indicate that facilitation effects obtained for morphologically complex forms are dissociable from the effects of orthographic relatedness between primes and targets. However, they do not seem to be consistent in terms of explaining the role of semantic relatedness in early morphological priming effects. While some of the studies have supported the influence of semantic relatedness on decompositional processes, others have proposed a purely morphological account of decompositional processes at early stages of processing.

Turning to L2 processing studies, whether or not L2 learners segment a morphologically complex word into its stem and affix in a native-like manner is still a hotly debated question. However, very few studies have examined the role of semantic and orthographic information in L2 morphological processing. One such study was carried out by Kırkıcı & Clahsen (2013), who investigated inflectional and derivational processes in Turkish as an L1 and an L2. In their follow-up experiment (Experiment 2), the authors tested whether purely orthographically related prime-target pairs yielded any facilitation during visual word recognition, and found no orthographic priming effects in either the L1 speakers or the L2 learners. Thus, they concluded that priming effects observed for inflectionally and/or derivationally related prime-target pairs are driven by morphological, not orthographic, information in both L1 and L2 processing.

On the other hand, Heyer and Clahsen (2014) examined the L1 and L2 processing of derivationally related (+M+O+S) and purely orthographically related (-M+O-S) words in English. Whereas significant priming effects were obtained only for derivationally related pairs in L1 speakers, L2 learners exhibited significant priming effects for both derivationally related and purely orthographically related pairs. More importantly, derivational and orthographic priming effects were of the same magnitude in L2 learners. These findings indicated that the L1 derivational processing is morphological in nature, but that the L2 derivational processing is governed by orthographic, not morphological, relatedness between derived words and their stems.

In the same vein, Duñabeitia et al. (2013) reported the influence of orthographic relatedness between primes and targets on L2 morphological processing. In the masked priming study conducted with unbalanced L1 Spanish-L2 English bilinguals, two conditions were used: (1) cognate condition in which morphologically related L1 cognate primes preceded L2 stem targets, e.g. *estudiante* 'student' – *STUDY*, and (2) non-cognate condition in which L2 stem targets were preceded by morphologically related L1 non-cognate primes, e.g. *doloroso* 'painful' – *PAIN*. The same design was also employed for balanced L1 Basque-L2 Spanish bilinguals. The results revealed priming effects only for cognate prime-target pairs in both low and high proficiency bilinguals, reflecting that cross-language morphological priming effects are due to the orthographic similarities between cognates regardless of the level of L2 proficiency.

CHAPTER 3

EXPERIMENT 1: THE PROCESSING OF MORPHOLOGICALLY COMPLEX WORDS IN TURKISH

This chapter consists of four major sections. The first section presents the morphological background to Experiment 1. The second section specifies the research questions and predictions related to Experiment 1. The third section presents the methodological details of the experiment, the results of which are reported in the fourth section.

3.1 Background to Experiment 1

In Turkish, a considerable majority of multisyllabic words are complex forms which are generally formed through the suffixation of inflectional and/or derivational morphemes (Göksel & Kerslake, 2005). Due to the fact that Turkish is an agglutinative language that has extremely productive and rich morphology, each verb can have over 2000 inflectional forms (Hankamer, 1989), whereas an English verb can have only four inflectional forms (Carlisle, Charmley, Salgueiro-Carlisle & Bennett, 1997). With regard to the derivational richness of Turkish, Aksan (1987) estimates that there are over 100 derivational morphemes, and that each derivational morpheme has more than one meaning and function as illustrated in (4) for the derivational *-lIk* suffix; see Göksel and Kerslake (2005).

(4) a. a container for a particular type of object (e.g. *odun-luk* “woodshed”)
b. an object relating to a body part (e.g. *göz-lük* “glasses”)
c. an embodiment of an abstract concept (e.g. *içten-lik* “sincerity”)

d. deriving adjectives from nouns (e.g. *ay-lık* “monthly”)

Another important characteristic of Turkish morphology is vowel harmony, which requires a suffix to agree with the features (i.e. frontness/backness and roundedness/unroundedness) of the vowel in the preceding syllable, and which leads to phonological variations for almost all suffixes (see Göksel & Kerslake, 2005, for a review). The suffix *-lIk*, as exemplified in (4), has four different surface variants, *-lık*, *-lik*, *-luk*, and *-lük*.

Experiment 1 focuses on the processing of the reported past suffix *-mIş* and the *-(y)IcI* nominalization suffix in L1 Turkish. The use of the reported past suffix *-mIş*, which is also known as the evidential suffix, entails that “…the information it [the speaker] gives is not based on having witnessed the action but on hearsay or on inference from observed facts…” (Lewis, 2000, p. 122). The *-mIş* suffix induces no changes in verb stems and surfaces in four forms, *-mış*, *-miş*, *-muş*, and *-müş* as shown in (5), depending on both the frontness and roundedness of the vowels in verb stems.

(5) *ağla-mış* “apparently s/he cried”
ye-miş “apparently s/he ate”
uyu-muş “apparently s/he slept”
gör-müş “apparently s/he saw”

The nominalization suffix *-(y)IcI* derives nouns from verbs and creates new words denoting “a person practicing a certain profession, or having a certain occupation” or “a tool, machine or substance performing a particular function” (Göksel & Kerslake, 2005, p. 55). The *-(y)IcI* suffix has four different forms according to vowel harmony rules, *-ıcı*, *-ici*, *-ucu*, and*-ücü* as illustrated in (6). The *-(y)IcI* suffix does not cause any changes in verb stems, but requires the buffer consonant *-y* to appear when the suffix is attached to a verb stem ending in a vowel, as illustrated in (7) below.

(6) *yaz-ıcı* "printer"
yönet-ici "manager"
koş-ucu "runner"
yüz-ücü "swimmer"

(7) *dinle-y-ici* "listener"
koru-y-ucu "protector"

The reasons why *-mIş* inflection and *-(y)IcI* nominalization are selected for investigation in this study are as follows. First of all, both suffixes have a high degree of productivity. The suffix *-mIş* is fully productive since it can be attached to any verb in Turkish. Similarly, the suffix *-(y)IcI* is attributed as the most productive suffix that attaches to verbs to form nominals (Göksel & Kerslake, 2005). Second, both suffixes are phonologically transparent; that is, the attachment of these suffixes does not bring about any changes in stems. In addition, the two suffixes have a high frequency of occurrence. Finally, they both consist of three letters and are therefore comparable with regard to orthographic length.

Taken together, the *-mIş* and *-(y)IcI* suffixes are matched on a set of parameters (i.e. productivity, semantic and phonological transparency, affix frequency, and affix length) that have been claimed to affect the processing of morphologically complex words (Laudanna & Burani, 1995; Baayen et al., 1997); this makes it possible to make a direct comparison between inflectional and derivational phenomena in L1 Turkish.

3.2 Research Questions and Predictions

The following research questions and predictions were formulated for Experiment 1:

1) How do native speakers of Turkish process past tense verb inflection and deverbal nominalization during early stages of visual word recognition?
    i. Do native speakers of Turkish decompose inflected word forms with the morpheme *-mIş* into stems and suffixes?
    ii. Do native speakers of Turkish decompose derived word forms with the morpheme *-(y)IcI* into stems and suffixes?
2) Do native speakers of Turkish make use of semantic and/or orthographic information during early stages of visual recognition of inflected and derived words?

Given the productive morphological system of Turkish, as well as the findings of previous research, it is expected that both inflected and derived words will be represented in a morphologically structured way. If native Turkish speakers decompose inflected and derived words into constituents, they will show priming effects for morphologically related prime-target pairs, thus suggesting that complex word forms with the suffixes *-mIş* and *-(y)IcI* will facilitate the recognition of their base forms. On the other hand, if it is the case that native Turkish speakers store and retrieve morphologically complex words as full forms, inflected and derived words will produce no priming effects.

Furthermore, it is predicted that there will be no priming effects for semantically (but not morphologically) related words. As participants are not consciously aware of prime words briefly presented in masked priming experiments, semantic activation does not occur at early stages of word recognition (Rastle et al., 2000), which will result in semantically related primes not facilitating the recognition of target words. With respect to orthographically (but not morphologically) related words, it is expected that orthographic relatedness will not yield priming effects either (Rastle et al., 2004; Marslen-Wilson et al., 2008). The lack of semantic and orthographic priming will suggest that early word recognition processes are not driven by semantic and orthographic relatedness, but rather by morphological relatedness between inflected/derived forms and their stems.

3.3 Experimental Methodology

The masked priming paradigm, which is also known as the “sandwich technique”, is used for both experiments to be conducted in the present study. In masked priming experiments, participants are presented with a row of symbols (e.g. XXXXX) before a prime word. The prime word is immediately followed by a target word on which participants are asked to make a lexical (word or non-word) decision. In other words, the prime is sandwiched between the row of symbols which acts as a forward mask and the target. In masked priming, the time between the onset of the prime and the onset of the target, the so-called “stimulus onset asynchrony (SOA)”, is typically kept very brief (between 30-80 ms); hence, the prime is invisible to most participants. Additionally, the prime and target are presented in different (lower vs. upper) cases and often also in different fonts in order to decrease the visibility of the prime.

The current study employs the masked priming technique to explore the processing of morphologically complex word forms. The obvious benefit of using the masked priming technique is the fact that it provides an insight into the automatic nature of visual word recognition by tapping into very early processing stages. Another crucial advantage of masked priming is that it allows to examine how morphological processing occurs in the absence of conscious awareness. The primes are both forward and backward masked, displayed at short SOAs, and presented as physically different forms from the targets; as a result, the primes cannot be identified. Participants suppose that they only react to the target words, yet what they actually react to is the relation between the prime and target words (Blumenthal-Dramé, 2012, p. 86). There is one more advantage of masked priming; because the type of relation between the primes and targets can be manipulated, it is possible to define the exact role of morphological, semantic and orthographic relatedness in morphological processing.

Masked priming experiments generally involve three conditions: in one (Identity), the prime and target are identical; in the second condition (Related), the prime-target pairs are morphologically, semantically, or orthographically related depending on what type of information is tested; in the third condition (Unrelated), the prime and target words do not share any relatedness concerning structural, meaning, or surface-form properties (see Table 2 for examples).

Table 2: *Three typical types of prime-target pairs in masked priming experiments*

Condition	Prime Type	Prime	Target
1	Identity	walk	WALK
2	Related	walked[1]	WALK
		hike[2]	WALK
		talk[3]	WALK
3	Unrelated	bottle	WALK

[1] morphologically related; [2] semantically related; [3] orthographically related

'Priming' occurs when the prime word activates the representation of the target word and thus facilitates its processing (Forster, 1998). The effect of priming can be determined by comparing participants' mean reaction times (RTs) to the target word among three different conditions. "Repetition priming" occurs when the Identity prime yields shorter RTs compared to the Unrelated prime. "Full priming" indicates that the Related and Identity conditions produce shorter RTs than the Unrelated condition while the RTs in the Related and Identity conditions do not differ significantly from each other. "Partial priming" is observed when the time to recognize the target word is shorter in the Related condition than in the Unrelated condition but longer than in the Identity condition. “No priming” refers to the lack of a statistically significant difference between the RTs in the Related and Unrelated conditions.

3.3.1 Participants

Experiment 1 was performed with 40 native Turkish speakers (35 females and 5 males) with a mean age of 21.53 years (SD: 2.40, range: 20-28). The participants reported to have acquired Turkish from birth. They were unpaid volunteers who were undergraduate or graduate students at the Department of Foreign Language Education, Middle East Technical University (METU), Ankara.

All the participants had normal or corrected-to-normal vision, and were naïve with respect to the purpose of the experiment.

3.3.2 Materials

The masked priming experiment consisted of 76 experimental stimuli, 324 fillers, and 10 practice items. The experimental stimuli incorporated three item sets. The first item set included 28 morphological items in four conditions: Identity, Inflected (Related), Derived (Related) and Unrelated (see Appendix B). As the targets[3] in all conditions were the infinitive verb stems[4] which can take both the inflectional *-mIş* and the derivational *-(y)IcI* suffix, the identity primes were also presented as the

---

[3] The targets were chosen among verb stems which could take the two suffixes under investigation; hence inflected and derived words primed the same target words. In this way, the present study ensured a more direct and accurate comparison between inflectional and derivational processes relative to earlier studies which investigated separate prime-target sets to compare inflectional and derivational processes (e.g. Silva & Clahsen, 2008; Kırkıcı & Clahsen, 2013).

[4] The targets were selected as infinitive forms of verb stems (e.g. *SATMAK*, “to sell”) rather than as bare forms (e.g. *SAT*, “sell”) for the following reasons: (1) the word form frequencies of bare verb stems were quite low and were not matched to the frequencies of unrelated primes, (2) infinitive forms of verb stems are standard citation forms found in dictionaries, (3) the infinitival marker *-mEk* does not bear any semantic load or require any person-marking affix, and (4) infinitive verb stems were already used as targets in previous German studies (e.g. Clahsen et al., 2003; Clahsen & Neubauer, 2010).

infinitive verb stems. In the Related condition, there were two types of primes, namely inflected primes with the suffix *-mIş* and derived primes[5] with the suffix *-(y)IcI*. The inflected and derived primes were morphologically, orthographically and semantically related to the targets (+M+O+S). The unrelated primes, half of which were nouns (like the *-(y)IcI* nominalizations) and the other half of which were adjectives (like *-mIş* participles and *-(y)IcI* nominalizations, which can also be used as adjectives), did not have any morphological, orthographic or semantic relation with the target words. The unrelated primes and targets did not share any letters in the same position. A sample set of morphological stimuli is provided in Table 3.

Table 3: *Sample set of morphological stimuli in Experiment 1*

	Primes				Target
	Identity	Related		Unrelated	
		Inflected	Derived		
Morphological (+M+O+S) N = 28	*okumak* "to read"	*okumuş* "apparently s/he read"	*okuyucu* "reader"	*çirkin* (Adj) "ugly"	*OKUMAK* "to read"
	satmak "to sell"	*satmış* "apparently s/he sold"	*satıcı* "seller"	*mevsim* (N) "season"	*SATMAK* "to sell"

In order to prevent any potential bias regarding participants' responses to the target words, the experimental stimuli were kept as similar as possible in terms of length and word form frequency. Length was measured in the number of letters and word form frequencies were taken from the 50-million-word Turkish National Corpus

[5] Even though it was tried not to include verb stems requiring the buffer consonant *-y* when they are derived with the agentive suffix *-IcI*, 7 out of 28 derived primes contained the buffer consonant *-y* (e.g. *oku-y-ucu*, "reader"). This was allowed because buffer consonant epenthesis is an example of phonological variations in Turkish (Oflazer, Göçmen & Bozşahin, 1994) and because phonological variations are assumed to be tolerated in the morphological processing system without inducing an additional processing cost (Lahiri, 2012, p. 149).

(Aksan et al., 2012) and were reported as per million. In the morphological item set, the inflected and derived primes were matched for length ($t(54) = .78$, $p = .44$) and word form frequency ($t(54) = .40$, $p = .69$). The unrelated primes were matched to the targets in length ($t(54) = .23$, $p = .82$) and word form frequency ($t(54) = .04$, $p = .97$). Table 4 presents length and word form frequency information for the morphological item set.

Table 4: *Mean length (in letters) and word form frequencies (per million) for related primes, unrelated primes and targets for morphological item set in Experiment 1*

	Inflected Prime	Derived Prime	Unrelated Prime	Target
Length	6.86	7.11	6.79	6.86
Word-form frequency	652.29	757.86	1466.39	1485.64

The second item set contained 24 orthographic items in three conditions: Identity, Related and Unrelated (see Appendix C). Targets were preceded by orthographically related, but morphologically and semantically unrelated (-M+O-S), primes or by their identical form. As a third condition, targets were primed by morphologically, orthographically and semantically unrelated words. The unrelated primes did not share any letters in the same position with the targets so as to avoid any orthographic overlap. An example stimulus set is shown in Table 5.

Table 5: *Sample set of orthographic stimuli in Experiment 1*

	Primes			Target
	Identity	Related	Unrelated	
Orthographic (-M+O-S) N = 24	*hazine* “treasure”	*haziran* “june”	*zeytin* “olive”	*HAZİNE* “treasure”

For primes and targets in the orthographic item set, the following matching criteria were applied. The related and unrelated primes were matched for length ($t(46) = .20$, $p = .85$) and word form frequency ($t(46) = .56$, $p = .58$), as summarized in Table 6. The targets in the orthographic and morphological item sets were matched in terms of word form frequency ($t(50) = .69$, $p = .49$). The word form frequency of orthographically related primes did not differ significantly from the word form frequency of inflected ($t(50) = .95$, $p = .35$) and derived ($t(50) = .72$, $p = .48$) primes in the morphological item set.

Table 6: *Mean length (in letters) and word form frequencies (per million) for related and unrelated primes as well as targets for orthographic item set in Experiment 1*

	Related Prime	Unrelated Prime	Target
Length	6.67	6.63	6.38
Word-form frequency	931.83	1158.88	1179.92

The degree of orthographic similarity between primes and targets was calculated using the absolute-position, spatial and open-bigram coding schemes in the Match Calculator application (Davis, 2000). The absolute-position coding scheme, which is the standard approach used to measure the degree of orthographic overlap between two words, requires the words to share the same letters in the strictly same positions, e.g. *beach* and *bleach* share only one common letter in the same position, and this absolute-position code results in a quite low degree of overlap (Davis, 2012). The spatial coding scheme, on the other hand, requires words to have common letters without any position-specific coding, e.g. *post* and *pots* consist of the same letters and hence are encoded by highly similar spatial codes (Davis, 2010, 2012). According to the open-bigram coding scheme, words are encoded in terms of "ordered letter pairs which can be contiguous or non-contiguous" (Kinoshita & Norris, 2013, p. 136). For example, *salt* and *slat* are encoded respectively by the following ordered letter pairs {*sa, sl, st, al, at, lt*} and {*sl, sa, st, la, lt, at*}, and the identical five letter pairs lead to a high degree of orthographic overlap between the words *salt* and *slat* (Davis, 2012). Based on these three coding schemes, half of the orthographically related prime-target pairs were matched to inflected prime-target pairs with regard to the degree of orthographic overlap ($t(12.64) = .94$, $p = .36$, $t(14.04) = .61$, $p = .55$, and $t(14.91) = .97$, $p = .35$). Overlap of the remaining orthographically related primes and targets was matched as closely as possible to the overlap of derived primes and targets ($t(14.84) = .1.67$, $p = .12$, $t(38) = 1.73$, $p = .09$, and $t(38) = 2.01$, $p = .051$).

In the third set, there were 24 items including semantically related, but morphologically and orthographically unrelated (-M-O+S), prime-target pairs. Apart from the Related condition, two more conditions were involved in the semantic item set: Identity and Unrelated (see Appendix D). Unrelated primes and targets did not bear any morphological, orthographic or semantic relation and did not include any letters in the same position. A sample stimulus set is provided in Table 7.

Table 7: *Sample set of semantic stimuli in Experiment 1*

	Primes			Target
	Identity	Related	Unrelated	
Semantic (-M-O+S) N = 24	*mektup* "letter"	*postane* "post office"	*yoğurt* "yogurt"	*MEKTUP* "letter"

To ensure semantic (un)relatedness between prime-target pairs in the Related and Unrelated conditions, 76 Turkish-speaking subjects were asked to rate, on a seven-point Likert scale ranging from "1 = strongly unrelated in meaning" to "7 = strongly related in meaning", how related these prime-target pairs were in meaning. The derived and unrelated prime-target pairs in the morphological item set were also rated in terms of semantic (un)relatedness on the same seven-point scale. The average ratings indicated that the related prime-target pairs in the semantic and morphological item sets were highly related in meaning (M: 6.08, SD: .51, range: 4.92-6.66; M: 5.79, SD: .22, range: 5.25-6.04), while the unrelated prime-target pairs in both item sets were not semantically related (M: 1.67, SD: .56, range: 1.06-3.26; M: 1.54, SD: .40, range: 1.16-2.35).

In the semantic item set, related primes were also matched to unrelated primes in terms of length ($t(46) = 1.39$, $p = .17$) and word form frequency ($t(37.14) = .69$, $p = .50$), as given in Table 8. The targets in the semantic and morphological item sets were matched for word form frequency ($t(50) = .28$, $p = .78$). Similar to targets, the related primes in semantic and morphological item sets were matched in word form frequency ($t(50) = .91$, $p = .37$ for semantically related and inflected primes; $t(38.24) = .66$, $p = .51$ for semantically related and derived primes).

Table 8: *Mean length (in letters) and word form frequencies (per million) for related and unrelated primes as well as targets for semantic item set in Experiment 1*

	Related Prime	Unrelated Prime	Target
Length	6.13	5.67	4.63
Word-form frequency	953.88	1158.75	1346.96

All prime-target pairs were distributed over four experimental lists using a Latin Square design; as a result, each target appeared only once in each list and was preceded by a different prime across lists.

124 word-word and 200 word-nonword filler pairs were added to the 76 experimental word pairs so that a “yes” response was correct for half of the targets, whereas a “no” response was correct for the other half. Nonwords were generated using the Turkish module of the Wuggy software (Keuleers & Brysbaert, 2010), which produces possible nonwords based on the phonological and orthographic

properties of a given language. In this way, all nonwords (e.g. *ahuvuzu*) had the same number of letters as existing input words (e.g. *ahududu* "raspberry"), and were legally pronounceable and syllabifiable in Turkish. To avoid more than two successive occurrences of the same prime-target pair type, the order of experimental and filler items was pseudo-randomized. Moreover, each of the four experimental lists was reversed in order to eliminate fatigue and training effects, resulting in eight lists in total.

3.3.3 Procedure

The presentation of visual stimuli as well as the recording of reaction times and accuracy was controlled by the DMDX software package (Forster & Forster, 2003). The stimuli were presented in white letters on a black background in the center of a 15.6 inch computer screen. The primes were presented in lower case Bookman Old Style 28 point, and the targets were presented in upper case Courier New 28 point.

Prior to the experiment, participants were informed about their right to withdraw from the study at any time and were asked to fill out a consent form (Appendix E). They also filled in a questionnaire that included questions about gender, age, and their language background. All participants were randomly assigned to each of the experimental lists, and they received oral and written instructions to make a lexical decision as quickly and accurately as possible by pressing one of the two buttons on a Logitech™ gamepad. Both right- and left-handed participants were required to press the "yes" button with their dominant hand.

Each experiment began with a short practice session to familiarize participants with the procedure. Immediately after the practice session, with the help of a brief manipulation checklist, it was guaranteed that the primes could not be recognized: when the participants were asked to tick the words or nonwords that they had seen during the practice session on a given list, they ticked the targets, not the primes, involved in the practice session. Each trial in the experiment included the following sequence of visual events: (1) a forward mask consisting of as many hashes (#s) as letters in the prime was shown for 500 milliseconds (ms), (2) the prime was displayed for 50 ms, (3) the target was displayed for 500 ms following the prime, and (4) a blank screen appeared until the "yes" or "no" button was pressed for the target, or until a timeout of 5000 ms occurred (see Figure 3).

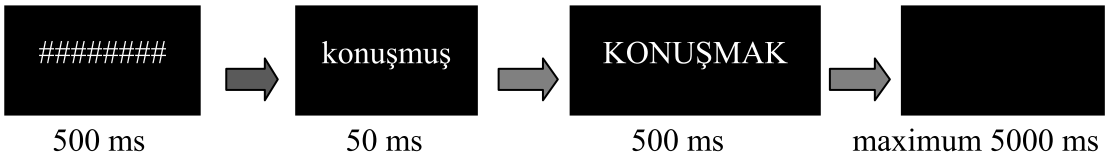

Figure 3: Schematic representation of the masked priming procedure in Experiment 1

There were two breaks during each experiment, one after the first third of the test trials and another after the second third. The experiment was carried out in a dedicated quiet room, and lasted approximately 40 minutes. After the experiment was performed, each participant was asked to describe what s/he had seen. It was clear that none of the participants was aware of the presence of the primes.

3.3.4 Data Analysis

Eleven related prime-target pairs were erroneously labeled as purely orthographic, though the primes and/or targets included an existing suffix in addition to the overlapping strings of letters (*karınca-KARPUZ, bayram-BAYRAK, kumbara-KUMSAL, karanfil-KARANLIK, takviye-TAKVİM, sevinç-SEVİYE, masraf-MASTAR, tarak-TARAF, mantar-MANTIK, sandalet-SANDALYE,* and *makale-MAKAM*). Therefore, these eleven items were removed from the orthographic set. One semantic item was also removed since it was incorrectly responded to by 40 percent of the participants (*ayıl-bayıl-borsa-AYIL,* "regain consciousness"-"lose consciousness"-"stock market"-"regain consciousness"). Besides, the orthographic data from one participant was excluded prior to analysis because of a high error rate (46%). A total of 64 experimental items were entered into the analysis.

Incorrect responses (i.e. nonword responses to word targets) and extreme RTs (i.e. any RTs exceeding 3000 ms) were excluded from the data set. Outliers were defined as any RTs below and above two standard deviations from the z-score (also known as standard score) for each participant and were not included in further analyses. These exclusions affected 8.6% of the experimental items tested.

For each item type (morphologically inflected, morphologically derived, orthographic, and semantic), a one-way repeated measures ANOVA with Prime Type (Identity, Related, and Unrelated) as the within-subjects factor was performed. Subsequent paired-samples t-tests were conducted to explore the significant main effects. The *p*-values of all analyses were Greenhouse-Geisser corrected for sphericity violations whenever applicable.

3.4 Results

3.4.1 Morphological Items

Table 9 displays native Turkish speakers' mean RTs as well as standard deviations (SDs) and error rates in the morphological (+M+O+S) item set.

Table 9: *Mean RTs (in ms), SDs (in parentheses), and error rates (in percent) for morphological items in Experiment 1*

	Identity	Inflected	Derived	Unrelated
RTs	528.91	552.77	548.98	573.34
(SDs)	(124.88)	(129.98)	(128.47)	(124.24)
Error rate	1.1	3.2	1.8	2.9
Priming effect	44	21	24	

With respect to *-mIş* inflection, the one-way repeated measures ANOVA on the error data did not reveal any significant main effects of Prime Type (Identity, Inflected, and Unrelated) in either participant or item analysis ($F_1(1.48, 57.69) = 1.66$, $p = .204$; $F_2(2, 54) = 1.67$, $p = .198$), suggesting that the error rate did not differ statistically among the three prime conditions. On the other hand, the ANOVA on the RT data yielded a significant main effect of Prime Type ($F_1(2, 78) = 20.25$, $p < .0001$; $F_2(2, 54) = 9.62$, $p < .0001$). Further t-tests demonstrated that the Identity condition produced significantly shorter RTs than the Unrelated condition, i.e. repetition priming, ($t_1(39) = 6.30$, $p < .0001$; $t_2(27) = 5.11$, $p < .0001$). In comparison with the inflected prime-target pairs, the identity pairs were responded to significantly faster across participants ($t_1(39) = 3.47$, $p = .001$) and marginally significantly faster across items ($t_2(27) = 2.01$, $p = .054$), while the unrelated prime-target pairs were responded to more slowly across participants and across items ($t_1(39) = 2.92$, $p = .006$; $t_2(27) = 2.15$, $p = .041$); this was indicative of the fact that the participants displayed partial priming effects for the Inflected condition.

For *-(y)IcI* derivation, the ANOVAs on the error data showed no main effects of Prime Type (Identity, Derived, and Unrelated) in the participant and item analyses ($F_1(1.48, 57.51) = 1.37$, $p = .258$; $F_2(2, 54) = 1.20$, $p = .31$), indicating that the percentage of incorrect responses did not significantly vary according to prime condition. Turning to the RT data, the main effect of Prime Type was found to be significant ($F_1(2, 78) = 24.79$, $p < .0001$; $F_2(2, 54) = 8.75$, $p = .001$). Follow-up t-tests were conducted to further examine the difference(s) between conditions. The results revealed shorter RTs for the Identity condition than for the Unrelated condition ($t_1(39) = 6.30$, $p < .0001$; $t_2(27) = 5.11$, $p < .0001$), reflecting repetition priming effects. The Derived condition also had shorter RTs than the Unrelated condition ($t_1(39) = 3.21$, $p = .003$; $t_2(27) = 2.27$, $p = .031$). As for the comparisons of the Identity and Derived conditions, identity primes yielded faster RTs than derived primes in the participant analysis only ($t_1(39) = 4.51$, $p < .0001$; $t_2(27) = 1.63$, $p = .115$). Thus, whereas the participant analyses showed partial priming effects for the

Derived condition (as suggested above for the Inflected condition,) the item analyses revealed full priming effects for the Derived condition. However, when the Inflected and Derived conditions were compared directly, there was no significant difference between the two morphologically related conditions ($t_1(39) = .11$, $p = .911$; $t_2(27) = .41$, $p = .685$).

3.4.2 Orthographic Items

For the orthographic (-M+O-S) item set, mean RTs to the targets (as well as SDs and error rates) are represented in Table 10.

Table 10: *Mean RTs (in ms), SDs (in parentheses), and error rates (in percent) for orthographic items in Experiment 1*

	Identity	Related	Unrelated
RTs	544.94	597.31	589.14
(SDs)	(122.11)	(144.71)	(119.20)
Error rate	3.6	3.3	5.7
Priming effect	44	-8	

The ANOVAs for the error data showed no significant main effects of Prime Type (Identity, Related, and Unrelated) in the participant and item analyses ($F_1(2, 76) = .71$, $p = .495$; $F_2(2, 24) = .17$, $p = .845$). For the RT data, on the other hand, the main effect of Prime Type was significant across participants ($F_1(2, 76) = 10.46$, $p < .0001$) and across items ($F_2(2, 24) = 9.78$, $p = .001$). Subsequent t-tests displayed the shortest RTs for the Identity condition (Identity-Related: $t_1(38) = 3.77$, $p = .001$, $t_2(12) = 4.78$, $p < .0001$; Identity-Unrelated: $t_1(38) = 4.15$, $p < .0001$, $t_2(12) = 3.28$, $p = .007$). However, no significant differences were found between the Related and Unrelated conditions ($t_1(38) = .20$, $p = .844$; $t_2(12) = .64$, $p = .537$), suggesting that the orthographically related primes yielded no priming effects.

3.4.3 Semantic Items

Table 11 presents mean RTs, SDs and error rates of native speakers of Turkish in the semantic (-M-O+S) item set.

Table 11: *Mean RTs (in ms), SDs (in parentheses), and error rates (in percent) for orthographic items in Experiment 1*

	Identity	Related	Unrelated
RTs	552.26	603.45	597.49
(SDs)	(148.45)	(138.53)	(130.52)
Error rate	4.2	9	5.8
Priming effect	45	-6	

For the error data, the one-way repeated measures ANOVA revealed significant main effect of Prime Type (Identity, Related, and Unrelated) in the item analysis ($F_1(1.73, 67.55) = 2.35$, $p = .11$; $F_2(1.45, 31.87) = 4.91$, $p = .022$) due to the fact that the participants made significantly more incorrect responses in the Related condition than in the Identity condition ($t_2(22) = 2.58$, $p = .017$).

The ANOVAs for the RT data revealed significant main effects of the factor Prime Type ($F_1(2, 78) = 22.16$, $p < .0001$; $F_2(2, 44) = 7.72$, $p = .001$). The results of follow-up t-tests revealed repetition priming effects, i.e. shorter RTs for the Identity than for the Unrelated, ($t_1(39) = 4.86$, $p < .0001$; $t_2(22) = 4.05$, $p = .001$). The mean RTs for the Related condition were not significantly different from those for the Unrelated condition ($t_1(39) = .39$, $p = .469$; $t_2(22) = .77$, $p = .451$), but significantly longer than the RTs for the Identity condition ($t_1(39) = 7.70$, $p < .0001$; $t_2(22) = 3.16$, $p = .005$); hence, the purely semantically related primes displayed no priming.

3.4.4 Summary

The results of Experiment 1 showed repetition priming effects in the morphological, orthographic, and semantic item sets, which indicates that native speakers of Turkish were sensitive to different types of primes presented at an SOA of 50 ms. In the morphological item set, native speakers also exhibited partial priming effects for inflected and derived words. However, in the orthographic and semantic item sets, they did not show any facilitation effects for the related prime-target pairs. As will be discussed in detail in Chapter 5, these priming effects suggest that native speakers of Turkish decompose inflected and derived word forms into their morphological constituents during L1 visual word recognition, and that these decompositional processes occur in the absence of orthographic and semantic effects.

Due to the ongoing debate regarding L1/L2 processing differences (see Section 2.3 for details) it will be very interesting to see whether native speakers of Turkish display the same priming patterns in their L2 processing, which will be covered in the next chapter.

CHAPTER 4

EXPERIMENT 2: THE PROCESSING OF MORPHOLOGICALLY COMPLEX WORDS IN ENGLISH

This chapter comprises four main sections. The first section provides the morphological background to Experiment 2. This is followed by the presentation of the research questions and predictions in the second section. The third section describes the methodological details of Experiment 2, and the obtained results are presented in the final section.

4.1 Background to Experiment 2

Unlike Turkish, the inflectional and derivational morphology of which is predominantly dependent on the use of suffixes (except for cases of reduplication like ***ep****eski* "very old" and derivation of some loan words like ***bi****haber* "unaware"), the English morphological system involves the use of both suffixes and prefixes. While inflected words in English are formed through suffixation, derived words are formed either through suffixation or prefixation (Plag, 2003). Moreover, while English inflectional morphology mainly concerns tense marking on verbs, English derivational morphology is relatively rich in that a variety of prefixes and suffixes are available to form derived nouns, verbs, adjectives, and adverbs.

As was pointed out Section 2.2, English past tense inflection has been a major matter of interest in the context of the single versus dual mechanism debate. This is because it comprises two types of past forms, i.e. regulars and irregulars, which are equivalent in terms of semantics (past) and syntax (tense), but which are actually morphologically distinct systems entailing either the attachment of the suffix *-ed* (in regulars) or idiosyncratic changes of verb stems (in irregulars). However, the current study aims at characterizing similarities and differences between inflectional and derivational processing, rather than between regular and irregular inflectional processes. Therefore, Experiment 2 eschews irregular past tense inflection, instead focusing exclusively on regular past tense inflection. The regular past tense suffix *-ed* has three allomorphs which are phonologically conditioned by the verb stem: /ɪd/ (e.g. *wanted*), /d/ (e.g. *loved*), and /t/ (e.g. *talked*). Despite these three different phonological variants, the regular affix *-ed* is still transparent because it does not cause any phonological changes in verb stems. In English, newly generated (e.g. *fax* → *faxed*) and non-existing (e.g. *rick* → *ricked*) verbs as well as more than 10,000[6] verbs undergo the regular past tense suffixation (Pinker, 1999), which manifests the broad range of applicability of the regular past tense affix. As has been put forth by Marchman (1997), the regular past tense pattern is also more frequently employed than the irregular one.

With reference to English derivational morphology, suffixes are often divided into two classes, neutral suffixes and non-neutral suffixes. These derivational suffixes are distinguished by the following characteristics (Kiparsky, 1982): Neutral suffixes (e.g. *-ness, -ment*) are often attached to free morphemes (i.e. stems that can stand alone), keep the semantic relatedness between stems and their derived forms, and do not lead to any changes of stress in stems. Non-neutral suffixes are usually attached to bound morphemes (i.e. stems that cannot stand alone as a word), are likely to change stress patterns in stems and do not relate the meaning of derived forms to that of stems (e.g. *virtu(e) + al* → *virtual*). Furthermore, the usage of non-neutral suffixes is generally limited to a handful of stems; for instance, the suffix *-tion* is attached to verb stems ending with *ceive* (e.g. *perceive + tion* → *perception*). Non-neutral suffixes are less frequently used to derive words; for example, only 41 out of 496 newly-coined derived words were affixed with non-neutral suffixes, whereas 456 were affixed with

[6] From Marslen-Wilson and Tyler (1998)

neutral suffixes (Iverson & Tyler, 1985, cited in Tyler & Nagy, 1989). Experiment 2 takes as its morphological focus the agentive *-er*, which, in line with the classification presented above, can be categorized as a neutral suffix. Similar to English regular past tense inflection, the suffix *-er* in English is phonologically and semantically transparent, productive, and highly frequent. Furthermore, the regular affix *-ed* and the agentive *-er* are comparable in orthographic length as well. These corresponding properties make it possible to draw accurate comparisons between the processing of inflectional and derivational processes in L2 English.

Importantly, the regular past tense suffix (*-ed*) and the agentive suffix (*-er*) may also be taken as translation counterparts of the Turkish suffixes *-mIş* and *-(y)IcI*, respectively, which were the morphological foci of Experiment 1. In this respect, it is possible to analyze more objectively the similarities and differences that L1 and L2 morphological processing bear.

4.2 Research Questions and Predictions

The research questions and predictions specific to Experiment 2 are as follows:

1) How do L1 Turkish learners of L2 English process past tense verb inflection and deverbal nominalization during early stages of visual word recognition in their L2?
    i. Do L2 learners of English decompose inflected word forms with the morpheme *-ed* into stems and suffixes?
    ii. Do L2 learners of English decompose derived word forms with the morpheme *-er* into stems and suffixes?
2) Do L1 Turkish learners of L2 English make use of semantic and/or orthographic information during early stages of visual word recognition in their L2?

3) Are pseudo-suffixed[7] words decomposed into their potential morphological constituents during early stages of visual word recognition in L2?

If L2 processing relies on the same mechanisms as L1 processing, then advanced L2 learners of English will pattern with the native Turkish speakers in Experiment 1 and with L1 English users tested in earlier studies. If so, L2 learners are first of all expected to parse both inflected and derived word forms into morphological units, and thus to faster recognize the target words which are preceded by the primes with the suffixes *-ed* and *-er* (Rastle et al., 2015; Marslen-Wilson et al., 1996). Second, L2 learners are expected to be insensitive to any orthographic and semantic overlap between the prime-target pairs. Based on the assumption that the visual recognition of inflected and derived words occurs independently of semantic priming effects, it is further anticipated that pseudo-suffixed words will be decomposed into their pseudo stems and suffixes (Rastle et al., 2004; Marslen-Wilson et al., 2008).

On the other hand, if different mechanisms are employed in L1 and L2 processing, advanced L2 English learners are expected to produce a relatively reduced amount of decompositional processing. In the light of results from previous studies into L2 morphological processing (Silva & Clahsen, 2008; Kırkıcı & Clahsen, 2013), L2 learners are predicted to process inflected words as full forms and derived words as stems plus suffixes. It is therefore expected that the L2 participants in the present study will display priming effects for derived word forms, but not for inflected forms. Additionally, it is expected that the L2 participants will not make use of surface-form or meaning similarities between complex words and their base forms during visual word recognition. If L2 processing depends solely on morphological relations between the prime-target pairs, then priming effects might also be observed

[7] Pseudo-suffixed words are morphologically simple words that seem to consist of an existing stem and a real suffix. E.g. *corner* is not a derived word; however, it seems like a combination of the stem *corn* and the suffix *-er*. Note that the processing of pseudo-suffixed words was not examined in Experiment 1. The reason was that the number of pseudo-suffixed words in Turkish is rather limited because of the high semantic transparency of Turkish suffixes, i.e. the combination of a real stem and a real suffix in Turkish often leads to semantically related complex words.

for pseudo-suffixed words because of the presence of potential suffixes, even though there is no semantic transparency between the pseudo-suffixed words and their (pseudo) stems.

4.3 Experimental Methodology

In parallel with Experiment 1, the masked priming paradigm (Forster & Davis, 1984) was used in Experiment 2 (see Section 3.3 in Chapter 3).

4.3.1 Participants

Experiment 2 was conducted with 44 Turkish learners of L2 English, who were randomly selected from undergraduate or graduate students at the Department of Foreign Language Education, METU, Ankara. The participants consisted of 36 females and 8 males, ranging in age from 21 to 28 (mean age: 23.20, SD: 2.23). They all reported Turkish as their native language and English as their second language. The participants had first been exposed to English at a mean age of 10.16 (SD: 1.48), and they had been learning English in a classroom setting (mean year of classroom exposure: 13.02, SD: 2.21). None of them had lived in an English speaking country for more than six months.

The Oxford Quick Placement Test (OPT) was administered to all the participants to ensure that they were all at a high proficiency level. The participants obtained a mean proficiency score of 89.13% (SD: 4.90, range: 48-59 out of 60). This score corresponds to the C1 level ("Advanced" or "Effective Operational Proficiency") in the Common European Framework of Reference for Languages (CEFR).

The participants were not paid for their involvement. They took part in the experiment on a voluntary basis and were naïve to the purpose of the experiment. They also had normal or corrected-to-normal vision.

4.3.2 Materials

In Experiment 2, the participants were presented with 370 prime-target pairs, 80 of which were experimental stimuli, 280 of which were fillers, and the remaining 10 of which were practice items. The experimental stimuli encompassed four sets of items. In the morphological item set, there were 20 quadruplets of English verbs which can be affixed with both the regular past *-ed* and the agentive *-er*. All the targets were presented in four conditions: Identity, Inflected (Related), Derived (Related) and Unrelated (see Appendix F). The identity primes –primes identical to the target– were the unmarked bare stems. In the Related condition, the targets were preceded by morphologically, orthographically and semantically (+M+O+S) related primes, specifically by either inflected primes marked with the suffix *-ed* or derived primes marked with the suffix *-er*. In the Unrelated condition, half of the targets were primed by nouns (like the *-er* nominalizations) and the other half was primed by adjectives (like past participles, which can also be used as adjectives). The unrelated prime-target pairs did not share any morphological, orthographic or semantic features and what's more, they did not contain any letter in the same position. Table 12 presents an example stimulus set.

Table 12: *Sample set of morphological stimuli in Experiment 2*

	Primes				Target
	Identity	Related		Unrelated	
		Inflected	Derived		
Morphological (+M+O+S) N = 20	*hunt*	*hunted*	*hunter*	*rock* (N)	*HUNT*
	employ	*employed*	*employer*	*awful* (Adj)	*EMPLOY*

The experimental stimuli were matched as closely as possible for length (in letters) and word form frequency. Word form frequencies were taken from both the Turkish subcorpus of the International Corpus of Learner English (Granger, Dagneaux, Meunier & Paquot, 2009) and the SUBTLEX-UK corpus (Van Heuven, Mandera, Keuleers & Brysbaert, 2014). The reasons why two corpora were used to extract word form frequencies are as follows: (1) It was assumed that since the participants were Turkish speaking learners of L2 English, using an L2 corpus would be more appropriate than using an L1 corpus; this was the reason for the use of the Turkish International Corpus of Learner English (TICLE) containing 196,900 words from 276 academic essays written by L1 Turkish learners of L2 English. (2) However, lots of words in the TICLE turned out to have zero frequency occurrences because the TICLE was a production-based corpus limited to argumentative essays on certain topics like education and environment. This created the necessity to additionally use the SUBTLEX-UK corpus, which consists of 201.3 million words from 45,099 BBC broadcasts. The SUBTLEX-UK word frequencies are based on the Zipf scale which has been suggested as a standardized frequency measure to be able to interpret frequency counts without depending on corpus size (Van Heuven et al., 2014). On the Zipf scale, values between 1 and 3 correspond to low frequency words, while values between 4 and 7 correspond to high frequency words.

In the morphological item set, the inflected and derived primes were matched for length ($t < 1$) and word form frequency ($t_{TICLE}(21.40) = 1.53$, $p = .14$; $t_{SUBTLEX}(38) = 1.98$, $p = .06$). The unrelated primes were matched to the targets in terms of length ($t(38) = .21$, $p = .83$) and word form frequency ($t_{TICLE}(38) = .03$, $p = .98$; $t_{SUBTLEX}(38) = 1.65$, $p = .11$). Table 13 shows length and word form frequency information for the morphological item set.

The second item set included 20 prime-target pairs. Each target was preceded by three types of primes, resulting in three conditions: Identity, Related and Unrelated (see Appendix G). Related primes had purely orthographic (-M+O-S) relation with the targets. On the other hand, unrelated primes did not share any morphological, orthographical or semantic relation with the targets. There was no letter occupying the same position in the unrelated primes and targets. A sample set of orthographic stimuli is shown in Table 14.

Table 13: *Mean length (in letters) and word form frequencies for related and unrelated primes as well as targets for morphological item set in Experiment 2*

	Inflected Prime	Derived Prime	Unrelated Prime	Target
Length	7.45	7.45	5.35	5.45
TICLE[1]	9.20	2.75	38.35	38.90
SUBTLEX-UK[2]	4.29	3.98	5.10	4.77

[1] Word form frequencies out of 196,900 words; [2] word form frequencies as Zipf-values

Table 14: *Sample set of orthographic stimuli in Experiment 2*

	Primes			Target
	Identity	Related	Unrelated	
Orthographic (-M+O-S) N = 20	*Free*	*freeze*	*disgust*	*FREE*

In the orthographic item set, orthographically related primes were matched to unrelated primes with respect to length ($t(38) = .24$, $p = .81$) and word form frequency ($t_{TICLE}(38) = 1.38$, $p = .18$; $t_{SUBTLEX}(24.99) = 1.97$, $p = .06$), as presented in Table 15. The targets in orthographic and morphological item sets could not be statistically matched for word form frequency ($t_{TICLE}(20.47) = 2.15$, $p = .044$; $t_{SUBTLEX}(38) = 3.66$, $p = .001$), but the Zipf-frequency values of targets in both item sets (3.99 for orthographic targets and 4.77 for morphological targets) were indicative of high frequency. The word form frequency of orthographically related primes did not differ significantly from that of derived primes in the morphological item set ($t_{TICLE}(38) = .34$, $p = .74$; $t_{SUBTLEX}(26.31) = 1.19$, $p = .24$). As for inflected primes in the morphological item set, inflected and orthographically related primes were matched for their word form frequencies in the TICLE, but not for their frequencies in the SUBTLEX-UK ($t_{TICLE}(20.68) = 1.65$, $p = .11$; $t_{SUBTLEX}(38) = 2.37$,

p = .023). However, the Zipf-frequency values of both inflected and orthographically related primes corresponded to high frequency (4.29 and 3.69, respectively).

Table 15: *Mean length (in letters) and word form frequencies for related and unrelated primes as well as targets for orthographic item set in Experiment 2*

	Related Prime	Unrelated Prime	Target
Length	7.50	7.35	4.30
TICLE[1]	2.30	4.50	7.50
SUBTLEX-UK[2]	3.69	4.16	3.99

[1] Word form frequencies out of 196,900 words; [2] word form frequencies as Zipf-values

Another matching criterion was related to the degree of orthographic overlap between primes and targets. Using the spatial coding scheme (based on the number of shared common letters), half of the orthographically related prime-target pairs were matched to derived prime-target pairs in terms of the amount of shared letters ($t(28) = 1.23$, $p = .23$). Overlap of the other half was matched to the overlap of inflected prime-target pairs ($t(28) = 1.20$, $p = .24$). According to the absolute-position coding scheme (based on the positions of shared letters) and the open-bigram coding scheme (based on the ordered pairs of letters in words), overlap of related primes with the target was identical to the overlap of derived primes and targets for half of the orthographic items, and to that of inflected primes for the other half. These coding schemes were implemented using the Match Calculator program (Davis, 2000); see Section 3.3.2, for further details.

Third, the semantic item set contained 20 items in three conditions: Identity, Related and Unrelated (see Appendix H). In the Related condition, primes were purely semantically related (-M-O+S) to the targets. In the Unrelated condition, targets were primed by morphologically, orthographically and semantically unrelated words and, moreover, the targets and unrelated primes shared no letters in the same position. An example stimulus set is presented in Table 16.

Table 16: *Sample set of semantic stimuli in Experiment 2*

	Primes			Target
	Identity	Related	Unrelated	
Semantic (-M-O+S) N = 20	*accuse*	*blame*	*moon*	*ACCUSE*

The semantic (un)relatedness between prime-target pairs in the Related and Unrelated conditions was assessed by means of a five-point Likert scale questionnaire ranging from "1 = strongly unrelated in meaning" to "5 = strongly related in meaning". The same questionnaire was also used to determine the degree to which the derived and unrelated prime-target pairs in the morphological item set were semantically related. The average ratings coming from 53 Turkish learners of L2 English (who did not take part in the experiment) provided evidence that the related prime-target pairs in both semantic and morphological item sets were semantically related (M: 3.82, SD: .65, range: 2.50-4.69; M: 3.95, SD: .21, range: 3.23-4.19). On the other hand, the average ratings of below 2.50 demonstrated that the unrelated prime-target pairs in the semantic and morphological item sets were not related in meaning (M: 1.39, SD: .35, range: 1.07-1.63; M: 1.26, SD: .24, range: 1.00-2.08).

For the primes and targets in the semantic item set, the additional criteria were as follows. The related and unrelated primes were matched for length ($t(38) = .91$, $p = .40$) and word form frequency ($t_{TICLE}(38) = .36$, $p = .72$; $t_{SUBTLEX}(28.48) = 1.84$, $p = .08$). The targets in semantic and morphological item sets were matched for word form frequency ($t_{TICLE}(38) = 1.05$, $p = .30$; $t_{SUBTLEX}(38) = 1.02$, $p = .32$). The orthographically related primes were matched in word form frequency to inflected primes ($t_{TICLE}(20.77) = 1.43$, $p = .17$; $t_{SUBTLEX}(38) = 1.17$, $p = .25$) and to derived primes ($t_{TICLE}(38) = .37$, $p = .71$; $t_{SUBTLEX}(38) = .55$, $p = .59$). Table 17 provides length and word form frequency information for the semantic item set.

Table 17: *Mean length (in letters) and word form frequencies for related and unrelated primes as well as targets for semantic item set in Experiment 2*

	Related Prime	Unrelated Prime	Target
Length	5.75	5.35	4.90
TICLE[1]	3.25	4.00	21.85
SUBTLEX-UK[2]	4.07	4.36	4.57

[1] Word form frequencies out of 196,900 words; [2] word form frequencies as Zipf-values

Finally, the fourth item set consisted of 20 items in three conditions: Identity, Related and Unrelated (see Appendix I). In the Related condition, pseudo-suffixed words preceded their (pseudo)stems; as a result, the related primes were morphologically and orthographically, but not semantically, (+M+O-S) related to the targets. It is also particularly important to note that the pseudo-suffixed primes and targets were selected from low frequency words, since low frequency leads learners to have less familiarity with words and thus increases the degree of semantic opacity between the pseudo-suffixed prime-target pairs. Besides, as in the former three item sets, the unrelated primes and targets did not have any morphological, orthographic, semantic relation or any letters occupying the same position. A sample stimulus set is presented in Table 18.

As shown in Table 19, the related and unrelated primes were matched for length ($t(38) = .64$, $p = .53$) and word form frequency ($t_{TICLE}(19) = 1.80$, $p = .09$; $t_{SUBTLEX}(38) = 1.91$, $p = .24$) in the pseudo-suffixed item set. As mentioned above, the targets had significantly lower frequency than the targets in morphological item set ($t_{TICLE}(19) = 2.71$, $p = .014$; $t_{SUBTLEX}(38) = 6.87$, $p < .0001$). The frequency of the pseudo-suffixed primes was also significantly lower than that of inflected ($t_{TICLE}(19)$

= 2.25, p = .036; $t_{SUBTLEX}(38) = 7.86$, $p < .0001$) and derived ($t_{TICLE}(19) = 2.68$, p = .015; $t_{SUBTLEX}(38) = 6.65$, $p < .0001$) primes in the morphological item set.

Table 18: *Sample set of pseudo-suffixed stimuli in Experiment 2*

	Primes			Target
	Identity	Related	Unrelated	
Pseudo-suffixed (+M+O-S) N = 20	*crypt*	*cryptic*	*abstain*	*CRYPT*

Table 19: *Mean length (in letters) and word form frequencies for related and unrelated primes as well as targets for pseudo-suffixed item set in Experiment 2*

	Related Prime	Unrelated Prime	Target
Length	7.10	6.90	4.70
TICLE[1]	0.00	0.40	0.05
SUBTLEX-UK[2]	2.95	2.73	3.42

[1] Word form frequencies out of 196,900 words; [2] word form frequencies as Zipf-values

The related primes and targets in the orthographic, semantic, and pseudo-suffixed item sets were selected from previous studies (Marslen-Wilson et al., 2008; Rastle et al., 2000; Rastle et al., 2004). All the prime-target pairs were assigned to four experimental lists according to a Latin Square design, so that each target appeared only once in each list and was paired with a different type of prime. The 80 experimental stimuli were mixed with 100 word-word, 160 word-nonword and 20 nonword-nonword fillers; as such, half of the targets required a “yes” response, and the other half required a “no” response. The nonwords were created in accordance with the phonological and orthographic properties of English by using the Wuggy pseudoword generator (Keuleers & Brysbaert, 2010). All the experimental and filler items were pseudo-randomized to ensure that no same prime-target pair type appeared in more than two consecutive trials. The order of the experimental and filler items in each list was reversed to avoid fatigue and training effects in participants, which generated eight lists in total.

4.3.3 Procedure

Experiment 2 was conducted following the same procedure as in Experiment 1 (see Section 3.3.3 in Chapter 3 for details).

4.3.4 Data Analysis

Participants' accuracy and RTs, which were recorded by the DMDX software package (Forster & Forster, 2003), served as the dependent variables. Prior to analysis, one orthographic item with a high error rate (41%) was removed from the orthographic set (*gram-grammar-source-GRAM*). The pseudo-suffixed items also produced high error rates; however, since this was an expected finding due to the considerably low frequency of the pseudo-stem targets, none of these items was excluded. Thus, a total of 79 experimental items were submitted to the analysis.

As in Experiment 1, incorrect responses and extremely long RTs (greater than 3000 ms) were omitted from the data set. Outliers (RTs above or below two standard deviations from the z-score for each participant) were discarded from further analyses. All these exclusions accounted for 14.01% of the experimental items.

A one-way repeated measures ANOVA with Prime Type (Identity, Related and Unrelated) as the within-subjects factor was conducted for each item type (morphologically inflected, morphologically derived, orthographic, semantic, and pseudo-suffixed). To further examine the significant main effects, the follow-up paired-samples t-tests were performed. The *p*-values of all analyses were Greenhouse-Geisser corrected in cases where the assumption of sphericity was violated.

4.4 Results

4.4.1 Morphological Items

Table 20 shows L2 English learners' mean RTs, SDs and error rates in the morphological (+M+O+S) item set.

Table 20: *Mean RTs (in ms), SDs (in parentheses), and error rates (in percent) for morphological items in Experiment 2*

	Identity	Inflected	Derived	Unrelated
RTs	557.99	574.72	564.17	603.89
(SDs)	(135.83)	(123.07)	(114.02)	(138.03)
Error rate	0	0.5	1.4	4.5
Priming effect	46	29	40	

Concerning the regular past tense inflection, the one-way repeated measures ANOVA on the error data displayed a significant main effect of Prime Type (Identity, Inflected and Unrelated) in the participant and item analyses ($F_1(1.10, 47.25) = 5.96$, $p = .016$; $F_2(1.13, 21.45) = 8.27$, $p = .007$). Planned comparisons indicated that the main effects stemmed from participants' low accuracy in the Unrelated condition (Identity-Inflected: $t_1(43) = 1$, $p = .32$, $t_2(19) = 1$, $p = .33$; Identity-Unrelated: $t_1(43) = 2.67$, $p = .011$, $t_2(19) = 3.25$, $p = .004$; Inflected-Unrelated: $t_1(43) = 2.29$, $p = .027$, $t_2(19) = 2.65$, $p = .016$). Similarly, the ANOVAs on the RT data showed significant main effects of Prime Type ($F_1(2, 86) = 7.82$, $p = .001$; $F_2(2, 38) = 7.32$, $p = .002$). These significant main effects were investigated via pairwise comparisons. The results revealed repetition priming effects, i.e. faster RTs in the Identity condition than in the Unrelated condition ($t_1(43) = 3.48$, $p = .001$; $t_2(19) = 3.44$, $p = .003$), and full priming effects, i.e. similar RTs in the Identity and Inflected conditions with both of them being shorter than the Unrelated condition (Identity-Unrelated: $t_1(43) = 3.48$, $p = .001$, $t_2(19) = 3.44$, $p = .003$; Identity-

Inflected: $t_1(43) = 1.78$, $p = .083$, $t_2(19) = 1.21$, $p = .243$; Inflected-Unrelated: $t_1(43) = 2.42$, $p = .02$, $t_2(19) = 2.87$, $p = .01$).

In relation to deverbal *-er* nominalization, the ANOVAs for the error data yielded significant main effects of Prime Type (Identity, Derived and Unrelated) across participants and items ($F_1(1.33, 56.98) = 5.44$, $p = .015$; $F_2(1.31, 24.82) = 6.23$, $p = .014$). The error rates did not differ significantly between the Identity and Derived conditions ($t_1(43) = 1.77$, $p = .083$; $t_2(19) = 1.83$, $p = .083$). However, the Unrelated condition had significantly higher inaccuracy than the Identity condition in both participant and item analyses ($t_1(43) = 2.67$, $p = .011$; $t_2(19) = 3.25$, $p = .004$), and marginally higher inaccuracy than the Derived condition in the participant analysis only ($t_1(43) = 2.01$, $p = .051$; $t_2(19) = 1.93$, $p = .069$). For the RT data, the ANOVAs revealed main effects of Prime Type ($F_1(1.73, 74.19) = 9.11$, $p = .001$; $F_2(2, 38) = 8.61$, $p = .001$), reflecting robust repetition priming and full priming effects (Identity-Unrelated: $t_1(43) = 3.48$, $p = .001$, $t_2(19) = 3.44$, $p = .003$; Identity-Derived: $t_1(43) = .39$, $p = .70$, $t_2(19) = .75$, $p = .46$; Derived-Unrelated: $t_1(43) = 3.25$, $p = .002$, $t_2(19) = 3.06$, $p = .006$). To determine whether the 40-ms derivational priming effect was significantly larger than 29-ms inflectional priming effect, the Derived condition was compared with the Inflected condition. The results demonstrated that there were no significant differences between the amounts of facilitative effects in the two conditions ($t_1(43) = 1.32$, $p = .194$; $t_2(19) = .75$, $p = .465$).

4.4.2 Orthographic Items

Table 21 presents mean RTs as well as SDs and error rates in the orthographic (-M+O-S) item set.

Table 21: *Mean RTs (in ms), SDs (in parentheses), and error rates (in percent) for orthographic items in Experiment 2*

	Identity	Related	Unrelated
RTs (SDs)	590.54 (158.07)	627.98 (160.92)	668.92 (183.63)
Error rate	2.5	2.8	6.9
Priming effect	78	41	

The ANOVA on the error data showed significant main effects of Prime Type (Identity, Related and Unrelated) in the participant and item analyses (F_1(1.63, 69.95) = 4.58, p = .019; F_2(1.36, 24.42) = 4.06, p = .044), which was due to the Unrelated condition having higher error rates than the Identity and Related conditions (Identity-Related: t_1(43) = .09, p = .93, t_2(18) = .22, p = .83; Identity-Unrelated: t_1(43) = 2.35, p = .023, t_2(18) = 2.11, p = .049; Related-Unrelated: t_1(43) = 2.36, p = .023, t_2(18) = 2.15, p = .045).

Looking at the ANOVAs on the RT data, main effects of Prime Type were found to be significant (F_1(2, 86) = 21.48, p < .0001; F_2(2, 36) = 15.85, p < .0001). L2 learners of English displayed repetition priming and partial priming effects; that is, whereas the word/nonword decisions produced the shortest RTs in the Identity condition, the RTs were the longest in the Unrelated condition (Identity-Unrelated: t_1(43) = 5.72, p < .0001, t_2(18) = 5.25, p < .0001; Identity-Related: t_1(43) = 3.63, p = .001, t_2(18) = 2.95, p = .009; Related-Unrelated: t_1(43) = 3.52, p = .001, t_2(18) = 2.90, p = .01).

4.4.3 Semantic Items

For the semantic (-M-O+S) item set, mean RTs and SDs (as well as error rates) are presented in Table 22.

Table 22: *Mean RTs (in ms), SDs (in parentheses), and error rates (in percent) for semantic items in Experiment 2*

	Identity	Related	Unrelated
RTs	567.77	619.35	628.30
(SDs)	(133.82)	(141.61)	(145.29)
Error rate	1.7	2	2.7
Priming effect	61	9	

The ANOVAs on the error data yielded no significant main effects of Prime Type (Identity, Related and Unrelated) across either participants or items ($F_1(2, 86) = .48$, $p = .62$; $F_2(2, 38) = .18$, $p = .84$), suggesting that the rate of incorrect responses did not differ statistically according to the given three prime conditions. The ANOVAs on the RT data, on the other hand, indicated significant main effects for Prime Type ($F_1(2, 86) = 25.08$, $p < .0001$; $F_2(2, 38) = 18.44$, $p < .0001$). The main effects were further analyzed using paired-samples t-tests. The Identity condition produced the fastest RTs (Identity-Unrelated: $t_1(43) = 6.64$, $p < .0001$, $t_2(19) = 6.10$, $p < .0001$; Identity-Related: $t_1(43) = 5.43$, $p < .0001$, $t_2(19) = 4.18$, $p = .001$), i.e. the identity primes facilitated L2 learners to recognize the target words more than the other prime types did. Unlike in the comparison of the Identity and Unrelated conditions (repetition priming effects), there were no significant differences in RTs between the Related and Unrelated conditions ($t_1(43) = .58$, $p = .57$; $t_2(19) = 1.24$, $p = .23$), which was indicative of the absence of purely semantic priming effects.

4.4.4 Pseudo-Suffixed Items

Table 23 displays mean RTs to the targets (as well as SDs and error rates) in the pseudo-suffixed (+M+O-S) item set.

Table 23: *Mean RTs (in ms), SDs (in parentheses), and error rates (in percent) for pseudo-suffixed items in Experiment 2*

	Identity	Related	Unrelated
RTs	713.29	699.40	765.58
(SDs)	(251.45)	(214.65)	(225.74)
Error rate	23.1	31	35.7
Priming effect	52	66	

For the error data, the one-way repeated measures ANOVA showed main effects of Prime Type (Identity, Pseudo-Suffixed and Unrelated) in both participant and item analyses ($F_1(1.72, 73.87) = 4.77$, $p = .015$; $F_2(2, 38) = 8.94$, $p = .001$). Subsequent t-tests revealed the Unrelated condition to produce higher error rates than the Identity condition ($t_1(43) = 3.66$, $p = .001$; $t_2(19) = 3.70$, $p = .002$). The Unrelated condition also displayed higher inaccuracy (only in the item analysis) than the Related condition ($t_1(43) = 1.22$, $p = .23$; $t_2(19) = 3.09$, $p = .006$), yet there were no significant differences between the error rates in the Identity and Related conditions ($t_1(43) = 1.61$, $p = .12$; $t_2(19) = 1.22$, $p = .28$).

For the RT data, the ANOVAs found significant main effects of Prime Type ($F_1(2, 86) = 4.86$, $p = .01$; $F_2(2, 38) = 5.31$, $p = .009$). Pairwise comparisons indicated significant repetition priming effects (Identity-Unrelated: $t_1(43) = 3.07$, $p = .004$, $t_2(19) = 2.24$, $p = .038$). A full priming effect was observed for the Pseudo-Suffixed condition (Identity-Pseudo suffixed: $t_1(43) = .52$, $p = .606$, $t_2(19) = 1.35$, $p = .193$; Pseudo suffixed-Unrelated: $t_1(43) = 2.50$, $p = .016$, $t_2(19) = 2.72$, $p = .014$).

4.4.5 Summary

The results of Experiment 2 were similar to those of Experiment 1 as firstly, repetition priming effects were found in the morphological, orthographic and semantic item sets, and secondly purely semantically related prime-target pairs produced no priming effects. In this experiment, advanced Turkish learners of L2 English also displayed full priming effects for all morphologically related (i.e. inflected, derived, and pseudo-suffixed) prime-target pairs. At first glance, one might conclude that native speakers of Turkish process morphologically complex word forms in the same way in both their L1 and L2. However, the fact that purely orthographically related prime-target pairs produced partial priming effects in this experiment indicates that native speakers of Turkish make use of not only morphological but also orthographic information during L2 visual word recognition. In the next chapter, the findings obtained from Experiments 1 and 2 will be discussed in more detail.

CHAPTER 5

DISCUSSION AND CONCLUSION

This final chapter consists of two main sections. The first section summarizes the current study and presents general conclusions by discussing the results from the empirical chapters. The second section suggests directions for future research.

5.1 Summary of the Study and Discussion

The present study primarily aimed to address whether morphologically complex word forms are processed as morpheme-based units or as whole units during early stages of visual word recognition, and whether or not there are differences between L1 and L2 morphological processing. Furthermore, the study examined both inflectional and derivational processes to find out whether inflected and derived word forms are processed in the same way or not. Lastly, it was sought to explore whether semantic and orthographic effects are involved in the early stages of L1 and L2 visual word recognition. To this end, two experiments were run using the visual masked priming technique with an SOA of 50 ms. Experiment 1 was conducted with native Turkish speakers to investigate the L1 processing of Turkish inflected words ending with the suffix *-mIş* and of Turkish derived words ending with the suffix *-(y)IcI*. Experiment 2, on the other hand, was administered to native Turkish speakers who were highly proficient in their L2 (English) in order to examine the L2 processing of English inflected words with the suffix *-ed* and of English derived words with the suffix *-er*. In the following sections, the results of these experiments will be discussed on the basis of the abovementioned purposes of this study.

5.1.1 Discussion of L1 Results

The main finding of Experiment 1 was that native speakers of Turkish exhibited partial priming effects for both inflected (+M+O+S) and derived (+M+O+S) prime-target pairs. In other words, the prior presentation of identical primes (e.g. *kullanmak,* "to use") significantly facilitated the recognition of stem targets (e.g. *KULLANMAK,* "to use") relative to unrelated control primes (e.g. *heyecanlı,* "excited"). Inflected and derived primes (e.g. *kullanmış* "s/he apparently used", *kullanıcı* "user") also speeded up reaction times to their stem targets; however, these morphologically related prime-target pairs yielded smaller facilitation effects than the identical pairs. The same priming patterns obtained for inflected and derived prime-target pairs can be taken as a strong indication that inflected and derived words are identically represented in the lexicon, which is contrary to realization-based morphological theories arguing for the distinction between inflectional and derivational processes (Matthews, 1991; Anderson, 1992). On the other hand, it must not be disregarded that the partial priming effects reported for inflected and derived prime-target pairs in L1 Turkish are not compatible with previous masked priming studies that found full priming effects for inflected and/or derived words (i.e. statistically same amount of facilitation effects as for the identical primes) in L1 speakers of English and German (e.g. Silva & Clahsen, 2008; Morris & Stockall, 2012; Clahsen & Neubauer, 2010). Even though both partial and full priming effects actually reflect morphological decomposition during word recognition, the reduced amount of priming in Turkish, which is morphologically relatively richer than English and German, seems to be unexpected on the basis of the economy of storage principle. This is because the economy of storage principle maintains that the amount of full-form storage decreases with the increasing number of word forms to be stored in the mental lexicon (Frauenfelder & Schreuder, 1992). It further asserts that the listing of word forms in the lexicon takes up storage space and produces a heavy memory load, and that this memory load can be alleviated by storing word forms as morpheme-based units rather than as full-form units (ibid). In regards to this principle, Hankamer (1989) also computes that an educated native speaker of

Turkish needs to store over 200 billion word forms, which is far beyond the storage capacity of the human brain, and argues that the morphological richness of Turkish promotes reliance on decompositional processes to save significant storage space in the brain.

As discussed in Section 2.4.3, the inflected and derived word forms employed in the present study are not only morphologically but also semantically and orthographically related to their stems. Therefore, to test any influence of semantic and orthographic relatedness on morphological priming effects, two control-item sets were constructed in Experiment 1. In the semantic item set, no priming effects were found for purely semantically related (-M-O+S) prime-target pairs. This was because semantically related words (e.g. *postane* “post office”) elicited as long reaction times as unrelated prime words (e.g. *yoğurt* “yogurt”) during the recognition of target words (e.g. *MEKTUP* “letter”). What follows from this finding is that a prime presentation time of 50 ms does not allow L1 speakers to activate semantic properties of prime words and hence semantic overlap between primes and targets does not facilitate the visual word recognition process in L1. This finding is consistent with earlier cross-linguistic findings that semantic effects do not play a role at the early stages of visual word recognition (e.g. Longtin et al., 2003; Rastle et al., 2004; Lavric, Elchlepp & Rastle, 2012). Similarly, no priming effects were observed for purely orthographically related (-M+O-S) prime-target pairs (e.g. *haziran* “june” – *HAZİNE* “treasure”) in the orthographic item set, which corroborates earlier results indicating that the initial stages of visual word recognition are insensitive to orthographic relatedness between primes and targets (e.g. Rastle et al., 2004; Marslen-Wilson et al., 2008).

Thus, overall, three general conclusions can be reached on the basis of the findings of Experiment 1 conducted with L1 speakers of Turkish. The first general conclusion is that the same morpholexical representations underlie inflectional and derivational processes in L1 Turkish. Second, priming effects are obtained for inflected and derived word forms in the absence of semantic and orthographic effects and are therefore most probably driven by the morphological relatedness between inflected/derived word forms and their stems. Finally, since morphological priming effects have been taken as indicative of decomposition (e.g. Silva, 2009), it can be confidently concluded that productive inflected and derived word forms are decomposed into their morphemic components, i.e. stems and suffixes, during visual word recognition in L1 Turkish. For instance, when morphologically complex words such as *kullanmış* and *kullanıcı* are presented as prime words, these complex words are accessed through representations of their stems and affixes, i.e. *kullan + mış* and *kullan + ıcı*. Hence, when their stems are presented as target words, repeated stem activation facilitates the recognition of the stem targets and gives rise to priming effects.

5.1.2 Discussion of L2 Results

In Experiment 2, advanced L2 speakers of English whose native language was Turkish demonstrated full priming effects for inflected (+M+O+S), derived (+M+O+S), and pseudo-suffixed (+M+O-S) prime-target pairs. That is, the same priming patterns were observed for all morphologically related prime-target pairs, regardless of whether there was a semantically transparent (e.g. *killed – KILL; killer – KILL*) or opaque (e.g. *whisker – WHISK*) relationship between primes and targets. This result suggests that semantic opacity does not have any influence on L2 morphological processing, which is in keeping with the results of previous L1 studies reporting equivalent priming effects for semantically transparent and opaque words (e.g. Rastle et al., 2004; Longtin et al., 2003). Additionally, the fact that purely semantically related (-M-O+S) prime-target pairs (e.g. *sick – ILL*) failed to induce any priming effects provides useful evidence with respect to the ineffectiveness of semantic relatedness on morphological priming. Thus, the results coming from the pseudo-suffixed and purely semantically related prime-target pairs exclude the possibility that L2 learners make use of semantic information during early stages of visual word recognition.

The priming effects obtained for inflected and derived prime-target pairs reveal that inflected and derived words have identical morpholexical representations in an L2. On the one hand, this result runs counter to the findings of Silva and Clahsen (2008) and Kırkıcı and Clahsen (2013), who reported priming effects for derivation but not for inflection and explained the distinction between inflection and derivation within realization-based theories of morphology. On the other hand, this result lends strong support to the findings of Voga, Anastassiadis-Symeonidis and Giraudo (2014), who replicated Silva and Clahsen's (2008) study with Greek learners of L2 English and found full priming effects for both inflection and derivation, and to the findings of Feldman et al. (2010), who reported priming effects for inflection in Serbian learners of L2 English.

Silva and Clahsen (2008) pointed out two alternative proposals to account for the absence of inflectional priming effects in their L2 learners: (1) "the syntactic representations of the L2 grammar may lack the functional categories (e.g. INFL or TENSE) or the relevant functional features (e.g. [±past]) that are required for inflection", (2) "inflections may have incomplete or unspecified feature specifications in an L2" (p. 257). In fact, these two proposals, respectively, refer to the Impaired Representation Hypothesis and the Missing Surface Inflection Hypothesis which have been formulated regarding the non-native-like use of inflectional morphology in an L2 (see Prévost & White, 2000). According to the Impaired Representation Hypothesis, L2 grammar is impaired in the domain of inflectional morphology due to the lack of functional categories and features (e.g. Meisel, 1991; Eubank, 1993/94; Vainikka & Young-Scholten, 1994, 1996; Hawkins & Chan, 1997). For example, based on the analyses of L2 German data from native speakers of Turkish, Korean and Romance languages, Vainikka and Young-Scholten's (1994, 1996) 'Minimal Trees' account postulates that functional categories are absent at the initial stages of L2 syntactic development. Eubank's (1993/94) 'Valueless Features' account also posits that although the functional categories in L1 grammar are initially transferred to L2 grammar, their features become valueless in L2 grammar. The Missing Surface Inflection Hypothesis, on the other hand, suggests that L2 grammatical representations do not lack the functional categories and features associated with inflection, but that L2 learners have difficulty in realizing surface morphology (e.g. Haznedar & Schwartz, 1997; Prévost & White, 2000; Lardiere, 2000). For instance, while adult learners of French and German never used finite verb forms in non-finite contexts, they optionally used finite forms in finite contexts, indicating that the adult L2 learners had syntactic knowledge of finiteness but suffered from the morphological realization of finiteness (Prévost & White, 2000). Overall, these hypotheses claim that inflected word forms have incomplete representations at the syntactic or morphological level of L2 grammar, and thus that L2 learners may not process inflected forms in a morphologically structured format.

On the other hand, the fact that the L2 participants in the present study exhibited inflectional priming effects indicates that L2 learners can develop structured representations for inflected word forms. This variability in L2 inflectional processing may stem from the type of L2 exposure. According to Muñoz (2008), there are two types of L2 exposure: naturalistic exposure, where learning takes place through unstructured and unlimited input in a second language environment, and classroom exposure, where learning occurs through structured and formal input in a foreign language environment. Previous studies examining various aspects of L2 processing have proved the effects of L2 exposure (e.g. phonological processing: Flege & Liu, 2001; processing of relative clause attachment ambiguities: Frenck-Mestre, 2002; gender agreement processing: Morgan-Short, Sanz, Steinhauer & Ullman, 2010). As such, it can be speculated that the L2 processing of inflected word forms depends on the nature of L2 input. While naturalistic input may not help L2 learners to acquire certain functional categories and features, classroom input may enable L2 learners to focus on functional categories and features through grammar-based classroom practices and to build structured representations for inflected forms. In Silva and Clahsen's (2008) study, which failed to find inflectional priming effects, for example, German, Japanese and Chinese learners of L2 English had been living in the UK and had been receiving naturalistic exposure to English. Similarly, Kırkıcı and Clahsen's (2013) L2 learners of Turkish from different L1 backgrounds had also been living in the target language environment and had been exposed to naturalistic input. On the other hand, in the studies reporting significant priming effects for inflected words (Voga et al., 2014; Feldman et al., 2010, and the current study), L2 learners of English had been learning English in a classroom setting and had not been living in an English-speaking country. Thus, the reason why previous studies present an inconclusive picture about L2 inflectional processing may relate to whether or not L2 learners are exposed to the target language in a structured learning setting. In this respect, Gor and Long (2009) also highlight the positive effects of classroom exposure on the acquisition of regular inflectional patterns.

Another important result of Experiment 2 was that partial priming effects arose for purely orthographically related (-M+O-S) prime-target pairs (e.g. *scandal – SCAN*). This shows that orthographic overlap between prime-target pairs leads to facilitation during visual word recognition in L2. From a limited number of studies examining orthographic effects in L2 morphological processing, it can be inferred that orthographic priming is closely related to individual differences in exposure to L2; orthographic priming effects are observed in L2 learners who are exposed to their L2 primarily through formal instruction (e.g. Heyer & Clahsen, 2014; the present study), but not in L2 learners who receive naturalistic input (e.g. Silva, 2009; Kırkıcı & Clahsen 2013). Taken together with the possible effects of classroom exposure on L2 inflectional processing, it appears that L2 classroom input may trigger sensitivity to the surface-form properties of words as well as to the inflectional categories and features. Furthermore, the fact that morphologically related prime-target pairs produced a greater magnitude of priming effects than orthographically related pairs (full vs. partial priming effects) can be taken as indicating that orthographic information affects but does not govern L2 morphological processes.

On the whole, four general conclusions can be drawn from the results of Experiment 2, which tested highly proficient learners of L2 English with Turkish as their L1. First of all, productive inflected and derived words are processed in the same way in an L2 since morpholexical representations of inflected words do not differ from those of derived words. Second, although inflectional and derivational priming effects emerge independent of the semantic relatedness between inflected/derived word forms and their stems, orthographic relatedness plays a role in visual recognition of inflected and derived words. The third conclusion is that, based on significant morphological priming effects, inflected and derived word forms are segmented into their stems and affixes (e.g. *kill* + *ed*, *kill* + *er*) during visual word recognition in L2 English. However, it should be noted that these decompositional processes are not purely morphological in nature, but are summed effects of morphological and orthographic information. Lastly, from the results of Experiments 1 and 2, it can be concluded that native speakers of Turkish do not display the same behavior in L1 and L2 processing: while L1 morphological processing is driven by morphological properties of inflected and derived word forms, L2 morphological processing is based on converging effects of morphological and orthographic overlap between inflected/derived words and their stems. Thus, this study provides support for the view that L2 processing is more dependent on non-structural information sources than L1 processing, and indicates that the high level of L2 proficiency does not necessarily render L2 processing native-like (Clahsen & Felser, 2006a).

5.2 Suggestions for Further Research

The findings of the present study open up new avenues to further investigate how morphologically complex words are processed in L1 and L2. To begin with, an obvious shortcoming of this study is that the orthographic priming results in Experiment 1 were obtained from 13 items, whereas the morphological and semantic priming results were respectively obtained from 28 and 24 items. Therefore, 11 prime-target pairs which were removed from the orthographic item set prior to data analysis need to be exchanged with new purely orthographically related words in order to increase the reliability of the obtained orthographic priming results.

Second, Experiment 2 may be administered to low proficiency Turkish learners of L2 English as a follow-up to this study; thus, the effect of proficiency on L2 morphological processing may be examined, and it may be discussed whether there are any developmental differences between high and low proficiency L2 learners. Besides, the scope of this study may be extended to take type of L2 exposure as an additional variable in Experiment 2. To this end, advanced Turkish learners who have received naturalistic input to L2 English input (as well as the L2 learners in the present study) might be tested. Such a study would provide useful findings to confirm or reject the speculative explanations which have been made in the previous section in order to account for the contradictory results (regarding inflectional and orthographic priming) of earlier L2 studies.

Additionally, the effect of semantic opacity may also be investigated in L1 processing. Although it is much more challenging to find pseudo-suffixed prime-target words (e.g. *corn* + *er* – *CORN*) in Turkish than in English, semantic opacity may be explored by including nonword prime-target pairs (e.g. *karlan** + *ıcı* – *KARLANMAK**, *darn** + *er* – *DARN**) in both L1 Turkish and L2 English.

REFERENCES

Abutalebi, J. (2008). Neural aspects of second language representation and language control. *Acta Psychologica, 128,* 466-478.

Aksan, D. (1987). Türkçenin Gücü. T. İş Bankası Kültür Yayınları.

Aksan, Y., Aksan, M., Koltuksuz, A., Sezer, T., Mersinli, Ü., Demirhan, U. U., … Yıldız, İ. (2012). Construction of the Turkish National Corpus (TNC). In *Proceedings of the Eight International Conference on Language Resources and Evaluation (LREC 2012).* İstanbul. Türkiye. http://www.lrec-conf.org/proceedings/lrec2012/papers.html

Alegre, M., & Gordon, P. (1999). Rule-based versus associative processes in derivational morphology. *Brain and Language*, *68*, 347-354.

Anderson, S. R. (1992). *A-morphous morphology*. Cambridge: Cambridge University Press.

Aronoff, M. (1994). *Morphology by itself: Stems and inflectional cases*. Cambridge, MA: MIT Press.

Baayen, H., Dijstra, T., & Schreuder, R. (1997). Singulars and plurals in Dutch: Evidence for a parallel dual route model. *Journal of Memory and Language, 37*, 94-117.

Berent, I., Pinker, S., & Shimron, J. (1999). Default nominal inflection in Hebrew: Evidence for mental variables. *Cognition*, *72*, 1-44.

Berko, J. (1958). The child's learning of morphology. *Word, 14*, 150-177.

Beyersmann, E., Castles, A., & Coltheart, M. (2011). Early morphological decomposition during visual word recognition: Evidence from masked transposed-letter priming. *Psychonomic Bulletin & Review, 18,* 937942.

Blevins, J. P. (2006). English inflection and derivation. In B. Aarts, and A. M. McMahon (eds.), *Handbook of English Linguistics*, pp. 507-536. London: Blackwell.

Bloomfield, L. (1933). *Language*. New York: Henry Holt.

Blumenthal-Dramé, A. (2012). *Entrenchment in usage-based theories: what corpus data do and do not reveal about the mind*. Berlin etc.: Walter de Gruyter.

Bochner, H. (1992). Simplicity in Genrative Morphology. Berlin and New York: Mouton de Gruyter.

Boudelaa, S., & Marslen-Wilson, W. (2005). Discontinuous morphology in time: Incremental masked priming in Arabic. *Language and Cognitive Processes*, *20*, 207-260.

Bowden, H., Gelfand, M. T., Sanz, C., & Ullman, M. (2010). Inflectional morphology in L1 and L2 Spanish: An examination of frequency effects. *Language Learning*, *60* (1), 44-87.

Caramazza, A., Laudanna, A., & Romani, C. (1988). Lexical access and inflectional morphology. *Cognition, 28,* 297-332.

Carlisle, R. S., Charmley, T., Salgueiro-Carlisle, M., & Bennett, K. (1997). Errors with inflectional morphemes in the English compositions of LEP students. In A. Melby (ed.), *The Twenty-Third LACUS Forum 1996*, pp.461-474. The Linguistic Association of Canada and the United States.

Chialant, D., & Caramazza, A. (1995). Where is morphology and how is it processed? The case of written word recognition. In L. B. Feldman (ed.), *Morphological Aspects of Language Processing*, pp. 55-76. Hillsdale, N: Lawrence Erlbaum Associates Inc.

Clahsen, H. (2004). *Prefixed word forms in the German mental lexicon*. Unpublished Manuscript.

Clahsen, H., & Felser, C. (2006a). Grammatical processing in language learners. *Applied Psycholinguistics, 27,* 3-42.

Clahsen, H., & Felser, C. (2006b). How native-like is non-native language processing? *Trends in Cognitive Sciences, 10*, 564-570.

Clahsen, H., Felser, C., Neubauer, K., Sato, M., & Silva, R. (2010). Morphological structure in native and nonnative language processing. *Language Learning, 60 (1),* 21-43.

Clahsen, H., & Ikemoto, Y. (2012). The mental representation of derived words: An experimental study of -sa and -mi nominals in Japanese. *The Mental Lexicon*, *7*(2), 147-182.

Clahsen, H., & Neubauer, K. (2010). Morphology, frequency, and the processing of derived words in native and non-native speakers. *Lingua 120*, 2627-2637.

Clahsen, H., Sonnenstuhl, I., & Blevins, J. (2003). Derivational morphology in the German mental lexicon: A dual mechanism account. In R. H. Baayen & R. Schreuder (eds.), *Morphological Structure in Language Processing,* pp. 125 - 155. Berlin: Mouton de Gruyter.

Davis, C. J. (2000). Match Calculator. Software. http://www.pc.rhul.ac.uk/staff/c.davis/Utilities/MatchCalc/index.htm

Davis, C. J. (2010). The spatial coding model of visual word identification. *Psychological Review, 117,* 713-758.

Davis, C. J. (2012). The orthographic similarity of printed words. In J. S. Adelman (ed.), *Visual Word Recognition Volume 1,*pp. 185-206. Hove: Psychology Press.

Diependaele, K., Sandra, D., & Grainger, J. (2005). Masked cross-modal morphological priming: Unravelling morpho-orthographic and morpho-semantic influences in early word recognition. *Language and Cognitive Processes*, *20*(1/2), 75-114.

Don, J. (2014). *Morphological Theory and the Morphology of English*. Edinburgh: Edinburgh University Press.

Duñabeitia, J. A., Dimitropoulou, M.,Morris, J., & Diependaele, K. (2013). The role of form in morphological priming: Evidence from bilinguals. *Language and Cognitive Processes, 28,* 967-987.

Eubank, L. (1993/94). On the transfer of parametric values in L2 development. *Language Acquisition, 3*, 183-208.

Feldman, L. B., O'Connor, P. A., & Moscoso del Prado Martín, F. (2009). Early morphological processing is morpho-semantic and not simply morphoorthographic: A violation of form-then-meaning accounts of word recognition. *Psychonomic Bulletin & Review, 16 (4),* 684-691.

Feldman, L. B., Kostić, A., Basnight-Brown, D. M., Filipović Đurđević, D., & Pastizzo, M. J. (2010). Morphological facilitation for regular and irregular verb formations in native and non-native speakers: Little evidence for two distinct mechanisms. *Bilingualism: Language and Cognition, 13 (2),* 119-135.

Flege, J. E., & Liu, S. (2001). The effect of experience on adults' acquisition of a second language. *Studies in Second Language Acquisition, 23*, 527–552.

Frenck-Mestre, C. (2002). An on-line look at sentence processing in the second language. In J. Altarriba and R. Herridia (eds.), *Bilingual sentence processing,* pp. 218-236. Amsterdam: Elsevier.

Forster, K. I. (1998). The pros and cons of masked priming. *Journal of Psycholinguistic Research, 27*, 203–233.

Forster, K. I., & Davis, C. (1984). Repetition priming and frequency attenuation in lexical access. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 10,* 680-698.

Forster, K. I., & Forster, J. C. (2003). DMDX: A Windows display program with millisecond accuracy. *Behavior Research Methods Instruments and Computers, 35,* 116-124.

Frauenfelder, U. H., & Schreuder, R. (1992). Constraining psycholinguistic models of morphological processing and representation: The role of productivity. In G. E. Booij & J. van Marle (eds.), *Yearbook of morphology 1991*, pp. 165-183. Dordrecht: Kluwer.

Frost, R., Deutsch, A., Gilboa, O., Tannenbaum, M., & Marslen-Wilson, W. (2000). Morphological priming: Dissociation of phonological, semantic and morphological factors. *Memory & Cognition*, *28*(8), 1277-1288.

Frost, R., Forster, K., & Deutsch, A. (1997). What can we learn from the morphology of Hebrew? A masked-priming investigation of morphological representation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *23*(4), 829-856.

Gor, K., & Long, M. H. (2009). Input and second language processing. *Handbook of Second Language Acquisition*, 445-472.

Göksel, A., & Kerslake, C. (2005). Turkish: A comprehensive grammar. London: Routledge.

Granger, S., Dagneaux, E., Meunier, F., & Paquot, M. (2009). *The international corpus of learner English, Version 2. Handbook and CD-ROM*. Louvain-la-Neuve: Presses universitaires de Louvain.

Hagiwara, H., Sugioka, Y., Ito, T., Kawamura, M., & Shiota, J. I. (1999). Neurolinguistic evidence for rule-based nominal suffixation. *Language, 75,* 739-763.

Hahne, A., Mueller, J. L., & Clahsen, H. (2006). Morphological processing in a second language: Behavioral and event-related brain potential evidence for storage and decomposition. *Journal of Cognitive Neuroscience*, *18*(1), 121-134.

Halle, M., & Mohanan, K. (1985). Segmental phonology of modern English. *Linguistic Inquiry*, *16,* 57-116.

Halle, M., & Marantz, A. (1993). Distributed morphology and the pieces of inflection. In K. Hale and S. J. Keyser (eds.), *The view from vuilding 20: Essays in honor of Sylvain Bromberger*, pp. 111-176. Cambridge, MA: MIT Press.

Hankamer, J. (1989). Morphological parsing and the lexicon. In W. D. Marslen-Wilson (ed.), *Lexical representation and process*, pp. 392–408. Cambridge, MA: MIT Press.

Harley, H., & Noyer, R. (1999). State-of-the-article: Distributed morphology. *GLOT, 4,* 3–9.

Hasegawa, M., Carpenter, P., & Just, M. (2002). An fMRI study of bilingual sentence comprehension and workload. *Neuroimage, 15*(3), 647-660.

Hawkins, R., & Chan, C. (1997). The partial availability of UG in second language acquisition: The “failed functional features hypothesis”. *Second Language Research, 13,* 187-226.

Haznedar, B., & Schwartz, B. (1997). Are there optional infinitives in child L2 acquisition? In E. Hughes and A. Greenhill (eds.), *Proceedings of the 21st Annual Boston University Conference on Language Development*, pp. 257-268. Somerville, MA: Cascadilla Press.

Heyer, V., & Clahsen, H. (2014). Late bilinguals see a scan in scanner AND in scandal: dissecting formal overlap from morphological priming in the processing of derived words. *Bilingualism: Language and Cognition, 18*(3), 543-550.

Hudson, R. (1984). *Word Grammar*. Oxford: Blackwell.

Indefrey, P. (2006). A meta-analysis of hemodynamic studies on first and second language processing: Which suggested differences can we trust and what do they mean? *Language Learning, 56*, 279-304.

Kazanina, N., Dukova-Zheleva, G., Geber, D., Kharlamov, V., & Tonciulescu, K. (2008). Decomposition into multiple morphemes during lexical access: a masked priming study of Russian nouns. *Language & Cognitive Processes, 23,* 800-823.

Keuleers, E., & Brysbaert, M. (2010). Wuggy: A multilingual pseudoword generator. *Behavior Research Methods, 42*(3), 627-633.

Kırkıcı, B. (2005). *Words and rules in L2 processing: An analysis of the dual-mechanism model* (Doctoral dissertation). Middle East Technical University.

Kırkıcı, B., & Clahsen, H. (2013). Inflection and derivation in native and non-native language processing: Masked priming experiments on Turkish. *Bilingualism: Language and Cognition, 16,* 776-791.

Kinoshita, S. & Norris, D. (2013). Letter order is not coded by open bigrams. *Journal of Memory and Language, 69,* 135-150. http://dxdoi.org/10.1016/j.jml.2013.03.003

Kiparsky, P. (1982). Word formation and the lexicon. In F. Ingemann (ed.), *Proceedings of the 1982 Mid-America Linguistics Conference*, pp. 3-29. Lawrence: University of Kansas.

Lahiri, A. (2012). Asymmetric phonological representations of words in the mental lexicon. In A. Cohn et al. (eds.), *The Oxford Handbook of Laboratory Phonology*, pp. 146-161. Oxford: Oxford University Press.

Lardiere, D. (2000). Mapping features to forms in second language acquisition. In J. Archibald (ed.), *Second Language Acquisition and Linguistic Theory*, pp. 103-129. Oxford: Blackwell.

Laudanna, A., & Burani, C. (1995). Distributional properties of derivational affixes: Implications for processing. In L. B. Feldman (ed.), *Morphological Aspects of Language Processing*, pp. 345-364. Hillsdale, NJ: Erlbaum.

Lavric, A., Elchlepp, H., & Rastle, K. (2012). Tracking morphological decomposition using brain potentials. *Journal of Experimental Psychology: Human Perception & Performance, 38,* 811- 816.

Lehtonen, M., Niska, H., Wande, E., Niemi, J., & Laine, M. (2006) Recognition of inflected words in a morphologically limited language: Frequency effects in monolinguals and bilinguals. *Journal of Psycholinguistic Research, 35,* 121-146.

Lewis, G. L. (2000). *Turkish Grammar*. Oxford: Oxford University Press.

Ling, C. X., & Marinov, M. (1993). Answering the connectionist challenge: a symbolic model of learning the past tenses of English verbs. *Cognition*. *49*(3), 235-290.

Longtin, C., Segui, J., & Hallé, P. (2003). Morphological priming without morphological relationship. *Language and Cognitive Processes*, *18*(3), 313-334.

Lyons, J. (1968). Introduction to theoretical linguistics. London & New York: Cambridge University Press.

MacWhinney, B., & Leinbach, J. (1991). Implementations are not conceptualisations: Revising the verb learning model. *Cognition*, *40*, 121-157.

Marchman, V. A. (1997). Children's productivity in the English past tense: The role of frequency, phonology, and neighborhood structure. *Cognitive Science, 21*(3), 283-304.

Marcus, G., Pinker, S., Ullman, M., Hollander, M., Rosen, J., & Xu, F. (1992). Overregularization in language acquisition. *Monographs of the Society for Research in Child Development, 57*(4, Serial number 228).

Marslen-Wilson, W. D. (2007). Morphological processes in language comprehension. In G. Gaskel (ed.), *The Oxford handbook of psycholinguistics*, pp. 175-193. Oxford: Oxford University Press.

Marslen-Wilson, W. D., Bozic, M., & Randall, B. (2008). Early decomposition in visual word recognition: Dissociating morphology, form, and meaning. *Language and Cognitive Processes, 23,* 394–421.

Marslen-Wilson, W. D., Ford, M., Older, L., & Zhou, X. (1996). The combinatorial lexicon: Priming derivational affixes. In G. W. Cottrell (ed.), Proceedings of the 18th Annual Conference of the Cognitive Science Society, pp. 223-227. Mahwah, NJ: Lawrence Erlbaum Associates Inc.

Marslen-Wilson, W. D., & Tyler, L. K. (1997). Dissociating types of mental computation. *Nature, 387*, 592-594.

Matthews, P. H. (1991). *Morphology*. Cambridge: Cambridge University Press.

McClelland, J. L., & Patterson, K. (2002). Rules or connections in past-tense inflections: What does the evidence rule out? *Trends in Cognitive Sciences*, *6*, 465-472.

McCormick, S., Brysbaert, M., & Rastle, K. (2009). Is morphological decomposition limited to low-frequency words? *The Quarterly Journal of Experimental Psychology, 62*, 1706-1715.

McDonald, J. L. (2006). Beyond the critical period: Processing-based explanations for poor grammaticality judgment performance by late second language learners. *Journal of Memory and Language, 55,* 381-401.

Meisel, J. M. (1991). Principles of Universal Grammar and strategies of language use. In L. Eubank (ed.), *Pointcounterpoint: Universal grammar in the second language*, pp. 231–276. Amsterdam: Benjamins.

Morgan-Short, K., Sanz, C., Steinhauer, K., & Ullman, M. T. (2010). Second language acquisition of gender agreement in explicit and implicit training conditions: An event related potential study. *Language learning, 60*, 154-193.

Morgan-Short, K., & Ullman, M. T. (2011). The neurocognition of second language. In A. Mackey and S. Gass (eds.), *Handbook of Second Language Acquisition*, pp. 282-299. London: Routledge.

Morris, J. & Stockall, L. (2012). Early, equivalent ERP masked priming effects for regular and irregular morphology. *Brain & Language, 123,* 81-93.

Muñoz, C. (2008). Symmetries and asymmetries of age effects in naturalistic and instructed L2 learning. *Applied Linguistics, 29*, 578-596.

Neubauer, K., & Clahsen, H. (2009). Decomposition of inflected words in a second language: An experimental study of German participles. *Studies in Second Language Acquisition, 31*, 403-435.

Oflazer, K., Göçmen, E., & Bozşahin, C. (1994). *An Outline of Turkish Morphology*: Technical Report, Middle East Technical University.

Paradis, J. (2009). *Oral language development in French and English and the role of home input factors*. Report for the Conseil Scolarie Centre-Nord, Edmonton, Alberta.

Perani, D., Paulesu, E., Galles, N. S., Dupoux, E., Dehaene, S., Bettinardi, V., Cappa, S. F., Fazio, F., & Mehler, J. (1998). The bilingual brain: Proficiency and age of acquisition of the second language. *Brain*, *121*, 1841-1852.

Pinker, S. (1991). Rules of language. *Science*, *253*, 530-535.

Pinker, S. (1999). *Words and Rules: The Ingredients of Language*. New York: HarperCollins.

Pinker, S., & Prince, A. (1988). On language and connectionism: analysis of a paralel distributed processing model of language acquisition. *Cognition, 28*(1/2)*,* 73-193.

Pinker, S., & Ullman, M. T. (2002). The past-tense debate: The past and future of the past tense. *Trends in Cognitive Sciences*. *6*(11), 456-463.

Plag, I. (2003). *Word-formation in English.* Cambridge: Cambridge University Press.

Pliatsikas, C., & Marinis, T. (2013). Processing of regular and irregular past tense morphology in highly proficient L2 learners of English: A self-paced reading study. *Applied Psycholinguistics, 34*(5)*,* 943-970.

Plunkett, K., & Marchman, V. (1993). From rote learning to system building: acquiring verb morphology in children and connectionist nets. *Cognition*, *48*, 21-69.

Portin, M., Lehtonen, M., & Laine, M. (2007). Processing of inflected nouns in late bilinguals. *Applied Psycholinguistics, 28,* 135-156.

Prasada, S., Pinker, S., & Synder, W. (1990) Some evidence that irregular forms are retrieved from memory but regular forms are rule-generated. Paper presented at the 31st Annual Meeting of the Psychonomic Society, New Orleans, LA.

Prévost, P., & White, L. (2000). Missing surface inflection or impairment in second language? Evidence from tense and agreement. *Second Language Research, 16*, 103-133.

Rastle, K., Davis, M. H., Marslen-Wilson, W. D., & Tyler, L. K. (2000). Morphological and semantic effects in visual word recognition: A time-course study. *Language and Cognitive Processes*, *15*(4/5), 507-537.

Rastle, K., Davis, M. H., & New, B. (2004). The broth in my brother's brothel: Morpho-orthographic segmentation in visual word recognition. *Psychonomic Bulletin and Review*, *11*(6), 1090-1098.

Rastle, K., Lavric, A., Elchlepp, H., & Crepaldi, D. (2015). Processing differences across regular and irregular inflections revealed through ERPs. *Journal of Experimental Psychology: Human Perception and Performance, 41*(3), 747-760.

Rumelhart, D.E., and McClelland, J.L. (1986). On learning the past tenses of English verbs. In D.E. Rumelhart (ed.), *Parallel Distributed Processing: Explorations in the Microstructure of Cognition*, pp. 216-271. Cambridge, MA: MIT Press.

Schreuder, R., & Baayen, R. H. (1995). Modeling morphological processing. In L. B. Feldman (ed.), *Morphological aspects of language processing*, pp. 131-156. Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

Silva, R. H. (2009). *Morphological processing in a second language: Evidence from psycholinguistic experiments* (Doctoral dissertation). University of Essex.

Silva, R., & Clahsen, H. (2008). Morphologically complex words in L1 and L2 processing: Evidence from masked priming experiments in English. *Bilingualism: Language and Cognition*, *11*, 245-260.

Sonnenstuhl, I., Eisenbeiss, S., & Clahsen, H. (1999). Morphological priming in the German mental lexicon. *Cognition, 72*, 203-236.

Stemberger, J.P., & MacWhinney, B. (1988). Are inflected forms stored in the lexicon? In M. Hammond and M. Noonan (eds.), *Theoretical Morphology: Approaches in Modern Linguistics*, pp. 101-116. San Diego, CA: Academic Press.

Stump, G. T. (1998). Inflection. In A. Spencer and M. Zwicky (eds.), *Handbook of Morphology,* pp. 13-43. Oxford: Blackwell.

Taft, M., & Forster, K. I. (1975). Lexical storage and retrieval of prefixed words. *Journal of Verbal Learning and Verbal Behavior*, *14*, 638-647.

Tokowicz, N., & MacWhinney, B. (2005). Implicit and explicit measures of sensitivity to violations in second language grammar. *Studies in Second Language Acquisition*, *27*, 173- 204.

Tyler, A., & Nagy,W. (1989). The acquisition of English derivational morphology. *Journal of Memory and Language, 28*, 649-667.

Ullman, M.T. (2001a). The Declarartive/Procedural Model of Lexicon and Grammar. *Journal of Psycholinguistic Research, 30*(1), 37-69.

Ullman, M. T. (2001b). The neural basis of lexicon and grammar in first and second language: The declarative/procedural model. *Bilingualism: Language and Cognition*, *4*(2), 105-122.

Ullman, M. T. (2004). Contributions of memory circuits to language: The declarative/procedural model. *Cognition, 92*, 231-270.

Ullman, M. T. (2005). A cognitive neuroscience perspective on second language acquisition: The declarative/procedural model. In C. Sanz (ed.), *Mind and Context in Adult Second Language Acquisition: Methods, Theory and Practice,* pp. 141-178. Washington, D.C.: Georgetown Univesity Press.

Ullman, M. T. (2012). Declarative/Procedural model (DP). In P. Robinson (ed.), *The Routledge Encyclopedia Second Language Acquisition*, pp. 160-164. New York: Routledge.

Vainikka, A., & Young-Scholten, M. (1994). Direct access to X-bar theory: Evidence from Korean and Turkish adults learning German. In T. Hoekstra and B. D. Schwartz (eds.), *Language Acquisition Studies in Generative Grammar*, pp. 265-316. Amsterdam: John Benjamins.

Vainikka, A., & Young-Scholten, M. (1996). Gradual development of L2 phrase structure. *Second Language Research, 12*, 7-39.

Van Heuven, W. J. B., Mandera, P., Keuleers, E., & Brysbaert, M. (2014). Subtlex-UK: A new and improved word frequency database for British English. *Quarterly Journal of Experimental Psychology.*

Voga, M., Anastassiadis-Symeonidis, A., & Giraudo, H. (2014). Does morphology play a role in L2 processing? Two masked priming experiments with Greek speakers of ESL. *Lingvisticæ Investigationes, 37*(2), 338-352.

Yang, C. (2002). *Knowledge and Learning in Natural Language*. Oxford: Oxford University Press.

Yang, C. (2005). On productivity. *Linguistic Variation Yearbook, 5*, 265-302.

Wartenburger I., Heekeren H. R., Abutalebi J., Cappa S.F., Villringer A., & Perani D. (2003). Early Setting of Grammatical Processing in the Bilingual Brain. *Neuron*, *37*, 159-170.

APPENDICES

APPENDIX A: Ethics Committee Approval

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

DUMLUPINAR BULVARI 06800
ÇANKAYA ANKARA/TURKEY
T: +90 312 210 22 91
F: +90 312 210 79 59
ueam@metu.edu.tr
www.ueam.metu.edu.tr

Sayı: 28620816/534-1058

05.12.2014

Gönderilen : Doç. Dr. Bilal Kırkıcı
İngiliz Dili Öğretimi

Gönderen : Prof. Dr. Canan Sümer
IAK Başkanı Vekili

İlgi : Etik Onayı

Danışmanlığını yapmış olduğunuz İngiliz Dili Öğretimi Bölümü öğrencisi Duygu Fatma Şafak'ın "Anadil Türkçede ve İkinci Dil İngilizcede Çekimlenmiş ve Türetilmiş Sözcüklerin Biçimbilimsel İşlemlenmesi" isimli araştırması "İnsan Araştırmaları Komitesi" tarafından uygun görülerek gerekli onay verilmiştir.

Bilgilerinize saygılarımla sunarım.

Etik Komite Onayı

Uygundur

05/12/2014

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

APPENDIX B: Morphological Items in Experiment 1

Prime Conditions			
Identical	**Related**		**Unrelated**
	Inflected	**Derived**	
dinlemek	dinlemiş	dinleyici	kumral
okumak	okumuş	okuyucu	çirkin
kullanmak	kullanmış	kullanıcı	heyecanlı
satmak	satmış	satıcı	mevsim
kurtarmak	kurtarmış	kurtarıcı	eğlenceli
koşmak	koşmuş	koşucu	pahalı
sürmek	sürmüş	sürücü	çamaşır
konuşmak	konuşmuş	konuşucu	başvuru
izlemek	izlemiş	izleyici	perşembe
tüketmek	tüketmiş	tüketici	yağmurlu
yönetmek	yönetmiş	yönetici	kahvaltı
yazmak	yazmış	yazıcı	elbise
yüzmek	yüzmüş	yüzücü	berbat
binmek	binmiş	binici	numara
bakmak	bakmış	bakıcı	ilginç
vermek	vermiş	verici	dikkatli
üretmek	üretmiş	üretici	huzurlu
korumak	korumuş	koruyucu	mandalina
taşımak	taşımış	taşıyıcı	pencere
sunmak	sunmuş	sunucu	ağabey
pişirmek	pişirmiş	pişirici	sağlıklı
bulmak	bulmuş	bulucu	sakin
aramak	aramış	arayıcı	nefret
yüklemek	yüklemiş	yükleyici	şişman
çekmek	çekmiş	çekici	pastane
almak	almış	alıcı	serin
göndermek	göndermiş	gönderici	satranç
kesmek	kesmiş	kesici	orman

APPENDIX C: Orthographic Items in Experiment 1

Prime Conditions		
Identical	**Related**	**Unrelated**
bahane	baharat	turuncu
seviye	sevinç	yorgan
taraf	tarak	zümrüt
takvim	takviye	anahtar
hasret	hastane	fermuar
karpuz	karınca	cesaret
kumsal	kumbara	fasulye
mantık	mantar	adliye
papatya	papağan	dilekçe
sandalye	sandalet	mühendis
karanlık	karanfil	gözleme
makam	makale	şöhret
bayrak	bayram	şelale
fırtına	fırsat	cenaze
kelime	kelebek	sanayi
yumuşak	yumurta	cinsiyet
mastar	masraf	tedavi
hazine	haziran	zeytin
teneffüs	teneke	kahraman
mangal	manzara	yelken
minnet	minder	hayran
temmuz	tembel	salata
mercimek	merdiven	kaplıca
patron	patates	bereket

APPENDIX D: Semantic Items in Experiment 1

Prime Conditions		
Identical	**Related**	**Unrelated**
lokanta	restoran	tereyağı
doğa	tabiat	muayene
güz	sonbahar	fuar
kent	şehir	nakit
ihtimal	olasılık	kardeş
imkan	olanak	gümüş
gezi	seyahat	ayran
harika	muhteşem	hemşire
öneri	teklif	domates
baş	kafa	sebze
fayda	yarar	şenlik
sosis	salam	peynir
ayıl	bayıl	borsa
afiş	broşür	şayet
taze	bayat	şehit
mektup	postane	yoğurt
simit	poğaça	mükemmel
fare	klavye	bulut
aidat	depozito	hayvan
sev	beğen	kira
kazan	kaybet	biber
kürek	kazma	lisans
fiş	fatura	dergi
palet	dalgıç	esnaf

APPENDIX E: 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 *Doç. Dr. Bilal Kırkıcı* ve *Duygu Fatma Şafak*'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 F: Morphological Items in Experiment 2

Prime Conditions			
Identical	**Related**		**Unrelated**
	Inflected	**Derived**	
clean	cleaned	cleaner	name
walk	walked	walker	great
murder	murdered	murderer	year
offend	offended	offender	aware
work	worked	worker	chair
design	designed	designer	board
develop	developed	developer	common
own	owned	owner	elephant
print	printed	printer	kind
train	trained	trainer	shelf
report	reported	reporter	little
interpret	interpreted	interpreter	previous
kill	killed	killer	noise
support	supported	supporter	young
employ	employed	employer	awful
paint	painted	painter	nurse
view	viewed	viewer	long
play	played	player	window
entertain	entertained	entertainer	possible
hunt	hunted	hunter	rock

APPENDIX G: Orthographic Items in Experiment 2

Prime Conditions		
Identical	**Related**	**Unrelated**
sigh	sight	rabbit
surf	surface	witness
elect	electron	disease
extra	extract	calendar
dial	dialog	cloth
intern	international	equipment
parent	parenthesis	instruction
enter	enterprise	ocean
ant	antique	luggage
demon	demonstrate	intelligent
gala	galaxy	honour
flu	fluid	lecture
harm	harmony	memory
gram	grammar	source
nap	napkin	structure
text	textile	scissors
monk	monkey	palace
scan	scandal	dentist
free	freeze	disgust
phone	phonetic	vegetable

APPENDIX H: Semantic Items in Experiment 2

Prime Conditions		
Identical	**Related**	**Unrelated**
drug	pill	bowl
accuse	blame	moon
sofa	couch	farm
grief	sorrow	fiction
scare	frighten	circle
gain	profit	sock
chief	boss	religion
law	rule	silk
ill	sick	hero
build	construct	smoke
fight	battle	donkey
ban	forbid	tooth
stop	cancel	milk
child	infant	library
evidence	proof	cheese
soap	detergent	arrive
follow	pursue	scream
jacket	coat	angel
wealth	fortune	poison
stomach	belly	orange

APPENDIX I: Pseudo-Suffixed Items in Experiment 2

Prime Conditions		
Identical	**Related**	**Unrelated**
brace	bracelet	mirth
brisk	brisket	concoct
fleet	fleeting	leash
glut	gluten	malign
plum	plumage	lithe
scull	scullery	enigma
audit	audition	tranquil
buzz	buzzard	precept
crypt	cryptic	abstain
gruel	grueling	respite
butch	butchery	replete
arch	archer	obviate
whisk	whisker	revere
lard	larder	juvenile
raft	rafter	aptitude
bloom	bloomer	hesitate
splint	splinter	phenomena
flick	flicker	embezzle
snip	sniper	futile
stilt	stilted	ridicule

APPENDIX J: Turkish Summary

Giriş ve Kuramsal Artalan

Dili anlama, ruhdilbilimsel araştırmalarda uzun süredir incelenen temel bir konu olmuştur. İnsanlar binlerce sözcüğün bilgisini zihinlerinde saklayabilmekte, yazılı veya sözlü dile maruz kaldıklarında da bu bilgiye oldukça hızlı ve doğru bir şekilde erişebilmektedirler. Üstelik günümüzde çoğu kimsenin ikinci (ve hatta üçüncü ya da dördüncü) dili öğrendikleri düşünüldüğünde, o kadar çok sayıda sözcüğün zihinsel sözlükte nasıl temsil edilebildiği sorusu büyük bir merak uyandırmaktadır. Bu yüzden, zihinsel sözlüğün organizasyon sistemini açıklayabilmek amacıyla, sözcüklerin biçimbilimsel yapıları ve işlemlenme örüntüleri son yıllarda oldukça yoğun bir şekilde araştırılmaktadır.

Zihinsel sözlüğün organizasyon sistemiyle ilgili birçok konu arasından özellikle biçimbilimsel olarak karmaşık sözcüklerin işlemlenmesinin tek bir işlem üzerinden mi yoksa bir dizi işlem sonucu mu gerçekleştiği sorusu uzun zamandır devam eden bir tartışmanın kaynağı olmuştur. "Geçmiş zaman tartışması" olarak da bilinen (Pinker & Ullman, 2002) bu tartışma, genel olarak çekimsel biçimbilim alanı etrafında ve bilhassa İngilizcedeki geçmiş zaman çekimi etrafında dönmüştür. İngilizcedeki geçmiş zaman konusuna bu kadar yoğun ilgi gösterilmesinin sebebi, İngilizcenin kurallara dayalı bir işlemden geçmesi gereken düzenli geçmiş zaman eylemleri ile herhangi bir genellemenin yapılamadığı özgün bir işlemden geçmesi gereken düzensiz geçmiş zaman eylemleri arasında keskin bir ayrım sunabilmesidir. Düzenli ve düzensiz karmaşık sözcük yapılarının işlemlenmesinin altında yatan mekanizmayı veya mekanizmaları açıklayabilmek için bugüne kadar üç temel biçimbilimsel işlemleme modeli geliştirilmiştir: tekli mekanizma kurala dayalı modeller (İng. *single mechanism rule-based accounts*), tekli mekanizma çağrışımcı modeller (İng. *single mechanism associative accounts*) ve ikili mekanizma modeli

(İng. *the dual mechanism model*). Tekli mekanizma kurala dayalı modellere göre (Ling & Marinov, 1993; Yang, 2002), karmaşık yapılı bütün sözcüklerin birleşimi veya ayrışımı insan zihninde açıkça yer edindiği varsayılan kurallar çerçevesinde açıklanabilmektedir. Düzenli geçmiş zaman yapıları için kural *-ed* ekinin herhangi bir eylem köküne eklenmesi (ör. *join* + *ed* → *joined*) iken, düzensiz geçmiş zaman yapıları için birkaç kuralın olduğu öne sürülmektedir (ör. değişimin olmaması kuralı: *hurt* → *hurt*, ünlü harf değişimleri: *drink* → *drank*). Diğer taraftan, tekli mekanizma çağrışımcı modeller (ör. Rumelhart & McClelland, 1986) dilbilimsel kuralların dilin işlemlenmesinde rol oynadığı görüşüne karşı çıkmaktadır. Çağrışımcı modeller, biçimbilimsel olarak basit ya da karmaşık ayrımı yapmaksızın tüm sözcüklerin biçimbilimsel olarak analiz edilmeyen bütüncül ögeler halinde insan zihninde depolandığı görüşünü savunmaktadır. Son olarak, iki zıt uçta yer alan tekli mekanizma modellerine karşı hem kurala dayalı işlemlemeyi hem de bütüncül olarak işlemlemeyi kapsayan ikili mekanizma modeli geliştirilmiştir (ör. Pinker, 1999). İkili mekanizma modelinin uzantısı olarak önerilen bildirimsel/işlemsel modele göre, biçimbilimsel işlemleme bildirimsel ve işlemsel olarak adlandırılan iki bellek sisteminin kullanımına dayanmaktadır (Ullman, 2005). Bildirimsel bellek düzensiz çekimlenmiş yapıların bütüncül olarak depolandığı çağrışımsal bir sistem olarak sunulurken, işlemsel bellek ise düzenli çekimlenmiş yapıların biçimbilimsel açıdan daha küçük olan ögelerine ayrıştırıldığı birleşimsel bir sistem olarak ele alınmaktadır.

Yukarıda bahsedildiği gibi, biçimbilimsel işlemleme modelleri genellikle çekimlenmiş sözcük yapılarının ne şekilde işlemlendiği konusuna odaklanmıştır. Bu durum özellikle türetimsel ve çekimsel işlemleme arasında büyük bir ayrımın olduğunu iddia eden gerçekleştirme temelli biçimbilim teorileri (İng. realization-*based theories of morphology*) için önemli bir soruyu gündeme getirmektedir: türetilmiş sözcük yapılarının işlemlenmesi nasıl açıklanabilir? Gerçekleştirme temelli biçimbilimin destekçilerine göre (ör. Matthews, 1991; Anderson, 1992), türetimsel biçimbirimler kendi sözdizimsel ve anlamsal kategorilerini taşıyan yeni sözcükler üretirken (ör. *employ* → *employee*) çekimsel biçimbirimler aynı sözcüğün farklı yapılarını oluşturmaktadırlar (ör. *employ* → *employed*), bu yüzden de türetimsel ve çekimsel işlemleme süreçleri zihinsel sözlükte benzer şekilde temsil edilmemektedir. Marslen-Wilson (2007), türetimsel bir sözcüğün bütüncül olarak veya ayrıştırılarak işlemlenmesinin türetimsel biçimbirimlerin üretkenlik ve anlaşılabilirlik özelliklerine bağlı olduğunu savunmaktadır. Örneğin, İngilizcedeki *-ness* ve *-ity* biçimbirimleri sıfatlardan ad türetmektedir, ancak bu iki biçimbirim üretkenlik ve anlaşılabilirlik özellikleri bakımından farklılık göstermektedirler. *-ness* eki çok sayıda sözcüğe eklenebileceği için üretkendir ve hiçbir ses değişikliği gerektirmeden sözcük köklerine eklenebildiği için (ör. *kind* + *ness* → *kindness*) sesbilimsel olarak da anlaşılabilirdir. *-ity* eki ise birçok sıfat köküne eklenemediği için daha az üretkendir ve sözcük köklerinde ses değişikliğine yol açabileceği için de (ör. *hostile* + *ity* → *hostility*) sesbilimsel olarak daha az anlaşılabilirdir (Silva, 2009).

Aslında çekimsel yapılar üretkenlik ve anlaşılabilirlik özellikleri bakımından türetimsel yapılarla benzerlik göstermektedir. Düzenli geçmiş zaman eki *-ed* üretken ve anlaşılabilir bir şekilde birçok eyleme ve hatta Berko'nun (1958) ünlü "wug" testinde görüldüğü üzere gerçekte olmayan eylemlere bile eklenebilirken, düzensiz geçmiş zaman yapıları nispeten daha az üretken ve daha az anlaşılabilirdir (ör. *know* → *knew*). Yang (2005) da düzenli/düzensiz çekim ayrımının üretkenlik özelliğindeki farklılıktan kaynaklanabileceğini ve bunun sonucu olarak da düzenli ve düzensiz çekimlenmiş yapılara bütüncül olarak mı yoksa ayrıştırılarak mı erişildiği tartışmasının üretken ve daha az üretken olan türetimsel yapılara da uzatılabileceğini ileri sürerek çekimsel ve türetimsel biçimbirimler arasındaki benzerliğe dikkat çekmiştir. Böylece biçimbilimsel işlemleme modelleri hem çekimsel hem de türetimsel yapıların işlemlenmesini açıklamak için kullanılabilmektedir.

Çekimlenmiş ve türetilmiş yapıların anadilde (D1) ne şekilde işlemlendiği tartışması, yakın zamanda yön değiştirerek biçimbilimsel yapıların ikinci dildeki (D2) işlemlenmesi konusuna kilitlenmiştir; bunun sonucu olarak da D1 ve D2 konuşucularının aynı işlemleme mekanizmalarını kullanıp kullanamadıkları sorusu pek çok çalışmada araştırma konusu olarak ele alınmıştır. D1 ve D2 işlemlenme örüntülerini kıyaslayan iki ana yaklaşım ortaya çıkmıştır. "Paylaşımlı model" olarak adlandırılan ilk yaklaşım; D2 işlemlenmesinin anadilden transfer, düşük işlemleme hızı ve işler bellekteki yük gibi bazı faktörlerden etkilenebileceği ihtimaline dikkat çekmekte ve bu etkilere rağmen D1 ve D2 işlemlenme örüntülerinin temel olarak aynı olacağını vurgulamaktadır (ör. Perani vd., 1998). Diğer bir yaklaşım ise D1 ve D2 işlemlenme örüntüleri arasında temel farklılıklar olduğu yönündedir. Örneğin, yukarıda bahsi geçen bildirimsel/işlemsel modeli düzenli ve düzensiz biçimbilimsel yapıların işlemlenebilmesi için bildirimsel ve işlemsel olmak üzere iki farklı bellek sisteminin kullanıldığı görüşündedir. Bildirimsel/işlemsel bellek modeli, D2 işlemlenmesine ilişkin olarak da D2 konuşucularının bildirimsel sistemi daha çok kullandıklarını ve bu yüzden hem düzenli hem de düzensiz biçimbilimsel yapıları bütüncül olarak zihinlerinde depoladıklarını iddia etmektedir (Ullman, 2005). Ullman ayrıca D2 yeterlik seviyesinin önemine işaret ederek dil seviyeleri yüksek olan D2 konuşucularının işlemsel bellek sisteminden yararlanabileceklerini belirtmiştir.

Amaç ve Önem

Bu çalışmanın genel amacı biçimbilimsel yapıların işlemlenmesinin anadilde ve ikinci dilde ne şekilde gerçekleştiğini ortaya çıkarmaktır. Daha net bir ifadeyle, bu çalışma D1 Türkçedeki ve D2 İngilizcedeki çekimsel ve türetimsel işlemlenme örüntülerini aşağıdaki nedenlerden dolayı ayrıntılı bir şekilde incelemeyi hedeflemektedir.

İlk olarak, D2'de biçimbilimsel yapıların işlemlenmesi üzerine yapılan araştırma sayısı son zamanlarda hızla artmasına rağmen D1 ve D2 konuşucularının aynı işlemleme mekanizmalarından yararlanıp yararlanmadıkları sorusu hala net bir yanıt bulamamıştır. Bazı araştırmacılar D1 ve D2 konuşucularının benzer işlemleme mekanizmalarına erişebildiklerini savunmaktadırlar (ör. Perani vd., 1998; McDonald, 2006). Diğer araştırmacılarsa D1 ve D2 işlemlenmesinde niteliksel olarak farklılıklar gösterdiği ve D2 konuşucularının dilbilgisine dayalı mekanizmalarından daha az yararlandıklarını görüşünü paylaşmaktadırlar (ör. Ullman, 2005; Clahsen & Felser, 2006a). Bu iki zıt görüş göz önünde bulundurulduğunda, bu çalışmanın bulguları D1/D2 işlemlenme farklılıklarına ilişkin devam etmekte olan tartışmaya önemli bir katkı sağlayabilir.

İkinci olarak, gerçekleştirme temelli biçimbilim modelleri çekimlenmiş ve türetilmiş sözcük yapılarının zihinsel sözlükte farklı şekillerde temsil edildiğini iddia etmiştir, ancak bu çekimlenmiş-türetilmiş yapı ayrımı yapılan araştırmalarda ve özellikle birkaç çalışma hariç D2 işlemlenme alanyazınında pek ilgi görmemiştir. Çekimlenmiş ve türetilmiş yapıların işlemlenme örüntüleri arasındaki farklılıkları (varsa) ortaya çıkarmak amacıyla da bu çalışmada çekimlenmiş ve türetilmiş sözcük yapıları doğrudan kıyaslanmaktadır.

Üçüncü olarak, bu çalışma maskelenmiş hazırlama tekniğini kullanarak biçimbilimsel açıdan karmaşık sözcüklerin tanınmasında sözcüklerin anlamsal ve ortografik özelliklerinin nasıl bir rol oynadığını incelemeyi ve böylece D1 ve D2 biçimbilimsel işlemlenme örüntülerinin niteliğini daha iyi bir şekilde anlamayı amaçlamaktadır. Son olarak, İngilizce, Almanca ve Felemenkçe gibi dillerdeki biçimbilimsel işlemlenme üzerine yapılan çok sayıda araştırma bulunmaktadır. Ancak çekimsel ve türetimsel işlemlemeyi tipolojik olarak farklı dillerde ele alan çalışma sayısı oldukça sınırlıdır. Bu bakımdan Hint-Avrupa dil ailesine ait olmayan Türkçe, sondan eklemeli olması ve zengin biçimbilimsel özellikleri taşıması yönüyle çekimlenmiş ve türetilmiş sözcükleri inceleyebilmek için eşsiz bir fırsat sunmaktadır. Türkçenin tipolojik olarak farklı ve daha da önemlisi pek araştırılmamış bir dil olması dikkate alındığında, bu çalışma biçimbilimsel karmaşık sözcüklerin D1 Türkçede nasıl işlemlendiğini inceleyerek alanyazına önemli bir katkı sağlayacaktır.

Biçimbilimsel Odak

Bu çalışmada iki biçimbilimsel yapı incelenmektedir: geçmiş zaman ve eylemi adlaştırma. Deney 1, Türkçenin anadil konuşucuların öğrenilen geçmiş zaman eki -*mIş* ile çekimlenmiş eylemleri (ör. *dinle- dinlemiş*) ve kılıcı eki -*(y)IcI* ile türetilmiş adları (ör. *sat – satıcı*) ne şekilde işlemlediklerini araştırmaktadır. Diğer taraftan, Deney 2 ise Türkçenin anadil konuşucularının ikinci dilleri olan İngilizcede geçmiş zaman eki -*ed* (ör. *play – played*) ile çekimlenmiş eylemleri ve kılıcı eki -*er* (ör. *employ – employer*) ile türetilmiş adları nasıl işlemledikleri sorusunu ele almaktadır.

Bu çalışmanın kapsamında analiz edilecek olan çekimsel ve türetimsel biçimbirimler (Deney 1: -*mIş* ve -*(y)IcI*; Deney 2: -*ed* ve -*er*) bazı önemli özelliklerinden dolayı seçilmiştir. Bu biçimbirimlerin hepsi oldukça sık kullanılan ve sesbilimsel olarak oldukça anlaşılır olan eklerdir. D1 Türkçede ve D2 İngilizcede kıyaslanacak olan çekimsel ve türetimsel biçimbirimler eylem köklerine eşit sayıda harf ekleyerek kıyaslanabilir işlemleme yükü getirmekte ve böylece çekimsel ve türetimsel yapılar arasında bire bir kıyaslama yapma fırsatını sağlamaktadır. Ayrıca Türkçede ve İngilizcede incelenecek biçimbirimler birbirlerinin eş değeri olarak düşünülebilmektedir; çekimsel ekler eylemlerin düzenli geçmiş zaman yapılarını oluştururken türetimsel ekler de eylemleri kimin veya neyin yaptığını ifade eden adları oluşturmaktadır. Türkçe ve İngilizce ekler arasındaki bu benzerlikler, D1 ve D2 işlemlenmeleri arasındaki benzerlik ve farklılıkların çok daha doğru bir şekilde saptanmasını mümkün kılmaktadır.

Genel Araştırma Soruları

Bu çalışmada aşağıdaki temel araştırma sorularının cevaplanması amaçlanmıştır:

1) Çekimlenmiş ve türetilmiş sözcükler D1 Türkçedeki ve D2 İngilizcedeki görsel sözcük tanıma sürecinin erken aşamalarında köklerine ve eklerine ayrıştırılarak mı yoksa bütüncül sözcükler olarak mı işlemlenmektedir?
2) D1 ve D2'deki erken sözcük tanıma süreçleri biçimbilimsel olarak karmaşık olan sözcükler ve bu sözcüklerin kökleri arasındaki anlamsal ve/veya ortografik ilişkiden etkilenir midir?
3) Anadilleri Türkçe ve İngilizce ikinci dil seviyeleri yüksek olan konuşucular, D1 Türkçe işlemlenmesi sırasında yararlanılan aynı mekanizmaları D2 işlemlenmesinde kullanabilirler mi?

Denekler

Yukarıda belirtilen soruları cevaplayabilmek için yürütülen Deney 1'e anadilleri Türkçe olan 40 kişi (35 kadın, 5 erkek) katılmıştır. Yaş ortalamaları 21.53 olan katılımcılar anadillerinin Türkçe olduğunu belirtmişlerdir. Orta Doğu Teknik Üniversitesi'nde (ODTÜ) Yabancı Diller Eğitimi Bölümünde lisans veya lisansüstü eğitimlerini sürdüren ve deneye gönüllü olarak katılan katılımcılara herhangi bir ücret ödenmemiştir.

Deney 2 ise, ODTÜ Yabancı Diller Eğitimi Bölümündeki lisans veya yüksek lisans öğrencileri arasından rastgele seçme yöntemiyle belirlenen, anadilleri Türkçe ve ikinci dilleri İngilizce olan 44 katılımcıya uygulanmıştır. Yaş aralığı 21-28 (yaş ortalaması: 23.20) olan katılımcıların 36'sı kadın ve 8'i erkekti. Katılımcıların tümü anadillerinin Türkçe ve ikinci dillerinin İngilizce olduğunu onaylamıştır. Katılımcılar İngilizceyi ortalama 10.16 yaşında öğrenmeye başlamışlar ve ortalama 13.02 yıldır İngilizceyi sınıf ortamında öğrenmişlerdir. Ayrıca hiçbir katılımcı İngilizce konuşulan bir ülkede altı aydan fazla yaşamadığını rapor etmiştir. Deney 2'ye katılan tüm katılımcılara D2 seviyelerinin yüksek olduğundan emin olmak için Oxford Yerleştirme Sınavı uygulanmıştır. Katılımcıların sınav ortalamaları %89.13 idi. Bu ortalama Diller İçin Avrupa Ortak Öneriler Çerçevesinde C1 düzeyine ("Usta Kullanıcı") karşılık gelmektedir.

Deney 1: Biçimbilimsel olarak karmaşık sözcüklerin D1 Türkçede işlemlenmesi

Maskelenmiş hazırlama tekniği kullanarak bu çalışma kapsamında yürütülen ilk deney D1 Türkçe üzerine hazırlanmıştır. Bu deney için toplam 410 sözcük çifti hazırlanmıştır ve bunlardan 10 tanesi katılımcıların deneyin işleyişini anlayabilmeleri için örnek uygulama kapsamında kullanılmıştır. 76 sözcük çifti ise deneyin amaçları doğrultusunda üç set halinde oluşturulmuştur. İlk sette *-mIş* ile çekimlenmiş veya *-(y)IcI* ile türetilmiş toplam 28 adet biçimbilimsel, anlamsal ve ortografik olarak birbiriyle ilişkili olan sözcük çifti yer almıştır (ör. *okumuş – okumak; satıcı – satmak*). İkinci sette 24 adet sadece ortografik olarak ilişkili olan sözcük çifti (ör. *haziran – hazine*) ve üçüncü sette de tamamen anlamsal olarak ilişkili olan 24 sözcük (ör. *postane – mektup)* bulunmaktaydı. Geriye kalan 324 sözcük çifti ise, katılımcıların neyin test edildiğini anlamalarını engellemek için deneyin amacıyla ilgisi olmayacak şekilde hazırlanmıştır. 124'ü gerçek sözcüklerden ve 200'ü gerçekte olmayan sözcüklerden oluşan bu sözcük çiftleri sayesinde deneydeki hedef sözcüklerin yarısı 'evet' ve diğer yarısı 'hayır' cevabını gerektirmekteydi. Bu deneyde yer alan gerçek sözcükler Türkçe Ulusal Derlemi (Aksan vd., 2012) kullanılarak seçilmiştir, gerçekte olmayan sözcükler de Wuggy programı (Keuleers & Brysbaert, 2010) kullanılarak oluşturulmuştur.

Deney 1'de sözcüklerin görsel olarak sunumu, katılımcıların çevrimiçi yanıt süreleri ve doğrulukları DMDX yazılımı (Forster & Forster, 2003) tarafından kontrol edilmiştir. Deney başlatılmadan önce katılımcıların "Gönüllü Katılım Formu"nu doldurmaları istenerek rızaları alınmıştır ve bu formların imzalı bir kopyası katılımcılara verilmiştir. Ardından katılımcılara bir sormaca uygulanarak dilsel gelişmeleri hakkında bilgi toplanmıştır. Sonrasında katılımcılara sözlü ve yazılı olarak deney süreci anlatılmış olup kendilerine verilen Logitech™ oyun kolunun ilgili tuşlarına basarak bilgisayar ekranında görecekleri sözcüklerin gerçek olup olmadıklarına hızlı ve doğru bir şekilde karar vermeleri istenmiştir. Deneydeki her bir deneme dört görsel aşamadan oluşmuştur: (1) 500 milisaniye (ms) boyunca ekranda gösterilen ve kare işaretlerinden (#) oluşan ön hazırlama, (2) katılımcıların bilinçli bir şekilde bu aşamada verilecek olan sözcükleri fark etmemeleri amacıyla sadece 50 ms boyunca ekranda gösterilen hazırlama sözcüğü (ör. *okumuş, satıcı*), (3) hazırlama sözcüğünü takip eden ve katılımcıların yanıt vermesi beklenen hedef sözcük (ör. *OKUMAK, SATMAK*), (4) 'evet' veya 'hayır' tuşlarına basılana kadar veya 5000 ms'lik zaman aşımına kadar ekranda kalan boş ekran. Ayrıca yaklaşık 40 dk süren ve sessiz bir odada yapılan her bir deney sırasında katılımcılara iki mola hakkı verilmiştir.

Katılımcıların deney sırasında kaydedilen yanıt süreleri tek yönlü ANOVA kullanılarak analiz edilmiştir.

Deney 2: Biçimbilimsel olarak karmaşık sözcüklerin D2 İngilizcede işlemlenmesi

Bu çalışmadaki ikinci maskelenmiş hazırlama deneyi D2 İngilizce üzerine yapılmıştır. Bu deney 10 tanesi ön uygulamada kullanılan, 80 tanesi deneysel amaçlarla hazırlanan ve 280 tanesi katılımcıların deneyin amacını anlayarak sözcüklerin sunumuna ilişkin herhangi bir beklenti geliştirmemeleri için hazırlanan toplam 370 sözcük çiftinden oluşmuştur. 80 deneysel sözcük çifti dört setten oluşturulmuştur. Birinci set *-ed* geçmiş zaman ekiyle çekimlenmiş veya *-er* kılıcı ekiyle türetilmiş 20 adet biçimbilimsel, anlamsal ve ortografik olarak birbiriyle ilişkili olan hazırlama-hedef sözcük çiftinden oluşmaktaydı (ör. *hunted – HUNT; employer – EMPLOY*). İkinci sette 20 adet tamamen ortografik olarak ilişkili olan sözcük çifti (ör. *freeze – FREE*) yer alırken, üçüncü set için tamamen anlamsal olarak ilişkili olan 20 sözcük çifti (ör. *blame – ACCUSE*) hazırlanmıştır. Dördüncü sette ise biçimbilimsel ve ortografik olarak birbiriyle ilişkili olan ancak aralarında anlamsal bir ilişkinin olmadığı 20 adet sözcük çifti bulunmaktaydı (ör. *cryptic – CRYPT*).

Dördüncü sette yer alan sözcükler ile ilgili ilginç olan özellik, bu sözcüklerin ekli gibi görünmeleriydi. Bu ekli gibi görünen sözcükler (İng. *pseudo-suffixed words*), gerçekte var olan bir kökten ve gerçek bir ekten oluşuyor izlenimi vererek çekimlenmiş veya türetilmiş sözcükler gibi hedef sözcükleri ile biçimbilimsel açıdan ilişkili görünmektedirler, ama aslında bu sözcükler biçimbilimsel olarak basit yapılıdır. Örneğin, *corner* "köşe" sözcüğü türetilmiş bir sözcük değildir, ancak buna rağmen *corn* "mısır" kökünün ve *-er* ekinin birleşiminden oluşan karmaşık yapılı bir sözcük gibi görünmektedir. Deney 1'de bu tür ekli gibi görünen sözcüklerin işlemlenmesi incelenmemiştir Bunun sebebi de Türkçedeki eklerin sesbilimsel ve en önemlisi anlamsal olarak anlaşılabilir olması ve bu yüzden de Türkçede ekli gibi görünen sözcük sayısının oldukça sınırlı olması idi.

Deneyin amacından bağımsız olarak hazırlanan 280 sözcük çiftinin 100'ü gerçek sözcüklerden, 160'ı gerçek hazırlama sözcükleri ve gerçekte olmayan hedef sözcüklerden, 20'si de gerçek olmayan sözcüklerden oluşmaktaydı. Bu şekilde Deney 2'deki hedef sözcüklerin de yarısı 'evet' ve diğer yarısı 'hayır' cevabını gerektirmekteydi. Bu deneyde yer alan gerçek sözcükler Uluslararası Öğrenici Derleminin Türkçe alt derlemi (Granger, Dagneaux, Meunier & Paquot, 2009) ve SUBTLEX-UK Derlemi (Van Heuven, Mandera, Keuleers & Brysbaert, 2014) kullanılarak, gerçekte olmayan sözcükler de Wuggy programı (Keuleers & Brysbaert, 2010) kullanılarak seçilmiştir.

Ayrıca hem Deney 1'deki hem de Deney 2'deki biçimbilimsel set ile ortografik setteki sözcük çiftleri arasındaki ortografik benzerlik oranı Match Calculator (Davis, 2000) yazılımı kullanılarak istatistiksel olarak eşitlenmiştir. Biçimbilimsel set ile anlamsal ilişkili setteki sözcük çiftleri arasındaki anlamsal benzerlik de Likert ölçekli sormacalar kullanılarak kanıtlanmıştır.

Deney 2'de bir önceki deneyde takip edilen aynı deneysel yöntem uygulanmıştır ve katılımcıların yanıt süreleri benzer şekilde tek yönlü ANOVA kullanılarak incelenmiştir.

Genel Sonuçlar

Deney 1'den elde edilen bulgular; Türkçenin anadil konuşucularında çekimlenmiş ve türetilmiş sözcükler için istatistiksel olarak benzer şekilde hazırlama etkilerinin tespit edildiğini, ancak sadece ortografik ve sadece anlamsal olarak ilişkili olan denetleme sözcükleri için hazırlama etkilerinin bulunamadığını göstermiştir. Bu sonuçlar doğrultusunda üç temel çıkarım yapılabilmektedir. İlk genelleme, D1 Türkçedeki çekimlenmiş ve türetilmiş sözcüklerin zihinsel sözlükte benzer şekilde yer edindiğidir. İkinci genelleme, çekimlenmiş ve türetilmiş sözcükler için hazırlama etkilerinin anlamsal ve ortografik etkiler olmaksızın elde edilmesidir. Bu durum da D1 Türkçedeki biçimbilimsel yapıların işlemlenmesinin tamamen karmaşık yapılı sözcüklerdeki çekimsel veya türetimsel biçimbirimlerin özelliklerine dayandığını göstermektedir. Son olarak ise biçimbilimsel hazırlama etkileri ayrıştırarak işlemlemenin göstergesi olduğu için (Silva, 2009), D1 Türkçedeki görsel sözcük tanıma süreci esnasında üretken eklerle çekimlenmiş ve türetilmiş sözcük yapılarının daha küçük biçimbilimsel unsurlarına ayrıştırıldığı sonucuna ulaşılabilmektedir. Örneğin, *kullanmış* ve *kullanıcı* gibi biçimbilimsel olarak karmaşık yapılı sözcükler hazırlama sözcükleri olarak sunulduğu zaman, köklerine ve eklerine ayrıştırılarak (ör. *kullan + mış* ve *kullan + ıcı*) işlemlenmektedir. Böylece bu sözcüklerin kökleri hedef sözcük olarak sunulduğunda, sözcük kökleri tekrar çağrıştırılmış olmakta ve bu da hazırlama etkilerinin gözlemlenmesine neden olmaktadır.

Deney 2'nin sonuçlarına gelince; anadilleri Türkçe olan konuşucuların ikinci dilleri İngilizcedeki biçimbilimsel yapıları işlemleme örüntüleri iki yönden Deney 1'in sonuçlarıyla benzerlik göstermektedir. D2 konuşucuları sadece anlamsal olarak ilintili olan hazırlama-hedef sözcük çiftleri için herhangi bir hazırlama etkisi göstermezken, biçimbilimsel olarak ilişkili olan sözcük çiftleri için ayrıştırma mekanizmasının göstergesi olan hazırlama etkilerini göstermişlerdir. Diğer taraftan, Deney 1'deki anadil konuşucularının aksine, Deney 2'deki İngilizcenin ikinci dil konuşucularının ortografik denetleme sözcük çiftlerini işlemlemeleri esnasında hazırlama etkileri bulunmuştur. Tüm bu bulgular temel alınarak dört genel çıkarım yapılabilmektedir. Birincisi, üretken eklerle çekimlenmiş ve türetilmiş sözcükler ikinci bir dilde aynı şekilde işlemlenmektedir, çünkü çekimlenmiş ve türetilmiş sözcük yapıları zihinsel sözlükte nasıl saklandıkları veya zihinsel sözlükten nasıl erişildiklerine dair farklılıklar göstermemiştir. İkinci olarak ise çekimlenmiş ve türetilmiş sözcükler için elde edilen hazırlama etkileri, karmaşık yapılı sözcükler ve bu sözcüklerin kökleri arasındaki anlamsal bağlantıdan bağımsız olarak ortaya çıkmaktadır. Ancak sözcüklerin anlamsal özelliklerinin aksine, ortografik ilişki çekimlenmiş ve türetilmiş sözcüklerin görsel olarak tanınması sürecinde rol üstlenmektedir. Üçüncü olarak, D2 konuşucularının istatistiksel olarak göstermiş oldukları biçimbilimsel hazırlama etkileri göz önünde bulundurulduğunda çekimlenmiş ve türetilmiş sözcüklerin D2 İngilizcedeki görsel sözcük tanıma süreci esnasında köklerine ve eklerine ayrıştırıldığı (ör. *kill* + *ed, kill* + *er*) çıkarımı yapılabilmektedir. Ancak, D2 işlemlenmesinde tespit edilen ortografik etkilerin göz ardı edilmemesi gerekmektedir. Çünkü ortografik etkiler nedeniyle D2 konuşucularının ayrıştırma mekanizmasını kullanabilmesi tamamen biçimbilimsel olan etkilerden kaynaklanmamış, fakat biçimbilimsel ve ortografik etkilerin bir birleşimi olarak gözlemlenmiştir. Deney 1'in ve Deney 2'nin bulguları birlikte ele alındığında önerilebilecek dördüncü genelleme ise Türkçenin anadil konuşucularının D1 ve D2 işlemlemelerinde aynı şekilde davranmamalarıdır. D1 biçimbilimsel işlemleme, çekimlenmiş ve türetilmiş sözcüklerin biçimbilimsel özelliklerinin etkisi olarak gerçekleşmektedir; D2 biçimbilimsel işlemleme ise, çekimlenmiş veya türetilmiş sözcüklerle bu sözcüklerin kökleri arasındaki biçimbilimsel ve ortografik etkilerin tamamlayıcı etkileri olarak gerçekleşmektedir. Böylece bu çalışma, D1 işlemlenmesine kıyasla D2 işlemlenmesinin yapısal olmayan bilgi kaynaklarına daha bağımlı olduğu görüşünü desteklemekte ve ileri düzey dil seviyesinin bile ikinci dil ve anadil konuşucularının aynı işlemleme mekanizmalarından yararlanabilmeleri için yeterli olamayabileceğini göstermektedir.

APPENDIX K: Tez Fotokopisi İzin Formu

TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü [ ]

Sosyal Bilimler Enstitüsü [x]

Uygulamalı Matematik Enstitüsü [ ]

Enformatik Enstitüsü [ ]

Deniz Bilimleri Enstitüsü [ ]

YAZARIN

Soyadı : Şafak
Adı : Duygu Fatma
Bölümü : İngiliz Dili Öğretimi

TEZİN ADI (İngilizce): Morphological Processing of Inflected and Derived Words in L1 Turkish and L2 English

TEZİN TÜRÜ : Yüksek Lisans [x] 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. [x]

TEZİN KÜTÜPHANEYE TESLİM TARİHİ: