THE ORGANIZATION OF THE MENTAL LEXICON

IN LATE SECOND LANGUAGE LEARNERS

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DECLARATION OF ORIGINALITY

I, Hanife Emel Yüksel Aytar, certify that

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ABSTRACT

The Organization of the Mental Lexicon in Late Second Language Learners

The present study compares the organization of words in the mental lexicon in native and nonnative speakers of English. More specifically, the study explores potential differences in two groups with respect to the extent of reliance on semantic and/or orthographic relations in the mental organization of words. It has been hypothesized that late L2 learners would rely more on orthographic relatedness among words in their lexical organization. Native speakers, however, are predicted to do the mental organization based on the semantic connection. To this aim, first language (L1) Turkish-speaking adults who are late second language (L2) learners of English were compared to native speakers of English via a masked priming lexical decision experiment. L2 participants were analyzed in two proficiency groups (low and high) to identify a potential developmental shift in their organization of the mental lexicon. The masked priming task (MPT) measured and compared participants' accuracy and reaction times (RT) in four prime conditions: i) Identity (prison-PRISON); (ii) Semantically-related (crime-PRISON); (iii) Orthographically-related (priest-PRISON); and (iv) Unrelated (truck-PRISON). The results of the MPT revealed that overall, the low L2 proficiency group was the slowest among the groups. Furthermore, in all groups the following pattern of priming was found: $\text{Identity}_{RT} < \text{Semantic}_{RT} < \text{Orthographic}_{RT} < \text{Unrelated}_{RT}$. This tendency suggests that in both native and nonnative groups, the organization of words is based on semantic relatedness rather than orthographic ones. Nevertheless, the lack of statistically significant interaction between primes and groups makes it difficult, at this point, to make a strong claim on the mental organization of words in the lexicon.

ÖZET

İkinci Dili Geç Yaşta Öğrenen Yetişkinlerde Zihinsel Sözlükçenin Organizasyonu

Bu çalışmada, ikinci dil (D2) İngilizceyi geç yaşta öğrenmiş yetişkinlerin zihinsel sözlükçe organizasyonları incelenmiş ve anadili (D1) İngilizce olan yetişkinlerle karşılaştırılmıştır. Çalışma, sözcükler arası kurulan semantik ve/veya ortografik ilişkilerin boyutunu ve bu bağlamda, incelenen gruplar arasındaki potansiyel farkları incelemektedir. Ikinci dili geç yaşta öğrenen yetişkinlerin, zihinsel sözlükçelerinde, sözcükler arasındaki ortografik ilişkilere dayalı bir bağlantı kuracakları varsayılmıştır. D1 konuşucularının ise daha çok semantik bağlantılar kurmaya eğilimli olacakları düşünülmüştür. D2 konuşucuları, İngilizce dil yeterlikleri açısından yüksek ve düşük seviye olarak iki gruba ayrılmıştır. Buradaki hedef, iki grup arasında zihinsel sözlükçede dil yeterliği yüzünden oluşabilecek potansiyel farkları izlemektir. Bu amaçla, Maskelenmiş Çağrıştırma Testi (MÇT) aracılığıyla İngilizce isimleri tanıma hızları (TH) ve verilen yanıtların doğruluğu ölçülmüştür. Çağrıştırıcı-hedef çiftleri dört farklı durumda sunulmuştur: i) Özdeş (prison-PRISON); (ii) Semantik ilişkili (crime-PRISON); (iii) Ortografik ilişkili (priest-PRISON); ve (iv) İlişkisiz (truck-PRISON). MÇT sonuçlarına göre, düşük seviye D2 grubu, tüm gruplar arasında en yavaş performansı sergilemiştir. Ayrıca, tüm gruplarda tanıma hızı bağlantılı çağrıştırma örüntüsü "Özdeş$_{TH}$<Semantik İlişkili$_{TH}$<Ortografik İlişkili$_{TH}$<İlişkisiz$_{TH}$" şeklindedir. Bu eğilim, hem D1 hem D2 konuşucularının, zihinsel sözlükçe organizasyonlarını ortografik değil, semantik ilişkilere dayandırdığını göstermektedir. Ancak, çağrıştırıcılar ve gruplar arasında istatistiksel olarak bir etkileşim farkı bulunmamıştır. Bu yüzden, zihinsel sözlükçe organizasyonuyla ilgili kesin bir sonuca varmak bu aşamada güçtür.

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CHAPTER 1

INTRODUCTION

1.1 Background literature

The acquisition, representation and processing of a second language (L2) in early and late bilinguals have attracted much interest in psycholinguistic research. Particularly the organization of the mental lexicon in individuals who learned an L2 after puberty has been the topic of much research in recent years as the field of second language acquisition (SLA) has begun to draw more on psycholinguistic research tools.

The core issue that has been investigated in this line of research has been the comparison of the mental lexicon in monolinguals and bilinguals to ultimately explore several questions as to whether late bilinguals can process an L2 in a similar fashion with monolinguals. To this end, while a body of research has examined the representation and processing of morphologically complex words (e.g., Coughlin & Tremblay, 2014; Feldman, Kostic, Basnight-Brown, Durdevic & Pastizzo, 2010; Jacob, Heyer, & Veríssimo, 2017; Neubauer & Clahsen, 2009; Silva & Clahsen, 2008), other studies have focused mostly on bare forms to explore the extent to which semantic, phonological, orthographical information is used in the organization of the first language (L1) and the L2 in the mental lexicon (Ahn, 2015; Jiang, 2000; Kroll & Stewart, 1994; Singleton, 1999; Singleton & Little, 1991; Talamas, Kroll & Dufour, 1999; Zareva, 2007).

The first line of research mentioned above has led to much investigation as it is important to examine whether or not inflected and derived word processing is similar in native and nonnative speakers (see Jacob, 2017 and Marslen-Wilson, 2007 for reviews). This question needs to be resolved ultimately to be able to clearly identify the human language processing capacity. Nevertheless, the present study reported in this thesis focuses merely on the basic mental organization of the L2 words in late L2 learners.

The main motivation of the thesis study stems from the assumption that L1 and L2 mental lexicons are distinct from each other (Channell, 1990; Meara, 1984; O'Gorman, 1996). For example, Channell (1990) claims that nonnative speakers will be different from native speakers both in comprehension and production skills. Although he agrees that the phonological, semantic and associational links are built similarly in L1 and L2 mental lexicons, he notes that there is still limited evidence showing clearly the similarity in L1 and L2 lexicons. Likewise, Meara (1984) argues, based on word association test results, that the mental lexicon of a native speaker and an L2 user of the same language is quite different. Unlike native speakers, L2 speakers are believed to depend on phonological cues more than semantic cues. In another study, O'Gorman (1996) uses the word association technique to explore potential differences between L1 and L2 mental lexicon. Participants with L1 Chinese and L2 English with intermediate-proficiency level were given a list of words both in Chinese and in English at different times and asked to write the first word they associated them with. The initial prediction of the researcher was to obtain findings similar to those of Meara (1984). In other words, the prediction was that nonnative speakers would opt for form-based associations unlike native speakers who would favor meaning-based associations. However, the findings showed that both groups built primarily semantic relations in their associations.

The age of onset in L2 acquisition and L2 proficiency is clearly implicated in other studies. For example, it has been suggested that late L2 learners who become exposed to an L2 after the critical age (Lenneberg, 1967) may not always demonstrate native-like processing (Sabourin, Brien, & Burkholder, 2014). Similarly, proficiency and language exposure are also highlighted as important factors determining the extent of native-like processing in the L2 (Abutalebi, Cappa, & Perani, 2005). Some researchers also posit a developmental arrangement in the bilingual mental lexicon (Ahn, 2015; Jiang, 2000; Singleton, 1999; Zareva, 2007). In other words, it has been suggested that the L2 mental lexicon is dynamic and it changes over time possibly as a function of L2 proficiency and exposure. For example, Singleton (1999) notes that this shift will be towards native norms. Specifically, this transition is believed to take place from a form-based association pattern to a semantic-based pattern as the proficiency of learners increases. That is, at initial L2 proficiency state, learners are predicted to build connections among L2 words on the basis of their orthographic and/or phonological similarities but gradually, they will be able to generate networks based on semantic relatedness among them.

In the same vein, Levelt (1989) assumes two levels (stages) for lexical entries. The first one is the lemma level that includes semantics and syntax of words, whereas the second level involves lexemes consisting of morphology, orthography and phonology of words. Based on Levelt's (1989) staged system, Jiang (2000) argues for a developmental shift in the organization of bilingual mental lexicon with the arrival of new words into it. According to this hypothesis, the first representational stage of L2 words in the mental lexicon encompasses lexemes only because they merely include formal features of L2 words. The second stage is the "L1 mediation stage" (p. 52) where L1 lemma information and L2 lexeme encounter and form a unit together. The last stage is the "L2 integration stage" (p. 53) in which L2 lexical entries become like L1 entries with fully represented specifications of semantics, phonology, orthography and morphology. Within this context, the role of L1 is also emphasized. For example, the claim put forth by Jiang (2000) assumes dependence on the L1 in the early stages of the bilingual mental lexicon. Nevertheless, L1-dependence in the representation and organization of L2 words is not necessarily unavoidable. As Jiang (2002) also acknowledges, even in the early stages of learning a new language, learners are able to use L2 words with no transfer errors, which means that the L2 mental lexicon does not always necessarily rely on the L1 lexicon.

In brief, previous research findings on the mental lexicon involving bilinguals are inconclusive; while some researchers found differences between native and nonnative speakers with respect to the organization of the L2 lexicon, others found similar patterns of organization in both groups. Nevertheless, it is important to note that previous work reveals the dynamic and developing nature of the L2 mental lexicon in which the nature of the associations change as a function of increased proficiency and exposure.

With respect to the methodological tools used to examine the mental lexicon, in recent years, different computer-based online techniques that measure participants' word recognition/reaction time either via masked or unmasked priming paradigms have become popular. Unlike the simple lexical decision technique, the priming paradigm involves a briefly presented prime word preceding a target word. The assumption here is that if there is a relationship (i.e., semantic, morphological, phonological, orthographical associations) between the prime and the target, the recognition of the target word would be quicker due to the facilitative effect of having been exposed to the related prime. Thus, the priming paradigm allows us to identify whether or not two given words are related in the mental lexicon. This paradigm also allows us to discover the type of relatedness (i.e., semantic, morphological, phonological or orthographical) that triggers faster target word recognition/activation, and also the time course of priming. The timing issue pertains to the effect of duration of the prime presentation as well as the duration between the end of the prime presentation up to the onset of the target. Depending on the duration of the prime or interval, there might be differential priming effects. In other words, long primes (duration longer than 60 milliseconds) tend to facilitate the access of the target words more. Also, if the interval between the prime and the target is short, the priming effects might be more evident than the cases where the prime is too long. However, with a long interstimulus interval, the priming effect may become weaker or disappear completely. The crucial point here is that the prime duration less than 60 ms leaves no room for the participant to consciously perceive the prime (Forster & Davis, 1984). Particularly when the briefly presented prime is crammed between a series of harsh marks and the target, a common procedure in the masked priming paradigm, it becomes almost impossible for participants to consciously notice the prime. In such designs, any observed priming effects are taken to indicate unconscious activation of connections that have already been established between the lexical units (i.e. prime and target) (Davis, Kim & Sanchez-Casas, 2003). That is, it is believed that via a masked priming paradigm one can discover whether or not there is an unconscious link between a prime and target in a participant's mental lexicon.

In the context of bilingual mental lexicon research, cross-language priming experiments have also been commonly used to identify the relations between the L1 and L2 lexicons (Gollan, Forster & Frost, 1997; Jiang & Forster, 2001; Keatley, Spinks & de Gelder, 1994). For example, in these experiments, researchers examine the extent and direction of priming when the prime and target are chosen from the L1 and L2, or vice versa. Although most studies reveal the role of dominance in the direction of priming (L1 facilitates L2 more than the other way around), some bidirectional facilitation effects have also been found in translation priming experiments (Duyck & Warlop, 2009). According to the Revised Hierarchical Model by Kroll and Stewart (1994), two languages are involved in distinct links during the translation. Therefore, even though the storage of concepts belongs to a common system in both languages, lexical items might be retrieved from two disjointed mental lexicons. In this body of research, some scholars have concentrated on the activation of the bilingual mental lexicon with a focus on the types of primes. In such studies, the aim is to observe whether the prime type influences the extent of facilitation in the activation process (Evett & Humphrey, 1981; Forster & Veres, 1998; Forster, Davis, Schoknecth & Carter, 1987; Meyer & Schvaneveldt, 1971). The fundamental focus in such studies has been to highlight whether participants outdo when targets are preceded with a particular prime type (e.g., semantically-related primes versus form-related primes). Despite the same focus on the potential differences in prime types, they have used different tasks, which might account for different results found in those studies. In relation to this, Singleton and Little (1991) emphasize the task effect and claim the task used to explore processing can play an important role in lexical access both in monolinguals and bilinguals, which may consequently affect the accounts of the bilingual mental lexicon.

1.2 The current study

Within this background, this thesis investigates, via a masked priming lexical decision task, the organization of the mental lexicon of late L2 English learners with L1 Turkish backgrounds. L2 English learners were grouped into two with respect to their L2 proficiency levels and they were compared to native speakers of English. The specific aim was to identify whether the organization of the English mental lexicon is semantically-based or orthographically-based in both native and nonnative speakers of English. By including two proficiency groups, the current study aims to shed light on the developmental nature of the mental lexicon. This will help us identify whether the patterns used in the activation of L2 words change as learners become more proficient in the L2. Within this background, the research questions of the present study are formulated as follows:

1. How do native speakers of English store/represent L1 English words in their mental lexicon? More specifically, is it semantically or orthographically-based organization that is more predominant in their mental lexicon?
2. How do L1 Turkish-L2 English speakers store/represent L2 English words in their mental lexicon? More specifically, is it semantically or orthographically-based organization that is more predominant in their L2 English mental lexicon?
3. Do L1 Turkish-L2 English speakers differ from English native speakers with respect to the nature of the mental organization of English vocabulary items?
4. Is there an effect of proficiency on the mental organization of L2 words in late L2 learners?

CHAPTER 2

LITERATURE REVIEW

2.1 What is mental lexicon?

The mental lexicon as a concept was first introduced and defined by Treisman (1960) as the representation of the vocabulary in an internal dictionary. It is also defined as an abstract mental dictionary or a storage for all the words in the mind of a person (Dijkstra, 2005; Gaskell & Altmann, 2007). Since then, it has attracted much attention of many psycholinguists. Particularly, such questions as which factors influence word access; how words are listed in the mental lexicon; what type of associations are there among words have been the topic of much research.

To explore these questions numerous studies have been conducted and previous research established important variables influencing research findings. For example, various studies revealed the role of neighborhood size (a measure based on the count of words that are similar to one another, e.g, mead, bead, lead, etc.) in the speed of lexical access (Gaskell & Altmann, 2007). Furthermore, frequency of a word has been established a very important variable affecting the speed of access of a word (Andrews, 1989; Huntsman & Lima, 2002). Besides the neighborhood size and frequency, familiarity of a word is a determining factor as to how easily and fast it will be accessed by users (Balota & Chumbley, 1984). One of the earlier studies that documents the influence of both factors is Forster and Chambers (1973) that revealed not only a difference between words and nonwords but also high frequency and low frequency words. In other words, real words and high frequency words are accessed faster than plausible nonwords and low frequency words, respectively. It has been found that deciding that a (plausible) nonword does not belong to a given target language takes longer compared to real words and implausible nonwords (those that violate the phonotactic constraints of a given language) (Forster & Chambers, 1973).

Every single word in the lexicon has certain semantic, morphological, orthographic, phonological and syntactic characteristics. It has been suggested that words in the lexicon are interconnected on the basis of all or some of these characteristics (Emmeroy & Fromkin, 1988; Wilks & Meara, 2002). Retrieving these characteristics of a word is what is generally referred to as the process of lexical access. This is a process we automatically and unconsciously do when we encode and decode language. In other words, to select correct and appropriate vocabulary items in language production and also to understand words that we encounter either in a written or spoken form, we need to access all the relevant information about words in our mental lexicon. On this note, it has been suggested that words in the mental lexicon have a different degree of proximity to the core vocabulary items including the very well-known words (Wolter, 2001). The depth of the knowledge for a word varies on the basis of its connections to the other words in the mental lexicon. Thus, lexical access is influenced by connections among words. This relation built in the mental lexicon is named as “a gigantic multidimensional cobweb” (Aitchison, 2012: 72)

Words in the mental lexicon are not aligned only by their formal resemblance to other words (e.g., similar meanings) but also by connections they build on the basis of their co-occurrence with other words and morphemes. Marslen-Wilson and Welsh (1978) state that finding a word in the mental lexicon may not depend on the access to its full form. In other words, language speakers are able to activate a word through the initial information about the input during the flow of information to the mental lexicon, which is named as “primary lexical interpretation” (Marslen-Wilson and Welsh, 1978: 29). Therefore, speakers can primarily have access to a word on the basis of the activation of its certain characteristics before its full presentation has been completed.

Thus, as some scholars have already suggested, to know a word involves knowledge of some or all of these characteristics of a word. Some scholars suggest that knowing a word primarily means knowing its meaning (Carroll, 2000). There are, nevertheless, other dimensions. Another line of research compares, for example, phonological/orthographic and semantic categorization of the mental lexicon (Channell, 1990; Levelt, 1989; Meara, 1984). Depending on the focus, the approaches to the mental dictionary vary from one another. Before we move on to discuss in more detail previous work exploring these issues in monolinguals and bilinguals, it will be relevant to look briefly at various techniques used to examine the mental lexicon.

2.2 Experimental methods used to examine the mental lexicon

Word recognition in the mental lexicon can be based on visual or auditory input. The focus of interest in this section will be on visual word recognition. One of the most widespread techniques utilized for in mental lexicon research is the naming task. In this task, words are given on the screen and the participant is asked to read them aloud. Reading time of the participant is believed to reveal information about the word recognition process. There are variations of this task such as standard word naming, delayed word naming and picture naming.[1] The fundamental issue debated over the use

[1] The standard word naming aims participants to read aloud the target words appearing on the screen as quickly as possible. The delayed word naming does not aim for an immediate response from participants to the target item. On the contrary, the response is delayed until the onset of a task-dependent cue (De

of a naming task is about sub-lexical categories. That is, whether the orthographic or phonological representations play a more crucial role in the activation of words has been questioned. Some researchers argue that phonology of a word is the core basis of its activation in the mental lexicon (Lesch & Pollatsek, 1993; Rubenstein, Lewis & Rubenstein, 1971; Van Orden, Pennington &Stone, 1990) while others argue that it is the orthography that stands out with its function in the activation (Jared & Seidenberg, 1991; Seidenberg &McClelland, 1989). Other researchers focus on nonlinguistic factors influencing word naming performance such as individual differences and the effect of language proficiency (de Groot, Borgwaldt, Bos & Van den Eijnden, 2002; Katz, Brancazio, Irwin, Katz, Magnuson & Whalen, 2012).

Another commonly used method is the word association task. This technique is based on potential associations among words and co-occurrence of certain words. For example, in general, people are found to respond faster to the word ‘student’ when it is preceded by the word ‘teacher’ due to strong semantic associations between them. This line of data collection technique dates back to Palermo and Jenkins’s (1964) study in which participants were to write a word that first crossed their minds after a certain word. The researchers noticed that the word ‘doctor’ was mostly associated with ‘nurse’. This simple pen-and-paper technique has stimulated more advanced work with word associations such as word associations ratio based on corpora (Church & Hanks, 1990). In addition, thesaurus dictionaries have been created that list not only associated words but also the associative strength among words. For example, Edinburgh Association

Groot, Borgwaldt, Bos & Van den Eijnden, 2002). Finally, the picture naming task provides participants with pictures to be named as targets (Kroll & Stewart, 1994).

Thesaurus is one of them (Lapalme, 2017). Word association tests have been investigated in reference to language proficiency and its effects on associative network in the lexicon (Khazaeenezhad & Alibabaee, 2013; Wolter, 2001). Word associations are taken as a sign of quality of vocabulary knowledge (Wolter, 2001); and also a means to uncover the intricate organization of words in the mental lexicon (Zareva, 2007).

Following word association tasks, lexical decision tasks have enriched our understanding of the mental lexicon. In a typical lexical decision task, the participant is asked to decide whether or not a string of letters presented to him/her on the screen is a word in a given language. In such tasks, the participant is expected to press a 'yes' button for words and 'no' button for nonwords in the target language. Nonwords might be legal (i.e., plausible) string of letters obeying the phonotactic constraints of a language or illegal violating these constraints. The two dependent variables tested in such tasks are the response/reaction time (how fast a person presses a yes or no button) and response accuracy (how accurate the person is in his/her response). Normally in the analyses of such experimental data, statistical analyses are conducted after all erroneous items and outliers (extreme reaction times) are excluded from the data.

Computer-based timed lexical decision tasks are generally categorized as simple and masked primed tasks. In the first type, the test items only include single word items, in the primed experiments, however, target words are preceded by a prime word. Different word types may elicit different reaction times (RTs), and simple lexical decision experiments can reveal information on that. The priming paradigm, on the other hand, can provide information as to which words are associated with one another. In other words, primed lexical decision tasks aim to display the organization of the mental lexicon based on the categorization of the target items (semantic, orthographical properties and so on). The crucial research question here is whether or not semantic, morphological, orthographical and phonological information is processed at the same time course in word recognition. For example, at what stage in lexical processing a reader accesses semantic information? Is orthographical/phonological information accessed before semantic information? For example, Votaw (1992) indicates that there are two stages of recognition. The first stage is pre-lexical where the orthographic information is accessed. In a later stage, the orthographical representation is merged with the semantic information.

As noted earlier, when processors are presented with primes related to targets, their processing is believed to be faster in the lexical decision tasks. That means that a prime word plays a facilitatory role in target word recognition. The presence of priming effects shows the connections between prime and target pairs in the mental lexicon. If the prime and target are related at either semantic, morphological, orthographic/phonological level, then upon the presentation of a prime, the recognition of a target should be faster. Kinoshita and Lupker (2003) propose five prime types: identity prime, where the prime and the target are identical (e.g., attitude-ATTITUDE), orthographically-related prime (also called form priming), in which the prime and the target share the same orthographic forms (e.g., aptitude-ATTITUDE), morphological prime in which prime and target share either the same stem or affix (e.g., decided-DECIDE), semantic prime, in which prime and target are semantically related or there are associative links between the two (e.g., black-WHITE), and translation prime includes the translation equivalent of the target (e.g., cheval-HORSE) (see also Gulan &

Valerjev, 2010). The effects of these conditions are assessed in relation to the baseline condition, which is the unrelated condition (e.g., cable-GLASS). Identity prime, like the unrelated prime, is also considered to function as a baseline condition because these two conditions are predicted to elicit the two extreme RTs (i.e., shortest and longest, respectively) in lexical decision. Priming is said to occur when the prime facilitates the recognition of the target word in the lexical decision task. Therefore, the relation between prime and target pairs is taken into consideration. Considering that there might be more than one condition being evaluated in studies, it is important to define the effect of priming. In order to ensure that priming experiment works well, the identity condition should trigger full priming (ultimate facilitation), which is expected to be stronger than all test conditions. As noted above, it is predicted that recognizing a target word right after an identity prime will be faster compared to other prime conditions, particularly the unrelated condition (Kinoshita & Lupker, 2003). In brief, the identity condition and unrelated conditions are the two control conditions in a priming experiment to demonstrate full priming. The test condition is supposed to be processed more slowly than the identity condition and faster than the unrelated condition. For example, in a study examining morphological priming effects, Silva and Clahsen (2008) label the morphologically-related prime as the test prime condition. If the RTs for identity and test conditions are equal and they are both significantly shorter than the unrelated condition, then this is interpreted as full priming. If, on the other hand, the RTs for the test condition is longer than the identity condition but shorter than the unrelated condition, then partial priming is said to occur. In case the test and unrelated conditions do not differ from each other in terms of the RT they elicit, then that means no priming effects are present.

As noted earlier, another crucial aspect of priming experiments is prime duration. In visual word recognition paradigms, this refers to the amount of time that the prime stays on the screen. Given that priming experiments explore unconscious effects of the primes on targets, it is of utmost importance to ensure that primes would go unnoticed. Forster et al. (1987) indicate that priming effects become weakened when the prime duration is shortened. This is because the prime is presented very briefly and this prevents the prime from being consciously perceived. When the prime duration is short (around 40 ms or shorter), priming takes place partially or does not take place at all (Kinoshita & Lupker, 2003). Mohan (1996 as cited in Kinoshita & Lupker, 2003) examined the effect of prime duration for identity and form prime conditions for pairs that are orthographically similar. She noticed that as the prime duration increases, the priming gets stronger for the identity prime (i.e. repetition prime). However, the scenario for the form priming is different because it shows an unclear picture. One notable thing is that at 30 ms and more, priming effect becomes stronger. Otherwise, if the identification of the prime is restricted, priming might not be observed (Kinoshita & Lupker, 2003).

As we will see in the coming chapters, the picture may be different for native and nonnative speakers. For example, Jiang (2013) states that in experiments involving L2 learners, the prime duration should be kept long enough to be able to observe the effects of priming. Therefore, 50 or 60 ms has been accepted as the right amount of time for prime presentation as it is short enough to block conscious prime identification but long enough to observe the effects of priming on the target. Prime duration should not be confused with the stimulus onset asynchrony (henceforth SOA). Figure 1 demonstrates the distinction among the terms. The SOA is defined as the time interval between the onset of the prime and the onset of the target. It is closely connected to the interstimulus interval (henceforth ISI) which is the time between the offset of the prime and the onset of the target excluding the prime duration (Schmidt, Haberkamp & Schmidt, 2011). Nevertheless, when the ISI is “0”, then the prime duration and SOA happen to be equal.

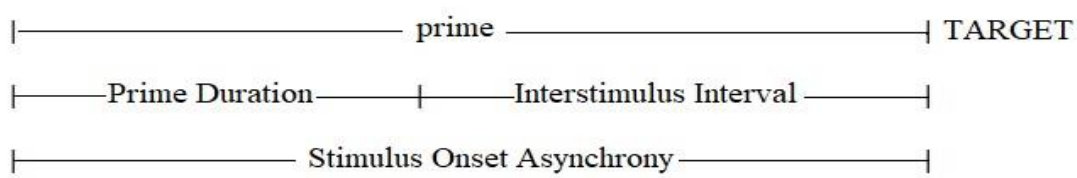

Figure 1 The presentation of the difference among prime duration, ISI and SOA

These three measures are manipulated carefully by researchers based on the purpose of their study. It is argued by Schmidt et al. (2011) that the SOA variation allows us to examine the visuo-motor processing in the sense that the longer the SOA, the more likely it becomes to observe priming effects. However, as Neely (1977) notes, the increase in the SOA might also decrease the likelihood of observing automaticity in activation. Therefore, if the research aim is to elicit automatic processing in the mental lexicon, the practice should not be to increase the SOA. Nevertheless, as stated before, depending on the aim of the study, the SOAs can be manipulated so that the time course of different types of priming (orthographic, morphological, semantic) can be explored.

It is important to note that in most research studies involving priming, a masked priming paradigm is used. The masked priming paradigm refers to the technique in which the prime is squeezed between a mask (as series of hash marks, #####) and the target. Hash marks that have the same length as primes, function as the cover of primes. Masks can be used as a forward mask in the three-field priming design. In other words, the order of appearance will be a mask, prime, and target. In the four-field priming design, both a forward and a backward mask can be included in the following order: forward mask, prime, target, backward mask. Once everything is set in the experiment, participants see the words on the screen and make lexical decision accordingly.

In overt priming, however, there is no mask and the prime is presented visually (or auditorily) for a longer period of time (longer than 200 ms). The overt prime is presented either right before the target or after other items intervening the prime and target (i.e., long lag priming). Long exposure duration in the overt priming paradigm allows the parser to consciously notice the prime. As in the masked priming paradigms, the overt priming paradigm takes the measures of response time and accuracy as dependent variables. However, unlike masked priming, the overt priming experiments enable us to identify deeper conscious lexical integration strategies (Heij, 2005).

Another priming paradigm involves the cross-modal priming. It is a task originally developed by Swinney (1979) integrating both visual and auditory stimuli at work. It is an online method that can measure lexical and sentential processing. Participants first hear an auditory stimulus (prime), and then they are asked to view the visually presented target word (cross-modal lexical priming) or the picture (cross-modal picture priming) displayed on the screen. Upon seeing the word, they are supposed to make a decision as to whether the stimulus is a word or nonword in the lexical decision task or classify the picture in the picture classification task (Marinis, 2018). The RTs to words or pictures are analyzed to see the effects of priming. The advantage of the cross-modal priming paradigm is that it highlights the ongoing processing and reflects upon this via RT analyses. Crucially, since the prime and target are not presented in the same modality (e.g., visually) as in the masked priming paradigm, it prevents the confounding effects of a visual overlap between the prime and the target.

In addition to computer-based RT experiments, there are also more sophisticated neurophysiological methods such as event-related potentials (ERP). This is a measure of brain's electrical activity (i.e., brain response) that occurs due to specific sensory, cognitive, or motor event (Acha & Carreiras, 2014: 22). Acha and Carreiras (2014) indicate that an ERP is commonly used in combination with other tasks such as priming and lexical decision tasks due to its precise temporal resolution. When the stimulus is presented, peaks in the perceptual or organizational processing are taken into account in order to interpret the waves. Each stimulus elicits a different peak in the brain. For example, a peak at 170 ms is observed for orthographic stimuli in the left hemisphere while a peak at 320 ms is obtained for phonologically pronounceable words (Bentin, Mouchetant-Rostaing, Giard, Echallier & Pernier, 1999). However, the peak for the orthography of words can change from 200 to 500 ms (Acha & Carreiras, 2014).

There is also a commonly used eye-tracking technique. Compared to the ERP technique discussed above, this method projects a more natural processing without a need for a subsequent task. It is a technique used to detect and measure an eye's movements (saccades) and stops (fixations) as well as backward movements (regressions) when reading in a text (Conklin & Pellicer-Sanchez, 2016: 2). This technique can be utilized to examine the processing of visual and/or auditory input. This innovative approach to language processing has started to attract researchers more than pen-and-paper techniques.

As will be discussed in more detail in the methodology section, the current study aims to investigate the organization of the mental lexicon via a lexical decision task based on masked priming. The main purpose of the study is to compare the lexical organization of late L2 English speakers to that of English native speakers. Specifically, the aim is to examine whether native and nonnative speakers of English differ from each other with respect to the organization of words in the mental lexicon. Within this context, the question of whether or not groups rely more on semantic or orthographic/phonological relatedness of words in their organization is the main question that is examined in the thesis. Before detailing the methodology, it is necessary to discuss previous research on the mental lexicon. Studies reviewed below involves both monolingual and bilingual lexical organization.

2.3 The representation of words in the monolingual mental lexicon

Psycholinguistic tools and techniques discussed above have been used to seek answers to several theoretical questions regarding the mental lexicon. The fundamental issues explored in this line of research pertains to the following questions: how are the individual units in the mental lexicon linked together?; what information is contained in an entry?; how are these entries accessed?;are phonological, orthographical, morphological, and semantic information contained in each entry accessed at the same time or are they subject to a differential time-course of activation? As will be discussed in this section, a substantial amount of work has been devoted to the investigation of the mental organization of words. Related with this is the line of research that focuses on the representation of multimorphemic words (i.e., morphologically complex words). The question of whether a morphologically complex word (either inflected or derived) is accessed on the basis of its morphemic units has occupied researchers over the years (see Marslen-Wilson, 2007 for a review). Given that morphologically related words such as 'wash' and 'washed' and 'washer' are not only morphologically related but also orthographically and semantically associated, particularly in the priming experiments, there have been much research efforts to tease apart the purely morphology-based links among words. In that sense, studies on the processing of morphologically complex words will also be relevant in the discussion. As noted earlier, this thesis attempts to identify potential native and nonnative differences with respect to the mental organization of words in English. Therefore, the discussion below first provides models of the mental lexicon and the previous findings of research initially conducted only with monolinguals. Research on the bilingual mental lexicon will follow this discussion.

Models of lexical access are typically categorized according to the type of search they assume to take place in lexical access. The Serial Search Model is an example of the models that propose that there is a sequenced search mechanism (e.g., Forster, 1976). The Logogen Model and the Cohort Model, on the other hand, both assume parallel processing. The Serial Search Model proposed by Forster (1976) uses the analogy of finding a book in the library in order to describe the lexical access in his model with only one difference: words in the mental lexicon are not merely organized alphabetically but also on the basis of various features such as frequency. Word search takes place in a sequence according to this model. There are two stages of access to a word in the mental lexicon. The first one is an access file that includes the stimulus of a word. The distinct sections, named as ‘bins’ by Forster (1976) in the access file (e.g. orthography, phonology and semantics) of a word are accessed and pointed to the master file which combines all the information to complete the access of a word. The information in the access file is frequency-dependent. Therefore, if a word has a high frequency, it is searched and accessed more quickly than low frequency words. Reaching the information in the master files is sequential. Once a word is accessed, the words related to the target can be accessed later. Thus, the model can account for semantic priming (Szubko-Sitarek, 2015). However, since the flow is serial, there have been limitations on its capacity. Thus, Forster (1989) has updated and come up with a parallel model carrying out synchronous searches. By that means, he can also explain the case with nonwords in the sense that the searching model keeps looking at all the sections until the decision that the target is not a word has been made.

Another model of word recognition is the Logogen Model proposed by Morton (1970). It is different from the Serial Search Model as it implements a simultaneous search mechanism for words. This model suggests that each word has a representation in long-term memory. These representational or recognition units are referred to as logogens and these contain information about the phonological, syntactic, semantic characteristics of a word. Logogen is “the part of the system that produces or leads directly to the instructions to the articulators” (Morton, 1970: 206). Each logogen has an activation level. Cognitive systems take the information and identify its lexical properties. Once an incoming speech signal is presented to all logogens, the logogens which match the incoming information are raised in activation. The activation increases as more and more features match with those of a logogen. This continues until a certain critical activation value is reached. As soon as the activation level of the logogen exceeds the threshold, the logogen fires. This is the moment, where word recognition takes place. The core of the model is the threshold factor in relation to the frequency of a word. If a word has a high frequency, the threshold level is lowered as a facilitator for the activation. The advantage of this model could be the possibility to explain both types of input, namely visual and auditory (Szubko-Sitarek, 2015).

In line with the parallel activation models of the mental lexicon, there are also connectionist models assuming multiple layers of activation together at work. The Interactive Activation Model by McClelland and Rumelhart (1981) is one example of these connectionist models. The Interactive Activation Model assumes that there are three levels of visual word recognition: feature level, letter level and word level. At the feature level, the qualities of the letters are processed. At the letter level, the processor deals with the letters that are activated. The last level is the stage where the word itself is recognized. These abstract levels of processing are simultaneously activated when a person is to recognize a target word. That is, both top-down and bottom-up activation processes are in an interaction with each other. What determines the recognition of the words is the messages that excite or inhibit the activation. For example, if the target word has five letters (TABLE), only those five letter words are excited as possible candidates, and words starting with T A B or T A or T are excited. The rest of the words are inhibited as impossible candidates. One of the assumptions that plays a role in the activation process is the effect of frequency. If words have a high frequency, there is less or no delay in their activation so words can remain longer in an active state.

The models that have been discussed so far attempt to describe the nature of the search mechanism required to activate a word in the lexicon. They specify whether or not different levels of information (i.e., semantic, phonological, orthographical, morphological) that each word carries are computed in a serial or parallel fashion in the access process. Therefore, looking at each sub-component of activation (i.e., letters, sounds, word forms, word meanings) is crucial as the mental lexicon contains all the information about words. It is still necessary to look at more fine-grained analyses of the lexicon to identify the role of different levels of linguistic information in the organization and storage of words. Specifically, it is necessary to look at the time course of activation of all these different features of words in lexical access. In that sense, bare forms with no inflections are studied by comparing the effects of semantic and orthographic information in auditory and visual word recognition tasks. While auditory word recognition tasks enable us to look into the role of primarily phonological features of words in lexical access, other linguistic features (e.g. semantic, morphological, orthographic) are also explored in that paradigm. In visual word recognition paradigms, on the other hand, all linguistic features of words can be examined. Visual word recognition theories approach words either as combinations of letters or whole units or chunks (Adams, 1979). One approach which is dependent on letters claim that words are formed of letters as their single units, so the recognition of a word depends on its alphabetical components (Johnston & McClelland, 1974). Clearly, orthography of a word has a role in its recognition since we are able to recognize words written in different fonts and scripts. However, how much role it plays in the activation of words is to be questioned together with other types of information like semantics or phonology.

It is also important to note that the sequence of activation of different levels of linguistic information may be different in language production and comprehension. In language production, lexical items are cascaded in such a way that while semanticallydriven activation takes place first, phonologically-driven activation follows it (Levelt, 1993). When testing this hypothesis, Schriefers, Meyer and Levelt (1990) have found that there is a cut-off time between phonological activation and semantic activation. The first 150 ms facilitates the activation of semantics while phonology is activated after 150 ms.

However, unlike production studies, the comprehension experiments reveal that form-based activation emerges first and this is followed by meaning-based activation (Perfetti & Tan, 1998; Perfetti & Zhang, 1995). For example, Perfetti and Zhang (1995) examine the sequence of phonology and semantic activation in the mental lexicon. They found a primary phonological activation at 90 ms followed by a semantic activation at 140 ms, which led them to propose that phonologically motivated activation precedes semantically motivated activation of words in language comprehension. Perfetti and Tan (1998) added the aspect of orthography to phonology and semantics in the recognition of words in the mental lexicon. They propose that the activation of orthography precedes phonology which then precedes semantics. While orthographic features stimulate the activation at the SOA of 43 ms, phonological features are activated at 57 ms and semantic activation occurs at the SOA of 85 ms. Thus, they suggest that in visual word recognition, even in shortened SOA activation of orthography is possible. When the SOA increases, it becomes possible to observe not only form-related information but also meaning-related features. In other word, semantic facilitation occurs at a longer SOA. This suggestion is in parallel with the processing studies arguing that the access to a word is through its form first; and then meaning is activated (Feldman, O'Connor & del Prado Martin, 2009). The studies discussed so far appear to agree upon the notion that form-related stimuli are initiated at the early periods whereas meaning is stimulated later than that and this sequence is dependent on the SOA condition. However, there are studies revealing that semantic activation is possible even in the early stages of processing with short SOAs. For example, the study by Perea and Gotor (1997) reveals that semantic activation occurs at very short SOAs regardless of tasks (i.e., lexical decision or naming). They have tested three SOA conditions (33 ms, 50 ms, and 67 ms) for both semantic and associative priming conditions.[2] They have found significant associative priming effects in all SOA conditions tested through both tasks. Furthermore, the semantic effects without associative links are found to be triggered at the SOA of 67 ms. They have tested only associative/semantic activation of words and were able to account for the activation for the associations in shorted SOAs. To examine the time course of activation of semantics in the mental lexicon in comparison to orthography, Pulvermüller, Assadollahi and Elbert (2001) conducted a neurophysiological experiment and based on the neuromagnetic responses in the brain, they suggested that semantic information is activated earlier than formal information.

With respect to the developmental nature of language acquisition, some researchers argue that links between orthography and semantics are difficult to establish at the beginning stages of visual processing (Harm & Seidenberg, 2004). A study by Polse and Reilly (2015) examines the issue with young learners and claim that there is a developmental shift from 'form recognition' towards 'meaning construction'. First grade and fourth grade children have been assessed in order to identify their reading skills by means of orthographically related and semantically related words. It has been found that

[2] An associative link between two words is said to exist if they are not related to each other meaning-wise but they, nevertheless prime each other (e.g.,Shepherd-Sheep).While 'shepherd' and 'sheep' do not come to mean the same things, they are still associated with each other. The words, 'whale' and 'dolphin', however, have a semantic relatedness as they are both mammals.

in children, orthography improves fast, but it takes time to master semantic relations. Likewise, the debate over the activation through orthographic or semantic facilitation in adults has been continuing. In order to account for the sequence of activation, it is worth looking also at complex words investigating the processing of morphology since morphemes cannot be considered without their orthographic and semantic aspects.

In this respect, the studies investigating morphological processing aim to understand what roles morphology of words play in comprehending and producing the language, together with other several dimensions of information (Clahsen, 2016). Complex words such as 'baker' carry the meaning of each unit forming them (i.e., bake and -er) (Gonnerman, Seidenberg & Andersen, 2007). When the root 'bake' and the suffix '-er' are considered together, their contribution to the meaning seems obvious. Moreover, the very same suffix adds the same meaning to other words that it is attached to (e.g., 'singer'). Similarly, in inflectional morphology, the prime and target pair such as 'washed-wash' is not only morphologically related but also orthographically and semantically related. Therefore, morphological processing has an inevitable link to semantics of a word. When it comes to the orthographical aspect of processing, studies examining especially regular and irregular verbs cannot disregard the overlap of orthography and morphology (Clahsen, 2016). To illustrate, orthographical overlap between the words 'talked' and 'talk' is more than 'brought' and 'bring'. Taking into account certain clashes of information, it becomes necessary to treat morphological processing with reference to orthography and semantics. In other words, to clearly pinpoint the effects of morphology in complex word processing, orthographic and semantic relatedness needs to be teased apart. In other words, there is a need to consider the semantic and orthographic facets of morphologically complex words in study designs to test pure effects of morphology. This line of investigation emphasizes the parallelism between the form and meaning of morphemes. This parallelism comes with a degree (Feldman, Barac-Cikoja & Kostic, 2002). In other words, some affixes make clearer meaning contribution to their base form such as 'allowable-allow' than others like 'allowance-allow'. The meaning similarity is more of an issue for inflectional morphology than derivational morphology because inflected words are loyal to their base meanings like 'talked-talk'; while derived words change their meaning as in the example of 'department-depart' (Marslen-Wilson, Tyler, Waksler & Older, 1994). Thus, semantic transparency is relevant for inflected words while semantic opaqueness is pertinent to words with derivational morphemes. Marslen-Wilson et al. (1994) have shown the effect of semantic transparency in morphologically complex words in one of the priming experiments in their study. They had semantically transparent derived-derived (confession-CONFESSOR) and derived-stem (punishment-PUNISH) prime-target pairs and opaque derived-derived (successful-SUCCESSOR) and derived-stem (casualty-CASUAL) prime-target pairs. They found that the derived-derived condition does not have a facilitatory effect in both transparent and opaque conditions whereas derived-stem condition facilitates the processing only when words are semantically related to each other that was provided with semantic transparency in the study. Similarly, Feldman et al. (2002) have examined the effect of meaning in the processing of morphologically complex words together with the impact of distinct time course for processing. They have recruited university students with the knowledge of Roman and Cyrillic alphabets under four prime conditions: i) inflected words (vole-VOLIM); ii) derived words with transparent meaning to the base (zavole-VOLIM); iii), derived words with opaque meaning to the base (prevole-VOLIM); and iv) morphologically complex but unrelated words (stampaju-VOLIM). They have tested these four prime conditions in the light of alphabet shift; that is, they have presented prime and targets in Roman alphabet primarily, and in another set of experiment, they have shown the primes in Cyrillic and targets in Roman. They have carried out both alphabet conditions with two distinct SOA conditions (48 ms and 250 ms). Results revealed that although there has not been facilitation at a short SOA condition, the long SOA condition has shown a relation between morphological processing and semantics in both alphabet conditions. Thus, they concluded that when there is enough time to process the target, semantics plays a role in morphologically complex words. In another study examining three test conditions in order to identify the time course of activation, Rastle, Davis, Marslen-Wilson and Tyler (2000) have explored the activation of morphology, orthography and semantics under three SOA conditions (43 ms, 72 ms, 230 ms) for five types of prime-target pairs: i) morphologically-, semantically- and orthographically- related condition (departure-DEPART); ii) morphologically- and orthographically-related condition (apartment-APART); iii) semantically-related condition (cello-VIOLIN); iv) orthographically-related condition (electrode-ELECT), identity condition (church-CHURCH). They observed the significant activation for 'departure-DEPART' type of pairs in all SOA conditions, but orthographically- and morphologically-related words (apartment-APART) were facilitated in the shortest SOA condition only (43 ms) and this was inhibited with the increase in the SOA. Hence, they concluded that semantic transparency plays a role in the activation of morphologically complex words regardless of SOA, but orthography seems to be sensitive to the SOA condition. Similarly, Feldman and Soltano (1999) have investigated complex words to see whether semantic or orthographic similarity between prime and target pairs has a role in morphological relatedness. They have implemented a lexical decision task with three prime conditions: namely, the morphologically-related (VOWED-vow), orthographically-related (VOWEL-vow) and semantically-related (PLEDGE-vow) conditions in three SOA variations (66 ms, 300 ms and long term priming effect). They have found that in all SOA conditions, morphologically-related primes significantly facilitated the target word processing, and triggered faster processing than semantically-related primes. In the case of orthographic relations, they have noted that orthographic facilitation has a negative correlation with SOA. In other words, as SOA increases, facilitation caused by orthographic relatedness decreases. Pastizzo and Feldman (2009) have also explored this relatedness effect by exploring the effects of form and meaning in word recognition. They have looked at form-related (COAT-float), meaning-related (SWIM-float) and both form and meaning related (BOAT-float) prime and target pairs under three SOA conditions (48 ms forward masked, 116 ms, and 250 ms). They have found a significant facilitation for both meaning and form related primes than form-only or meaning-only prime types in each SOA condition. Based on the BOAT-float type of prime-target pairs, they have inferred that morphological processing is facilitated by the conjoint effects of form and meaning.

All in all, it can be suggested that complex words are related to their stem not only morphologically but also semantically and orthographically. Therefore, complex words go through a lexical access procedure that is under the effect of semantics and orthography. This also suggests that words consisting of two or more morphemes are engaged in a non-arbitrary form and meaning connection (Gonnerman et al., 2007).

2.4 The representation of words in the bilingual mental lexicon

The organization and retrieval of the words in the mental lexicon can be more complicated in the minds of late bilinguals. Since they have already acquired a language as its native speaker, starting to learn another language when they are cognitively mature is a considerably different experience for the learners (Schmitt, 2000). In that case, models dwelling on the bilingual mental lexicon need to be referred here.

One of the mostly discussed models is the Bilingual Interactive Activation (BIA) Model proposed by van Heuven, Dijkstra and Grainger (1998) as an extension of the monolingual Interactive Activation Model put forth for the L1 mental lexicon by McClelland and Rumelhart (1981), which basically attempts to account for information processing during reading. The assumption here is that visual language processing involves the processing of visual features, letters and words. This model is originally used to explain the word superiority effect (WSE) (i.e., the commonly observed phenomenon that people recognize letters more easily when they are within words as compared to isolated letters), and also it is easier to recognize letter in words compared to non-words (unpronounceable letter strings that violate the phonotactic constraints of a given language). In this view, when a visual input is presented, first the features activate letters and the letters that do not match the features are inhibited. The letters excite the activation of words and all other candidate words are inhibited. Accordingly, word recognition takes place if the target word node’s activation meets all the necessary activation criterion.

Based on the monolingual model, the BIA Model investigates the activation of the languages in the bilingual mind. This model adds an additional component to the model, namely, the language nodes. There are two language nodes, one for each of the languages of a bilingual. It assumes that all other word recognition stages are the same in this model. The only additional assumption that the final stage is the activation of the language by the target word which inhibits all the other possible languages. Language nodes initiate inhibitory control over the non-target language. The more a word is encountered in a language, the less it is inhibited by the mechanism. Therefore, the amount of exposure and the proficiency in the language also matter in the activation process. Thus, the BIA model makes reference to an initial language non-selective access process with inhibitory control mechanisms in order to limit cross-language interference. While doing so, the model also emphasizes the role of word frequency effect, list context effects, and neighborhood effects in visual word recognition.

Another model of the bilingual lexical activation is the Revised Hierarchical Model proposed by Kroll and Stewart (1994). This model basically assumes that the mental lexicon of a bilingual has L1 words, L2 words, and corresponding concepts. In the initial L2 state, the link between the concepts and the L1 words is stronger than the link between these concepts and L2 words. According to this model, learning an L2 word necessarily involves building a link between the L2 word and the corresponding L1 word. When the bilingual becomes more proficient, direct links arise also between the L2 words and the concepts. This model assumes that the languages are represented separately in our mind but there are connections among them. The model also suggests that there are degrees of activation in terms of form and meaning of words. At the beginning of the learning processes, L2 learners depend mostly on the forms of words to activate them. Nevertheless, as they become more competent in the language, they begin to activate word meanings, as well. Moreover, the activation of meaning initially occurs by means of the L1 translation equivalents, but the dependency on the L1 translations in the mental lexicon disappears as a function of increased proficiency. The critical review on the Revised Hierarchical Model by Kroll, van Hell, Tokowicz and Green (2010) indicates that form and meaning mapping might be influenced by the context of the language, yet the qualities of the links established in between are the same in both languages.

In relation to models exploring the processing of two languages in the mental lexicon, the nature of the activation of these two languages has also been investigated in the light of (non)selectivity. In the language-selective activation, bilinguals may respond to the input by resorting to only the appropriate language system (Gerard & Scarborough, 1989) whereas both language systems are assumed to be at work in language-nonselective activation (de Groot & Nas, 1991; de Groot, Delmaar & Lupker, 2000; Grosjean, 2001). Dijkstra, van Jaarsveld and Brinke (1998) conducted two series of experiments in their study, the first of which touched upon the issue of language selectivity. They asked L1 Dutch and L2 English bilinguals who studied at a university at the time of the research study and had had ten years or more of exposure to English to perform in a lexical decision task in English consisting of English-Dutch homographs, cognates and solely English control items. The analyses of the reaction times data showed that cognates were processed significantly faster than solely English control items whereas there was no significant relationship between homographs and their counterparts in control items. The absence of a significant relationship is explained from the perspective of language selective processing because if there is not a significant reaction time difference, it is explained as the presence of the items in one language only (Dijkstra, 2005). On the other hand, the presence of a significant reaction time difference for cognates could lead to a language non-selective processing. The contradicting results within the same study is explained by the degree of activation of Dutch, which was the native language. The activation of Dutch might be sufficient to lead to a difference between cognate and their control words, yet not sufficient for the homographs and their controls. It might be worth noting that the nature of activation for bilinguals in terms of the (non)selectivity depends on certain tasks or contexts, so the cases where the access is selective or nonselective should be the starting point when investigating this issue (Pavlenko, 2009).

In relation to the above-mentioned models and subsequently emerged issues, the question of whether there is shared or separate mental lexicons for two languages has been previously studied. One perspective is known as the shared mental lexicon as two languages are active at the same time during the course of processing (Costa, 2005, de Groot, Delmaar & Lupker, 2000; Dong, Gui & MacWhinney, 2005). The other point of view states that two languages are accessed and stored separately in the mental lexicon, so language activation occurs in a language-specific manner (Colome, 2001; Costa & Caramazza, 1999; Gerard & Scarborough, 1989). In a related study, Dong et al. (2005) investigated L1 Chinese, L2 English late bilinguals who studied at the university during the course of the study. They tested the conceptual organization of words in the mental lexicon via within language and cross-language priming. They conducted the study with associated, identity and unrelated prime target pairs. To evaluate the associations between prime and target pairs, they chose six types of conceptual relations: verb-primitive (grasp-WITH), verb-default value (kick-FOOT), verb-preferred i value[3] (sail-SHIP), verb-preferred j value[4] (taste-FOOD), verb-trunk value (whisper-SPEAK), verb-antonym (take-GIVE). They compared four language conditions; namely, English-Chinese, Chinese-English, English-English, Chinese-Chinese under eight priming conditions with the SOA of 200 ms. Across conditions, they found significant priming effects in within-language design, they also observed priming effects for cross-languages designs. Therefore, they indicated that there is a shared system in the organization of mental lexicon since the words in different languages were so closely associated that they facilitated the activation of one another. In the second part of their experiment, they tested the lexical organization for the patterns that are not translation equivalents with two proficiency groups of late bilingual (L1 Chinese, L2 English) university students and two monolingual groups; one in Chinese and the other in English as baseline. They asked participants to order eight words given to them in terms of their closeness in meaning to the head word presented both in Chinese and English separately. Their findings showed that the L2 concepts firstly display a dependence on the L1, but such conceptual differences diminish as the learners become more proficient in the L2. The more proficient learners get in the L2, the more the two languages converge in their mental lexicon. They propose that there is a proficiency-dependent dynamic process in the mental lexicon organization of L2 words. As they stated, there is an ongoing

[3] The $[\ ]_i$ is the position for the external argument in a sentence, which can take the role of an actor, a patient or a theme.
[4] The $[\ ]_j$ is the position for the object in a sentence, which can take the role of a patient, a theme or a goal.

formation of the mental lexicon by building links between words both in the L1 and across languages. There are, however, other researchers arguing that there are separate mental lexicons for each language, but depending on the stimuli they might be activated simultaneously. For example, Colome (2001) states that there appears to be two distinct storage systems for both languages; namely, one phoneme is represented in two separate ways, so when participants are presented with a stimulus in one language, they automatically activate two sets of representations. This puts a lot of burden on the processor. Therefore, he argues that especially when L1 and L2 are similar to each other, an overlap or shared representation of two languages is inevitable in order to economize in processing. Besides the parallel aspects of two languages, some scholars emphasize that the word type can make a difference in the representation of words in the two languages. The study by de Groot and Nas (1991) recruiting Dutch-English bilinguals has put forward a shared system for cognates and a separate system for noncognates in the translation task. Thus, they claim that certain types of words (e.g., noncognates or abstract words) trigger a separate storage and access mechanism but cognates and concrete words are designated to a shared storage system. As summarized above, the mental lexicon storage system has much been studied and further research is needed to obtain a more comprehensive view of the bilingual lexicon.

The bilingual lexicon research has also examined the linguistic nature of language activation. More specifically, the nature of activation is also discussed with regard to difference in the processing of word forms and word meanings in the bilingual mental lexicon. The organization of mental lexicon and access to words belonging to two languages mostly question the case of bilinguals in comparison to native speakers.

Some studies aim to see the comparison of the two languages when the two languages are balanced in bilinguals' minds. That is, the case when people acquire both languages simultaneously at an early age (Kinoshita & Lupker, 2003). This limited line of research on bilingual mental lexicon ignores the cases where people acquire another language sequentially, which is named as late bilinguals within the study. In the case of late bilinguals, the developmental nature of the L2 makes researchers question whether there is a shift in the organization and representation of the mental lexicon towards a similarity to a native speaker's mental lexicon. This issue is investigated under the light of the developmental aspect of mental lexicon. According to some researchers who argue for the presence of weak links between L1 and L2 in low-proficiency L2 state, L2 learners first depend on the form-based cues in the recognition of the L2 words while they resort to semantic cues as they become more proficient in the L2. In other words, some researchers claim that unlike the L1 mental lexicon, which has a semantically-based storage and retrieval systems, the bilingual mental lexicon is based on formal links among L2 words (Laufer, 1989; Meara, 1984). It is suggested that early form activation precedes semantic activation with a clear-cut transition between them. Namely, the orthography of words provokes the activation of semantics, so the semantic activation does not take place before the activation of orthography is finalized (Forster, 1976). The interactive activation models (McClelland & Rumelhart, 1981) discussed above, however, predict that the onset of orthographic activation prompts the activation of other levels like semantics or vice versa. Therefore, they happen to get activated in a mutual way. Nevertheless, researchers that assume that the activation of orthographic (form) and semantic information is ordered, attempt to investigate this in bilinguals via translation-based tasks (Gollan, Forster & Frost, 1997; Midgley, Holcomb & Grainger, 2009; Schoonbaert, Duyck, Brysbaert & Hartsuiker, 2009). Gollan et al. (1997) has found semantic facilitation effects at 50 ms of SOA without any facilitation of orthography when the primes are in the L1. From the perspective of neuropsychology, Midgley et al. (2009) carried out a masked translation priming experiment with the SOA of 50 ms and stated that while the mental lexicon is undergoing a form-based activation, semantic activation also gets engaged in the process mutually. Besides the investigations of automatic activation in short SOA cases, Schoonbaert et al. (2009) studied two languages across 250 and 100 ms of SOAs in a cross-linguistic fashion. Their study looked into the semantic effects in the absence of orthography and found semantically related facilitation in both SOA conditions. They stated that the SOA only functions to raise the effect of priming. From a developmental perspective, some studies have focused on the effect of proficiency in order to understand the organization of bilingual mental lexicon (Ahn, 2015; Jiang, 2000; Kroll & Stewart, 1994; Singleton, 1999; Singleton & Little, 1991; Talamas, Kroll & Dufour, 1999; Zareva, 2007). As to the mapping of formal and semantic information of words in bilingual people, Jiang (2002) argue for a tendency towards reaching the L2 words in the mind through their L1 counterparts. He has designed an experiment based on semantic relatedness judgments. His findings have shown that L2 words rely on their L1 equivalents for semantic relations. He also posits that learners reorganize their mental lexicon as their proficiency increases in the L2. The interlingual links are elaborated more in the light of language proficiency in adults (Kroll & Stewart, 1994; Talamas, Kroll & Dufour, 1999). For example, Talamas et al. (1999) indicate that adult learners mostly make form-based errors at the beginning of their learning process. To investigate this, they have conducted a translation recognition study with adult speakers of English belonging to two proficiency groups. They predict that the transition from lexical association to concept mediation is possible to occur through fluency in the L2. While less proficient bilinguals showed dependency on form-related input, bilinguals that were more proficient were inclined to count on the meaning cues. Nevertheless, not all previous findings fully support this proficiency-based staged development in the organization of words in bilinguals. For example, Silverberg and Samuel (2004) have compared early acquirers of the language to low proficiency and high proficiency late learners on the condition of L1 Spanish primes related to L2 English targets in form and meaning. The early bilingual group displayed facilitation by semantic primes unlike the other two groups. Between the bilingual groups, high proficiency group was facilitated by formal information about words, but less proficient group seemed to be facilitated by neither form nor meaning. As a result of their findings, they suggest that the mental lexicon of early bilinguals and monolinguals share commonalities that are distinct from late learners of the language. Although late L2 learners master the L2 fully, they may still be categorized distinctly from the native speakers or early acquirers of the language. A different dimension has been added to the discussion by Duyck and Houwer (2008), who suggest that what matters is not the development in the L2, nor the mappings between forms and meaning, but the word itself. They carried out a letter-case judgment task with Dutch and English bilinguals to assess the 'low-level' activation of words. They asked the participants to label the words they see based on their presentation (i.e., lower case words should be labeled as 'animal' and the label for the uppercase words is 'OCCUPATION'). When the words and the labels match in meaning and form, they could recognize them better. Therefore, they accounted for the form and meaning mapping with the strong connections established very early between forms and meanings.

Apart from the bare forms examined to explore the organization and storage of bilingual mental lexicon, a great deal of research has been carried out with morphologically complex words in the literature. Mostly, the route of processing has been probed to look for the similarities and/or differences between monolinguals and bilinguals. The two distinct routes put forward for morphological processing are decomposition and full listing. The first model predicts that complex words are decomposed in the stem and morphemic constituents and they are stored separately in the lexicon. For example, the verb 'work' and the suffix, '–er' are stored separately and they put into a computation during the access the word, 'worker'. The second view, however, assumes that all morphologically complex forms (derived and inflected forms) are stored as a whole (i.e., single unit) and access procedure does not require (de)composition of stems and affixes. Some researchers claim that decomposition is relevant only for monolinguals. L2 learners, however, employ full-listing as a route to access complex words (Neubauer & Clahsen, 2009; Silva & Clahsen, 2008). This view has been challenged by other groups of researchers, and they suggest that decompositional route is accessible for both monolinguals and bilinguals (Coughlin & Tremblay, 2014; Feldman, Kostic, Basnight-Brown, Durdevic & Pastizzo, 2010). There seems to be no consensus on this issue yet and research continues to explore potential differences between monolinguals and L2 learners in processing morphology (see Jacob, 2017 for a recent review). In this line of research, apart from the word access routes in the mental lexicon, the nature of the storage of words has also been explored with regard to form and meaning mapping. In other words, morphological priming effects necessarily involve semantic and orthographic priming effects as well. In the processing of prime-target pairs like 'talked-TALK', orthographic and semantic similarity cannot be disregarded. Heyer and Clahsen (2015) investigate such an overlap in their study involving L1 English native speaker and late L2 learners of English with L1 German under orthographically related, morphologically related and unrelated prime conditions. They have conducted a masked priming experiment. The set of items include prime target pairs that are orthographically, semantically and morphologically related (i.e., darkness-dark) and the second set consists of only orthographically related prime target pairs (i.e., example-exam). Both groups display facilitation in the former set. Nevertheless, only the non-native group shows facilitation solely for the orthography condition. Thus, they assert that L2 processing of complex words is based on orthographical similarities. However, Jacob (2017) states that it is difficult to generalize this for all types of complex words and that further research examining the convergence of morphology with orthography and semantics is required.

As discussed above, research on the bilingual lexicon addresses several issues. For example, the way simplex and complex words are stored and accessed in each language; the way two languages interact with each other while accessing words in a particular language; the extent and temporal sequence of activation of different levels of linguistic information (e.g. the time course of activation of orthographic, semantic information) ; the role of age of onset of L2 acquisition; L2 proficiency as well word type and frequency in the organization of words are all among the questions explored in this field.

This thesis aims to contribute to the literature by investigating the time course of activation of the orthographic and semantic information in visual word recognition in L2 English. Since the study compares native speakers and late L2 learners, it will reveal additional information as to whether there are native-nonnative differences in the extent and timing of access to semantic and orthographic information of words. The study relies on a masked priming paradigm that is believed to tap an automatic activation of words in the lexicon and hence reveal the intricate network among L2 words.

CHAPTER 3

METHODOLOGY

The aim of the study is to compare the way native and nonnative speakers organize English words in their mental lexicon. To this end, two proficiency groups of L2 learners of English with L1 Turkish were tested. Their results were compared to that of the L1 English monolingual group. The experimental paradigm involves a masked priming task implemented on E-prime (Schneider, Eschman & Zuccolotto, 2012).

3.1 Participants

The information about the participants in the study was listed in Table 1. 24 low proficiency and 24 high proficiency learners of L2 English with L1 Turkish participated in the study. The participants, aged between 19 and 27 (mean age: 20.06) were all students at a preparatory school of a private university in Turkey. The participants were recruited through a convenient sampling technique after they gave consent to participate in the study. The L2 English proficiency levels were determined by the Oxford Quick Placement Test (Allan, 1985). The participants were also given a background questionnaire (see Appendix A) to gather information about their demographic and linguistic background concerning the first formal exposure to L2 English, length of L2 exposure and other language learning experiences.

As for the control group, 28 native speakers of English, who were matched to the L2 group in terms of education, SES, and age (mean age: 31,53) participated in the study. The control group was also given the linguistic background questionnaire to ensure that they are either monolingual speakers of English, who do not have knowledge of Turkish or any other foreign language beyond the beginner's level.

Table 1. Participant Information

Group	Gender (*N*)	Mean Age (Range)	Mean Age of First English Exposure (Range)	Mean Length of Exposure (Range)	Mean QPT Score (Quick Placement Test) (Range)
L1 English (*n*=28)	Female (10) Male (18)	31.53 (20-52)	-	-	-
L2 Low Proficiency (*n*=24)	Female (11) Male (13)	20.04 (19-27)	9.04 (3-11)	11 (9-17)	25.41 (21-30)
L2 High Proficiency (*n*=24)	Female (6) Male (18)	20.08 (19-26)	8.95 (5-13)	11.12 (7-20)	35.58 (32-40)

3.2 Instruments

The tasks administered were listed in Table 2. The purpose of the Oxford Quick Placement Test was to identify the proficiency levels of L2 English participants and group them accordingly. The masked priming task intended to observe the processing patterns in the three groups.

Table 2. The Outline of Research Methodology

Participants	Instrument	Dependent Variable	Independent Variable	Analysis
L2 Low Proficiency and L2 High Proficiency	Oxford Quick Placement Test (OQPT)	QPT Score	Group	Independent Samples t-test
L1 English, L2 Low Proficiency and L2 High Proficiency	Masked Priming Task	Accuracy, RTs	Prime Condition	Mixed ANOVA

3.2.1 Oxford Quick Placement Test

According to the article by Purpura (n.d.), the Oxford Quick Placement Test (henceforth OQPT) was firstly developed as a pen and paper test by Dave Allan in 1985. After that, its online version was made available in 2000. The test aims to provide a measure for language abilities of the test takers and place them as quickly and reliably as possible to different levels in line with the Common European Framework of Reference (henceforth CEFR). The version implemented in the study is pen and paper version comprised of 60 questions. When 1 point is given for each correct answer, each 10 points refers to one CEFR level from A1 to C2.[5] The experimental group in the study was divided into two proficiency groups as low and high proficiency.

[5] 0-10: Breakthrough (A1)
11-20: Waystage (A2)
21-30: Threshold (B1)
31-40: Vantage (B2)
41-50: Effective Operational Proficiency (C1)
51-60: Mastery (C2)

3.2.2 Masked priming task

The experimental task involves a masked priming lexical decision task first developed by Forster and Davis (1984). On the basis of the previous literature regarding the bilingual mental lexicon, in this study, a forward masked priming task was used. As illustrated in Figure 2, the procedure used in this task was as follows: first a forward mask (#####) which consisted of hash marks was presented on a computer screen for 500 ms. The forward hash mask was matched with the prime in length. In other words, the width of the mask covered the prime completely. Right after the mask, a lowercase prime was presented on the screen for 60 ms. In other words, in the present experiment, the prime duration was set at 60 ms to ensure that the different types of primes will be unconsciously accessed yet will not be consciously identifiable by either native or non-native speakers. The interstimulus interval, the time interval between the end of the prime and the beginning of the target, was set at 0 ms. In other words, the target immediately followed the prime in the same position on the screen. While the prime was presented in lowercase letters, the target was presented in uppercase letters to minimize the orthographic overlap between them. The targets stayed on the screen until the participants answered as ‘yes’ or ‘no’, so there was no cut-off time for this experiment. The participant's response was taken as the criterion for the transition to another item considering the non-native speaker group with two distinct proficiency levels to ensure a response for each item. The time between each trial was 1500 ms.

###### (500 ms)	prime (60 ms)	TARGET (until response)

Figure 2 The presentation of the stimuli in the masked priming design

In this experiment, four different types of primes were used: identity, orthographic, semantic, and unrelated. The orthographically-related primes were also phonologically-related. In other words, since orthographically-related English words are, in most cases, also phonologically-related, no attempt was shown to differentiate between orthographically- and phonologically-related primes. They were taken as one single category as all the selected items that are orthographically-related were also phonologically-related. Therefore, in the thesis I refer to them as orthographically-related primes.

As for the predictions, for both groups, while the identity condition is expected to trigger the shortest RTs, the unrelated condition is to elicit the longest RTs. Such findings on these two control conditions will ensure that the test works properly and participants are sensitive to prime conditions (Jacob, 2017). For the native speaker group, it was further predicted that the RTs to the target words after the semantically-related primes will be longer than the RTs in the identity prime condition but shorter than the orthographically-related and the unrelated prime conditions. In other words, native speakers of English will display semantic priming more than orthographic priming. This prediction is reversed for L2 learners in the sense that they are expected to show orthographic priming effects more than semantic priming effects. In other words, unlike native speakers, who are predicted to rely on semantic relatedness more than form similarity, L2 learners will benefit from orthographic priming more than semantic facilitations. Thus, orthographic priming effects were expected to be stronger than the semantic priming effects in the L2 group. With respect to L2 proficiency effects, it is predicted that the high proficiency L2 group might be more similar to the native group with respect to processing pattern in the sense that the shorter RTs in semantic condition than orthographic condition may emerge in this group. In the L2 low proficiency group, however, the effects of orthographic priming will be stronger than the effects of semantic priming. Specifically, the orthographic condition will lead to shorter RTs than the semantic condition. This is because it is assumed that building semantic network in the mental lexicon gradually emerges subsequent to a primarily form-based organization observed in the initial language development (Schmitt, 1998).

As to the stimuli, the prime-target pairs were chosen from among English nouns only, keeping the word frequency constant. The target items were selected based on the frequency instances per million words from SUBTLEX-US corpus developed by Brysbaert and New (2009). Regarding this corpus, Van Heuven, Mandera, Keuleers and Brysbaert (2014) have proposed a new measure for frequency which is easier to implement and more comparable to other measures than the traditional ones. It is called Zipf's value, which is a logarithmic scale with values ranging from 1 to 7 like in a Likert scale. The advantage of this standardized measure is that its values do not depend on the corpus size. It is the logarithmically calculated and standardized version of frequency per million words [log10(fpmw)+3 or log10(fpmw*1000)]. The values 1-3 indicate low-frequency words (with frequencies of 1 per million words and lower) and the values 4-7 indicate high-frequency words (with frequencies of 10 per million words and higher). Frequency norms were set from 4 to 7 of Zipf's value for the high frequency words for the present design to make sure all the items are familiar to the participants.

As shown in Table 3, the experimental items were divided into four versions in line with the Latin Square Design with different prime stimuli for the same target item in each version to ensure that the participants do not see the same target item more than once within the same experiment.

Table 3. Latin Square Design

Target	Version 1	Version 2	Version 3	Version 4
PRISON	prison-PRISON (identity)	crime-PRISON (semantically related)	priest-PRISON (orthographically related)	truck-PRISON (unrelated)

As shown in Table 4, each version included equal number of identity, orthographically related, semantically related, and unrelated primes. There were 24 target words (see Appendix B), 48 filler items (see Appendix C) and 72 nonwords (see Appendix D) in each version. Nonwords were constructed by means of a website, English Lexicon Project Website (Loftis, 2014), serving as a nonword generator by filtering the number of letters required to match the targets. The website provided a list of nonwords which were modified and categorized for the purposes of study. They were divided into four prime categories to fulfill the criterion of Latin Square Design. The orthographical relatedness between nonword primes and stimuli was met by keeping the first three letters the same (i.e., lotkish-LOTANY). Other prime conditions were attributed to their nonword targets randomly. All nonwords were legal, constructed within the phonotactic constraints of English, and they were matched to the target words in length, defined as the number of letters and syllables.

Table 4. The Number of the Test Items Across Versions

	Version 1	Version 2	Version 3	Version 4
Practice Items	16	16	16	16
Experimental Items	24	24	24	24
Fillers (Real Words)	48	48	48	48
Nonwords	72	72	72	72
TOTAL	160	160	160	160

For each target, there were 24 identity, 24 unrelated, 24 orthographically related, and 24 semantically related primes. Primes were matched to the targets in terms of their frequency, word length and syllable number as illustrated in Table 5. The semantic relatedness between targets and primes were determined based on the associations given in the Edinburgh Association Thesaurus (Lapalme, 2017). In this corpus, a word is listed with other words stimulating it in terms of meaning associations. For example, the word 'prison' stimulates the word 'crime' while the word 'priest' is not in the list of associations of this word because there is no semantic link between the 'priest' and 'prison'. Within the list of associated words for each target, one word which is matched to its target with regard to frequency, length (number of letters and of syllables) was chosen as a semantically related prime. As to the orthographical relatedness, two conditions were regarded. Firstly, the words starting with the first three letters of the target (priest-PRISON) and matching it for frequency, length and syllable number were taken as the orthographically related primes. Also, those words were checked for their semantic relatedness in the association corpus mentioned above to avoid any semantic relations between orthographically related primes and targets.

Table 5. Prime and Target Properties

Prime		Mean Word Frequency (per million) (*SD*)	Mean Zipf Value	Mean Length (number of letters) (*SD*)	Mean Length (number of syllables) (*SD*)
Identity (Target)	*'beauty-BEAUTY'*	29.83 (16.31)	4.39 (0.28)	5.95 (0.20)	1.95 (0.20)
Orthographically Related	*'beard-BEAUTY'*	28.11 (56.14)	3.99 (0.69)	5.91 (0.92)	1.83 (0.81)
Semantically Related	*'woman-BEAUTY'*	112.33 (165.48)	4.62 (0.79)	5.08 (0.40)	1.5 (0.51)
Unrelated	*'window-BEAUTY'*	70.64 (33.14)	4.80 (0.20)	5.37 (0.87)	1.62 (0.71)

3.3 Procedures

The participants were tested by the researcher individually in a quiet room. Before they started the experiment, they were asked to fill in the language background questionnaire for their language history. This was followed by the English proficiency test on the basis of which the participants were grouped into high and low proficiency groups. After a 15-minute break, the participants sat in front of a laptop in order to carry out the priming task. When the researcher made sure that they could comfortably begin the experiment, they were told to read the instructions provided on the screen. In addition, the researcher explained the instructions once again briefly to ensure that everything was clear. The participants were asked to press the 'yes' or 'no' buttons shown on the keyboard of the laptop in order to decide whether or not the letter strings appearing on the screen are words in English. The practice items were used as trial items to familiarize participants with the experimental procedure. E-Prime (Version 2.0) was used to record the accuracy and the RTs (Schneider, Eschman & Zuccolotto, 2012). A 'yes' response to a real word, and a 'no' response to a nonword were considered a correct response. The statistical analyses for the RTs in each prime condition were conducted on the correctly responded items. When the task was completed, the participants were asked to do a vocabulary test so as to make sure that all the vocabulary items presented as either a prime or a target are familiar to the participants. The vocabulary test (see Appendix E) was implemented to the L1 group with English instructions; and to the L2 group with Turkish instructions. For each participant, the same procedure was followed. The entire session in the priming experiment for one participant lasted for approximately 30 minutes.

3.4 Analyses

When the participants completed the OQPT, they were grouped based on their scores. After that, their RTs to target words in the masked priming task were exported and their responses were sorted and categorized according to the prime conditions in which they appeared in the test. Only correct responses were included in the analyses. There were no participants that were excluded due to high error rate. The overall error rate for all the participants was 3.39%. The mean error rate for the L1 English group was 0.89%. The L2 English group showed 4.86% error rate. While only the correct responses were analyzed in the study, the RTs which were three standard deviations below and above the mean were considered as outliers and were not further analyzed.

The mean RTs of each prime condition for each participant were analyzed by means of a 3X4 Mixed ANOVA between groups factor (L1 Native, L2 Low Proficiency and L2 High Proficiency) and within subjects factor (Identity, Orthographically-Related, Semantically-Related, and Unrelated Prime Conditions). Pairwise comparisons were investigated to observe the interactions between groups and prime conditions.

CHAPTER 4

RESULTS

This section presents the findings of the study. Firstly, the analysis of the OQPT scores is discussed to ensure that there is a difference between the two proficiency groups in terms of their proficiency scores. Secondly, the vocabulary ratings in the vocabulary test are discussed. Finally, the findings of the masked priming task are explained in detail.

4.1 Results of the OQPT

The OQPT scores were used to classify L2 participants as low proficiency and high proficiency groups, with 24 participants in each, as illustrated in Table 6. The test scores were analyzed by an independent samples t-test which revealed that there was a significant difference between low and high proficiency groups in terms of their proficiency scores (F=3.106, p< .000). This suggested that the OQPT scores of the two L2 groups were significantly different from each other with respect to their proficiency levels.

Table 6. Oxford Quick Placement Test Scores

Groups	Mean Scores (out of 60)	Range	Standard Deviation
L2 Low Proficiency (N=24)	25.41	21-30	2.76
L2 High Proficiency (N=24)	35.58	32-40	2.06

4.2 Results of the vocabulary test

The vocabulary test included all the target items and the prime words used across three conditions, namely orthographically related, semantically related and unrelated primes, with the ranking from 1 to 4. The identity prime condition was excluded since they are the same words as the targets. The participants were asked to rank (their knowledge of/familiarity with) each word in the list on a scale from 1 to 4.[6] The rankings given for the same item by each participant were listed to obtain the average score for each item. Mean score for each vocabulary item was then calculated to ensure that for each word, the mean score was 2.5 and above. A minimum mean score of 2.5 out of 4 was accepted as an appropriate level of familiarity for the item to be taken into further analysis.

4.3 Results of the masked priming task

The two dependent variables in the masked priming involved accuracy and reaction time (RT). The former measure was the primary determining factor because only correct responses were taken into the RT analyses. The erroneous responses (0.89% of the L1 data and 4.86% of the L2 data) were left out of the analyses. The scores which were three SD above and below the mean RTs of each participant were deemed outliers and were not analyzed any further, but neither the L1 group nor L2 groups had any extreme RTs that would be considered outliers. After removing erroneous responses, a statistical analysis of the mean RTs per prime condition was carried out.

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[6] 1: I don't know the word (I have never heard the word before and I have no clue about it)
2: I know a little (I have heard the word before, but I am not certain of its meaning)
3: I know a fair amount (When I read, I know what the word is)
4: I know it well (I know it a great deal, I could explain the word to others and use it in writing and discussion)

4.3.1 Descriptive statistics results

The mean RTs (in miliseconds) per prime condition for all three groups were examined as shown in Table 7, and figure 3 demonstrates the mean RTs across prime conditions for all groups.

Table 7. Mean Reaction Times (ms) per Condition

Condition	L1 English (*N=28)*		L2 Low Proficiency (*N=24*)		L2 High Proficiency (*N=24*)	
	M	*SD*	*M*	*SD*	*M*	*SD*
ID	646.20	110.39	711.13	175.83	573.44	87.25
OR	715.98	119.23	723.70	146.46	600.10	83.49
SR	662.31	118.06	717.50	120.78	617.97	107.51
UR	706.97	141.04	741.48	104.34	622.17	76.67

ID: identity prime, OR: orthographically related, SR: semantically related, UR: unrelated

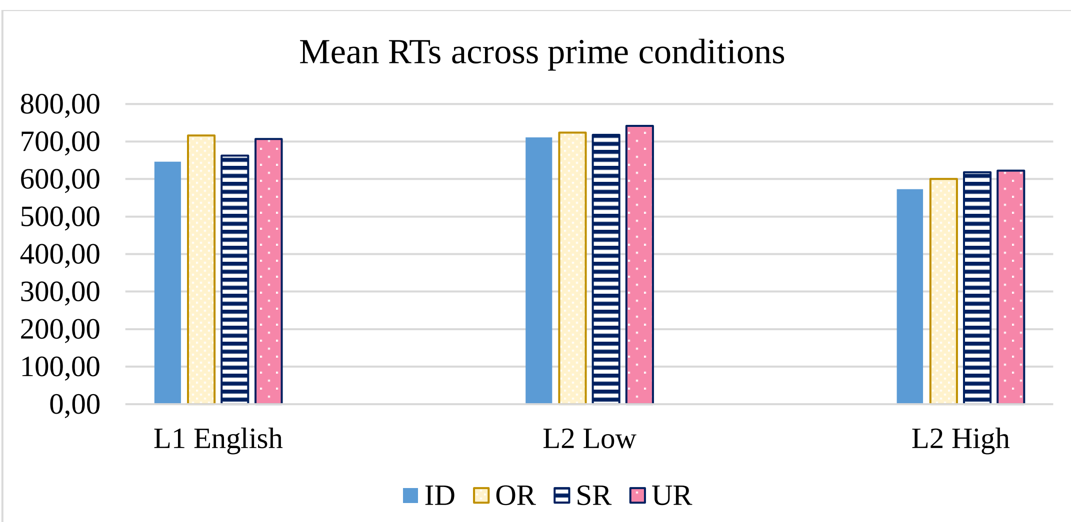

Figure 3 Mean RTs across three prime conditions for all groups

As can be seen from Table 7 and Figure 3 for all groups, the lowest and highest mean RTs were found in the identity and the unrelated prime conditions, respectively. In the native speaker group, the lowest response latency found in the identity prime condition was followed by semantically related condition. The orthographically related condition, however, yielded RTs as high as (even slightly higher) than the ones found in the unrelated condition, suggesting that for native speakers, primes that are orthographically related to targets do not bring any facilitation for the recognition of targets. Semantically related primes, however, facilitated target word recognition. In the L2 groups, high proficiency L2 learners were overall faster than low proficiency L2 learners. With respect to the priming patterns, both the low proficiency and high proficiency L2 participants were found to be fastest in the identity condition and slowest in the unrelated condition. In both groups, semantically and orthographically related conditions yielded higher RTs than the identity condition but lower RTs than the unrelated condition. The only unprecedented result was that unlike the high proficiency group, the low proficiency group was faster in the semantically related condition than the orthographically related condition. The results of mixed ANOVA as reported below present the statistically significant differences among different prime conditions across the three groups.

4.3.2 Results of mixed ANOVA

A 3 (groups) X 4 (conditions) mixed ANOVA with repeated measures in the latter was applied through IBM SPSS Statistics (Version 22). The analysis revealed that the main effect for both groups (F=9.293, p<.000) and primes (F=5.058, p<.002) was significant while prime and group comparison (F=1.258, p<.279) did not show a significant interaction.

‘Group’ as the between subjects factor yielded a significant main effect. Bonferroni adjustment as the post-hoc pairwise comparison was conducted in order to investigate the differences among the groups. When prime interactions were disregarded, a significant difference was found among the groups, which means that groups differ from one another in the overall speed of processing of the target forms. Firstly, the difference between L1 native and L2 high proficiency group was found to be significant (F=9.293, p<.015). The high proficiency L2 group (M=603.425, SD=20.064) was significantly faster than the L1 native group [mean difference=-79.444, p<.015, 95 percent confidence interval (-146,446,-12.443)]. The high proficiency L2 group was also significantly faster than low proficiency L2 group [mean difference=-120.032, p<.000, 95 percent confidence interval (-189.562,-50.501)]. However, the pairwise comparison between the L1 English group (M=682.869, SD=18.576) and low proficiency L2 group did not reveal a significant interaction [mean difference=-40.587, p<.426, 95 percent confidence interval (-107,588, 26.414)]. Although the low proficiency L2 group was slower than L1 English group in processing, this did not seem to be statistically significant.

Another significant main effect was observed in ‘prime condition’ as the within subjects factor. To clearly see the differences among the four prime conditions, Bonferroni correction was applied. Without looking at the group differences, the pairwise comparisons for four primes were evaluated. The Identity prime (ID) condition (M=643.591, SD=14.839) had the lowest response latency, which is interpreted as the fastest processing when the prime and the target are identical. It was followed by semantically-related prime (M=665.93, SD=13.311). This means that when the prime and target are semantically related, participants are faster in accessing the targets but they are still not as fast as they are in the identity prime condition. Crucially, overall the semantically-related primes yielded faster RTs than the orthographically-related prime (M=679.932, SD=13.712). The slowest processing was in the unrelated prime condition (M=690.212, SD=12.932). The mean differences between identity and semantically-related prime conditions [mean difference=-36.341, $p<.022$, 95 percent confidence interval (-69.186, -3.496)]; and between identity and unrelated prime conditions [mean difference=-46.620, $p<.002$, 95 confidence interval (-80.684, -12.557)] were statistically significant whereas the comparisons did not reveal a significant difference between identity and orthographically related prime conditions [mean difference=-22.339, $p<.497$, 95 confidence interval (-56.786,12.108)]. In addition, the comparison between orthographically and semantically related items did not reveal a significant [mean difference=14.002, $p<1.000$, 95 confidence interval (-22.983, 50.986)]. Furthermore, no significant differences were found between the unrelated condition and the orthographically-related prime [mean difference=10.280, $p<1.000$, 95 percent confidence interval (-24.290, 44.850)]; and between the unrelated prime and the semantically-related prime [mean difference=24.281, $p<.314$, 95 percent confidence interval (-9.105, 57.668)]. In brief, the overall pattern for primes can be indicated as follows: $\text{Identity}_{RT}<\text{Semantic}_{RT}<\text{Orthographic}_{RT}<\text{Unrelated}_{RT}$.

As for the interaction between groups and primes, there was not a significant difference (F=1.258, $p<.279$). This result can be interpreted as a similar processing pattern for both native and two non-native groups of different proficiency levels. Nevertheless, it may still be revealing to look closely at the differences in mean RTs to identify potential distinctions among the groups in terms of group tendencies. Therefore, pairwise comparisons of group and prime interactions carried out by Bonferroni correction as shown in Table 8 below were given with mean differences. In all prime conditions, the high proficiency L2 group reacted significantly faster than the L1 native and low proficiency L2 groups. The L2 low proficiency group was the slowest in all four prime conditions. The pairwise comparisons of the three groups in four prime conditions highlight the interactions per prime condition. In the identity condition, the high proficiency L2 group was significantly faster than the low proficiency L2 group (F=1.258, p<.001). However, the L1 native group showed no significant difference with either the high proficiency group (F=1.258, p<.139) or the low proficiency group (F=1.258, p<.224). The high proficiency L2 group did show a significantly faster processing compared to L1 native (F=1.258, p<.002) and L2 low proficiency (F=1.258, p<.002) groups in the orthographically-related prime condition whereas the L1 native and L2 low proficiency interaction was not statistically significant (F=1.258, p<1.000). As for the semantically-related prime condition, the high proficiency L2 group displayed a significantly faster performance than the low proficiency L2 group (F=1.258, p<.012). However, the interaction of the L1 native group was not significant with any of the groups; namely, the high proficiency group (F=1.258, p<.518) and the low proficiency group (F=1.258, p<.272). In the unrelated condition, L2 high proficiency participants were also significantly faster than both L1 native (F=1.258, p<.025) and L2 low proficiency participants (F=1.258, p<.001). The L1 native participants did not differ significantly from low proficiency L2 participants (F=1.258, p<.820). The fact that the highly proficient participants could recognize targets preceded by all four distinct prime conditions significantly more quickly than the less proficient group shows that there is a proficiency-based increase in the processing speed. Slightly slower RTs in the L1 native speakers than high proficient L2 speakers in all of the prime conditions may be due to the lack of practice in taking online tests and/or age effects (Salthouse, 1996). Recall that the age range in the L1 native speaker group was 20-52 with a mean of 31.53, whereas the age range in L2 participants was between 19-27 with a mean of 20.04 in the low proficiency group, and of 20.08 in the high proficiency group.

Table 8. The Pairwise Interactions of Groups per Prime Condition

	Comparisons	Mean Difference	p value
Identity	L1 Native-L2 Low Proficiency	-64.927	.224
	L1 Native-L2 High Proficiency	72.763	.139
	L2 High Proficiency-L2 Low Proficiency	-137.689*	.001*
Orthographic	L1 Native-L2 Low Proficiency	-7.714	1.000
	L1 Native-L2 High Proficiency	115.883*	.002*
	L2 High Proficiency-L2 Low Proficiency	-123.597*	.002*
Semantic	L1 Native-L2 Low Proficiency	-55.189	.272
	L1 Native-L2 High Proficiency	44.339	.518
	L2 High Proficiency-L2 Low Proficiency	-99.528*	.012*
Unrelated	L1 Native-L2 Low Proficiency	-34.518	.820
	L1 Native-L2 High Proficiency	84.793*	.025*
	L2 High Proficiency-L2 Low Proficiency	-119.311*	.001*

Bonferroni adjustment for multiple comparisons was applied.

Table 9 shows each group's performance in relation to the interactions of primes in order to answer the question about the storage and organization of mental lexicon in both the L1 and L2. Even though we cannot see statistically significant results, it is still worth looking more closely at the interactions to interpret the results. Recall that the overall mean RTs found in the L1 native speaker group was as follows:

$Identity_{RT} < Semantic_{RT} < Unrelated_{RT} < Orthographic_{RT}$

The pattern for the low proficiency group was similar to that of native speakers except for the fact that in the L2 group, the unrelated primes triggered the least priming effects, as predicted: $\text{Identity}_{RT} < \text{Semantic}_{RT} < \text{Orthographic}_{RT} < \text{Unrelated}_{RT.}$

The high proficiency L2 group demonstrated the following pattern: $\text{Identity}_{RT} < \text{Orthographic}_{RT} < \text{Semantic}_{RT} < \text{Unrelated}_{RT}$.

Significant differences were found only in the L1 native group between identity and unrelated conditions (F=1.258, $p<.026$) and between identity and orthographic conditions (F=1.258, $p<.005$). This suggests that the orthographic relation between prime and target did not facilitate target word recognition for native speakers. The absence of a significant difference between semantically and orthographically related test prime conditions and unrelated prime condition in both native and non-native groups suggests that there is no fully established semantically- or orthographically-based mental lexicon organization in either native speakers or non-native speakers. In other words, their mental lexicon does not rely merely on semantically- or orthographically-based relations among words.

Nevertheless, it is important to note that at least descriptive results reveal a predicted tendency in all groups in the sense that identity primes facilitated target word recognition but unrelated primes did not. The findings also show semantic and orthographic priming effects albeit less than those in the identity prime condition. The findings, however, did not reveal substantial differences between semantic and orthographic priming effects in any groups although overall, semantically related primes triggered quicker response times in native speakers than L2 groups. For L2 participants, high proficiency L2 learners appear to rely more on orthographic relatedness than low proficiency learners and this is an unpredicted finding. Nevertheless, not all differences are found to be statistically significant.

Table 9. The Pairwise Interactions of Prime Conditions per Group

	Comparisons	Mean Difference	p value
L1 English	Identity-Orthographic	-69.785*	.005*
	Identity-Semantic	-16.110	1.000
	Identity-Unrelated	-60.767*	.026*
	Semantic-Orthographic	-53.675	.115
	Semantic-Unrelated	-9.018	1.000
	Orthographic-Unrelated	-44.656	.182
L2 Low Proficiency	Identity-Orthographic	-12.573	1.000
	Identity-Semantic	-6.373	1.000
	Identity-Unrelated	-30.358	1.000
	Semantic-Orthographic	-6.200	1.000
	Semantic-Unrelated	-23.985	1.000
	Orthographic-Unrelated	-17.785	1.000
L2 High Proficiency	Identity-Orthographic	-26.665	1.000
	Identity-Semantic	-44.534	.312
	Identity-Unrelated	-48.736	.192
	Semantic-Orthographic	-17.870	1.000
	Semantic-Unrelated	-4.202	1.000
	Orthographic-Unrelated	-22.072	1.000

Bonferroni adjustment for multiple comparisons was applied.

Overall, the results of the study show that as proficiency increases, L2 participants become faster in language processing. Nevertheless, possibly due to small sample size, the findings are not completely revealing with respect to the organization of the mental lexicon. In other words, the findings did not reveal statistically significant differences between the semantic or orthographical facilitation in either native or nonnative speakers. Words in the mental lexicon do not appear to build a network based solely on semantic or orthographic relations although there is a tendency towards such facilitation. Compared to high proficiency L2 participants, native speakers and the low proficiency L2 group are found to be facilitated more by semantic relatedness. In the high proficiency L2 group, however, orthographic relatedness tends to play a more facilitative role than semantic relatedness in the organization of the mental lexicon. This is not in parallel with the literature stated before as native speakers are expected to rely more on semantic relations than form-based relatedness compared to non-native speakers who are predicted to follow a gradual shift from form-based lexical organization to a more semantically-based organization. These findings are further accounted for in the discussion section.

CHAPTER 5

DISCUSSION AND CONCLUSION

The current thesis study examined the organization of the bilingual mental lexicon in comparison to the baseline group of monolinguals via a masked priming lexical decision task. The study also explored the function of L2 proficiency in the mental organization of L2 words. The fundamental aim was to identify whether L2 learners' lexical organization is different from that of native speakers with respect to the reliance on semantic and/or orthographic relations among words. More specifically, the study examined whether semantic priming is more prevalent than orthographic priming in native speakers and high proficiency L2 learners compared to low proficiency L2 learners who have not yet had a chance to build full semantic associations among L2 words. This chapter will discuss the results of the study in reference to research questions and predictions.

As discussed earlier, concerning the organization of words in the mental lexicon, it has been suggested that there are two layers in the mental lexicon. In one layer, there is formal information relating to a word such as its phonology and orthography while the semantic information is stored in the other layer (Fernandez & Smith Cairns, 2010; Levelt, 1989). Based on this layered nature of the organization of the mental lexicon, the previous work claims that native speakers are more likely to build semantic links as opposed to formal links based on orthographical or phonological features (Channell, 1990; Meara, 1984). In line with this, in the current study, it was predicted that native speakers and high proficiency L2 learners would demonstrate clear effects of identity priming as well as semantic priming but not so much orthographic priming. Given that the prime duration in the experiment was long enough (60 ms) to activate not only form-based (i.e., orthographic priming) but also semantic priming, we predicted that the pattern of priming would be: $\text{Identity}_{RT} < \text{Semantic}_{RT} < \text{Orthographic}_{RT} < \text{Unrelated}_{RT}$ for both native speakers and high proficiency L2 learners. For the L2 group with lower proficiency, the predicted outcome was $\text{Identity}_{RT} < \text{Orthographic}_{RT} < \text{Semantic}_{RT} < \text{Unrelated}_{RT}$

As predicted, overall across three groups of participants, identity primes facilitated the recognition of the target words more than unrelated primes. This pattern ensured that the test items worked properly. Furthermore, the results revealed that the identity prime condition also triggered faster RTs than one of the two test condition primes, namely the semantically-related primes. This suggests that semantically-related primes produce priming effects but this was not full priming. Overall differences between the identity primes and orthographically-related primes were not significant. This implies that when the prime and target are orthographically-related, the recognition of the target word is as fast as it is in conditions when the prime and target are identical. This is generally interpreted as full priming. Nevertheless, the orthographically-related condition was not significantly faster than either the semantically-related condition or the unrelated condition. For us to be able to say that there is semantic or orthographic priming, we would have had faster RTs in these two conditions compared to the unrelated condition.

When we examine the results of each group more closely, we see that the English monolingual group performed significantly faster in the identity condition than the unrelated condition and orthographical condition. This suggests that identity primes triggered more facilitations than unrelated and orthographically-related prime. When it comes to the comparison of the meaning versus form-based primes, monolingual participants had faster processing in semantically-related prime conditions than the orthographically-related prime conditions even though the results were not statistically significant. Thus the findings are partially in parallel with the literature (identity < semantic < orthographic < unrelated). Despite the lack of statistically significant differences, we can still talk about a tendency towards a semantically-based organization of the mental lexicon. Nevertheless, possibly due to the limited sample size (both the number of participants and of items), it was not possible to ensure a statistically significant difference between the unrelated condition and semantic and orthographic prime conditions. Considering the descriptive data, it is possible to assert that both types of relatedness facilitate the activation of words in the mental lexicon as opposed to unrelated words in native speakers. This would be in line with the literature investigating complex words (Feldman, Barac-Cikoja & Kostic, 2002; Feldman & Soltano, 1999; Rastle, Davis, Marslen-Wilson & Tyler, 2000) and bare words (Evett & Humphreys, 1981; Humphreys, Besner & Quinlan, 1988; Perfetti & Tan, 1998). As for the reliance of one over the other type of relatedness, the current data shows a tendency for native speakers to have more semantically-built networks than the orthographical ones. This could be due to a dynamic nature of lexical organization going from more form-based association to semantically-determined associations which was well-observed in native speakers (Kroll, van Hell, Tokowicz & Green, 2010).

When the priming effects of bilinguals are observed in the study, it is noticeable that both low proficiency and high proficiency bilinguals responded faster to identity primes than to unrelated primes. Yet they still differed in the test prime conditions. The low proficiency group tended to process semantically-related primes faster than orthographically-related primes while it was the opposite for the high proficiency groups. Nevertheless, what is important in priming experiments is not the overall recognition speed in one particular prime condition but the RT difference between test conditions (semantically-related and orthographically-related prime conditions) and baseline conditions (identity and unrelated conditions). Our L2 results did not reveal any significant differences between either of the baseline and test condition. As noted earlier, sample size problems might account for the findings. It is also crucial to note that as many scholars claim, native speakers and nonnative speakers embrace a distinct route in the processing of two languages. In other words, the indeterminate findings (i.e., lack of semantic and orthographic priming (see Table 9) suggest that native-like processing or mental organization of words may not be possible in L2 learners at a proficiency level below C1. Recall that the mean language score was 25.41 and 35.58 for the low proficiency learners and high proficiency learners, respectively. Both groups were well below the C1 level. Our L2 findings do not support what Sunderman and Kroll found in their 2006 study that revealed parallel semantic and orthographic activation in both the low and the high proficiency groups. However, in our study no clear semantic or orthographic priming effects were found in either low or high proficiency group. As noted above, this finding can be attributable to limited sample size as well as the proficiency levels of participants. Each factor may have contributed to the absence of statistically significant differences across prime conditions despite the clear tendencies towards different priming patterns.

It is still important to note that the lack of statistically significant priming effects across conditions may also be related with the duration of the prime. Recall that Perfetti and Tan (1998) indicate that orthographic stimuli is facilitated through a short SOA (43 ms). Crucially, they suggested that if primes are presented with a higher SOA, then participants are inhibited which prevents orthographic facilitation. On the contrary, semantic information displays facilitation at a higher SOA (around 85 ms). In a shorter SOA, however, semantic relatedness does not get activated. McNamara (2005) also suggests that the longer SOA may trigger clear priming effects, but longer SOAs cannot capture automatic lexical access and activation; it can only reveal conscious access procedures, which involves more strategic planning. Given this, it is plausible to suggest that the prime duration of 60 ms should be sufficient to activate both orthographically and semantically priming. The current study was able to show some tendencies along these lines but the differences did not reach a statistically significant level. It is important to note, however, that 60 ms may not have been sufficient for L2 participants to display clear semantically-related priming effects. The bilingual participants in the present study first become exposed to English as a foreign language in their home country schools around the age of nine. Thus, they are considered late L2 learners or late bilinguals. The low proficiency group appeared to perform significantly more slowly than the high proficiency group in all four prime conditions. The faster processing of the high proficiency group in comparison with the low proficiency group, however, is not very revealing for us because neither group demonstrated significant priming effects in the test conditions. Jacob (2017) asserts that since L1 processing is faster than L2 to a large extent, prime durations should not be the same in order to see the comparative effect of priming for both groups. That suggests that if L2 learners in our study should have been exposed to primes for a duration longer than what native speakers had, we would have observed test condition priming more clearly. In the current study, the prime duration was 60 ms for both native and nonnative speakers. The results did not reveal strong priming effects for either group but at least the native speaker group had significant repetition priming. In other words, the identity prime conditions triggered significantly shorter response times for native speakers. Thus overall, the current data does not allow us to talk about the developmental nature of the lexical organization in the L2.

5.1 Overall conclusion

The present study compared the mental organization of words in native and nonnative speakers of English. Potential differences in two groups were predicted with respect to the extent of reliance on semantic and/or orthographic relations in the organization of English words. Specifically, late L2 learners were predicted to rely more on orthographic relatedness among words while native speakers were predicted to base the mental organization mostly on the semantically-based relations. On the basis of the RTs across groups, the following priming pattern was found:

$\text{Identity}_{RT} < \text{Semantic}_{RT} < \text{Orthographic}_{RT} < \text{Unrelated}_{RT}$.

Nevertheless, no significant interaction between groups and primes was found. Despite this further analyses were conducted to look closely at the specific priming patterns in each group. Overall, native speakers and L2 learners (low and high proficiency groups) showed certain tendencies but did not demonstrate significant differences in the organization of the mental lexicon as hypothesized at the beginning of the study. It is important to note, however, that as Kinoshita and Lupker (2003) indicate, the presence of priming is interpreted as a consequence of the certain prime and target relationship while the absence of it should not mean that this relationship does not exist. The level of L2 proficiency, the prime duration as well as the sample size could have influenced the current findings. Since our aim was to match the number of participants in each group, the study had to be conducted with a limited number of participants. Although the level of proficiency was significantly different in the study for the two groups, their proficiency (anything below C1 level) might not have been high enough to elicit the priming differences that we originally predicted. In addition, the prime duration of 60 ms may not have been sufficiently long to lead to priming. In other words, the prime duration of 60 ms might have been too short to reveal clear semantic and/or orthographic priming differences for participants, particularly the L2 groups.

Another factor that contributed to the findings may be the limited number of participants. In all three groups, we had less than 30 participants. Therefore, even the predicted tendencies did not come to a statistically significant level. Another important point to be taken into account is that, as Salthouse (1996) indicates, as adults grow older, it is likely to observe a decrease in the speed of their processing due to a slow down (or deterioration) in their cognitive functioning. Thus, the unprecedented RT difference in native speakers and L2 participants may be due to age difference between the two groups. This might have affected their processing speed as well as the pattern. All in all, in order to see the effects of priming, those factors mentioned above might be taken into account in further research.

5.2 Implications of the study

Learning an L2 is a complex activity which encompasses vocabulary knowledge, grammar and four skills to be mastered, namely reading, writing, listening and speaking. This study aimed to contribute to the bilingual mental lexicon research by investigating whether meaning and/or form play(s) a more crucial role in accessing the vocabulary items in the mental lexicon and whether this role is dependent on the L2 proficiency. If we understand the mechanisms involved in the recognition of L1 and L2 words and how this mechanism changes as a function of proficiency, we can plan and design our teaching methods accordingly. The present study involved L2 learners in two proficiency groups. However, learners, regardless of their proficiency, have not shown tendencies towards form-based or meaning-based access to words in the mental lexicon. Therefore, it will not be wrong to state that both form and meaning of the words should be emphasized during the course of vocabulary teaching. Schmitt (2008) emphasizes the importance of the link between form and meaning of words during the instructions in order to aid the recognition of them. In addition, Nation (2001) posits that vocabulary teaching is supposed to encompass both receptive and productive aspects. Thus, not only meaning but also the form of a word should be considered for vocabulary use. Even though both of them are equally important in teaching vocabulary in instructed settings, teachers will be informed about the dynamic nature of the mental organization of words while teaching vocabulary items. This will help design better activities to teach L2 vocabulary (Schmitt, 1998).

5.3 Limitations of the study

As already noted earlier, the study has certain limitations which may have affected the results of the study. Firstly, the number of experimental items could have been higher. However, due to the requirement to match them in terms of their length, frequency and part of speech, the number was inevitably small. In addition, the number of participants in each group could have been increased. The reason why the number of participants was limited was because of the difficulty of finding native speakers of English in Turkey, who are monolinguals. Testing more L2 participants was possible but then the sample size difference between native and nonnative groups would have been bigger. Nevertheless, the absence of statistically significant priming effects in the study could have been resulted from a limited number of participants. Finally, as noted earlier, the study could have involved L2 learners with higher L2 proficiency. The proficiency level of even the high proficiency group in the study may not have been sufficiently high to reveal the effects of semantic and orthographic priming and potential priming size differences between the two.

5.4 Suggestions for further research

Given the limitations noted above, first of all, future research should involve more participants. Furthermore, the proficiency levels of L2 participants should be high enough to reveal all types of priming effects that appear to emerge at a different time course. Future research should also test semantic and orthographic priming effects at different SOAs in native and nonnative speakers to be able to identify when exactly native and nonnative speakers demonstrate different priming effects. Such study would be able to identify clearly the differential time-courses of different priming effects.

Also, it might be valuable to carry out a research study comparing both production and comprehension of native and nonnative speakers to obtain a full picture of the organization of the mental lexicon.

In addition, it might be worthwhile to conduct a translation priming study to see the effects of languages. Such cross-language priming study might be very revealing to answer further questions on the organization of L1 and L2 words in the bilingual mental lexicon.

APPENDIX A

BACKGROUND INFORMATION FORM

Araştırmanın adı: *İkinci Dili Geç Yaşta Öğrenen Yetişkinlerde Zihinsel Sözlük Organizasyonu (The Organization of the Mental Lexicon in Late Second Language Learners)*
Proje Yürütücüsü: Prof. Dr. Ayşe Gürel

E-mail adresi: agurel@boun.edu.tr

Telefonu: 05...

Araştırmacının adı: Hanife Emel Yüksel Aytar

E-mail adresi: hanifeyuksel293@gmail.com

Telefonu: 05...

Dilbilgisel ve Demografik Bilgi Formu

I agree to participate in this study:

Signature:______________________________ Name:_____________________________

Date:____________________________________

I. Personal Information (will remain confidential)

Last name, First Name:____

Telephone Number:____

e-mail address:__________________________________ Sex: Female______Male_____

Date of Birth:________________________Place of Birth:City________Country______

Occupation:______________________

Highest level of schooling:Secondary______High school_______University________

II. Linguistic Information

Mother Tongue:____

Language of education:____

Primary School:____

Secondary School:____

High School:____

University:____

Age & Place of first exposure to English:______________________________________

How long have been learning English (e.g. 8 months)____________________________

How often do you use English?____

Where do you generally use English?
Home:______Work:_______Social:__________

Have you lived in an English-speaking contry before?____If so,how long did you stay there?

Country (1)________________Age of arrival:______ Length of stay:________

Country (2)________________Age of arrival:______ Length of stay:________

III. English Language Proficiency

Have you ever taken any standardized English Proficiency Test (e.g., TOEFL, IELTS)?____ How would you rate your linguistic ability in English in the following areas?

	Beginner	Intermediate	Advanced	Near-Native
Reading				
Writing				
Speaking				
Listening				
Overall Competence				

IV. Second/Foreign Language(s) (besides English)

Second/Foreign Language 1:______________________

	Beginner	Intermediate	Advanced	Near-Native
Reading				
Writing				
Speaking				
Listening				
Overall Competence				

Second/Foreign Language 2: ______________________

	Beginner	Intermediate	Advanced	Near-Native
Reading				
Writing				
Speaking				
Listening				
Overall Competence				

APPENDIX B

EXPERIMENTAL ITEM LIST

TARGET	Identity Prime Condition	Orthographic Prime Condition	Semantic Prime Condition	Unrelated Prime Condition
AFFAIR	affair	affinity	event	flight
BEAUTY	beauty	beard	woman	window
BRIDE	bride	bridge	flower	wall
BULLET	bullet	bull	death	entire
CARROT	carrot	career	rabbit	lamp
CASTLE	castle	case	tower	shirt
CLIENT	client	cliff	money	simple
COWARD	coward	cowboy	brave	memory
DRAGON	dragon	drastic	flame	table
FOREST	forest	fortune	peace	cousin
GENIUS	genius	gender	brain	hundred
HEAVEN	heaven	health	angel	scene
JUNGLE	jungle	junior	forest	magic
LESSON	lesson	lesion	class	chief
MANNER	manner	manual	style	body
MUSCLE	muscle	museum	sport	animal
NATURE	nature	nation	human	history
PARENT	parent	parsley	adult	chest

TARGET	Identity Prime Condition	Orthographic Prime Condition	Semantic Prime Condition	Unrelated Prime Condition
PLANET	planet	plain	world	letter
PRISON	prison	priest	crime	truck
SOCCER	soccer	socket	goal	tree
TALENT	talent	tall	music	kitchen
VALLEY	valley	valid	river	fresh
WEAPON	weapon	wealth	knife	south

APPENDIX C

FILLER LIST

FILLER	Identity Prime Condition	Orthographic Prime Condition	Semantic Prime Condition	Unrelated Prime Condition
ACCEPT	accept	accuse	welcome	listen
ADMIRE	admire	admit	flatter	explode
ADMIT	admit	admire	take	cook
ALLOW	allow	allege	permit	sing
APPEAR	appear	appoint	emerge	starve
ASSUME	assume	assess	calculate	tease
ATTEND	attend	attach	join	shout
BECOME	become	beckon	develop	search
BEGIN	begin	beg	start	wash
BEHAVE	behave	behold	perform	enjoy
BELONG	belong	believe	conserve	watch
BLESS	bless	bleed	thank	drink
CANCEL	cancel	canoe	delete	fall
CHOOSE	choose	choke	elect	mean
COMMIT	commit	combine	execute	feel
CONFESS	confess	construct	reveal	scare
CONFIRM	confirm	consider	certify	reflect
CONTINUE	continue	confine	sustain	advise

FILLER	Identity Prime Condition	Orthographic Prime Condition	Semantic Prime Condition	Unrelated Prime Condition
CONVINCE	convince	concern	persuade	hurry
DECIDE	decide	deceive	refuse	travel
DELIVER	deliver	delegate	transport	shave
DESERVE	deserve	descend	earn	offend
DISTURB	disturb	dismiss	bother	purchase
ENTER	enter	entail	arrive	listen
EXIST	exist	exile	live	guess
EXPECT	expect	expand	hope	borrow
IGNORE	ignore	ignite	neglect	finish
IMPRESS	impress	impose	influence	attract
INCLUDE	include	incur	have	steal
INFORM	inform	infer	consult	knock
INSIST	insist	inspire	repeat	move
INTEND	intend	intrude	think	break
LEARN	learn	lead	study	escape
PREFER	prefer	precede	adopt	explain
PREPARE	prepare	presume	arrange	reduce
PREVENT	prevent	preach	avoid	obtain
PROPOSE	propose	prohibit	offer	laugh
PROTECT	protect	proceed	defend	observe
PROVIDE	provide	proclaim	grant	stare

FILLER	Identity Prime Condition	Orthographic Prime Condition	Semantic Prime Condition	Unrelated Prime Condition
REALIZE	realize	react	aspire	invite
RECEIVE	receive	recite	get	terrify
RELAX	relax	relate	calm	build
REMIND	remind	remain	recall	stand
REPLACE	replace	repair	change	occur
RESIST	resist	resent	obstruct	irritate
SPEND	spend	speak	waste	close
SUFFER	suffer	suffice	undergo	lend
SURVIVE	survive	surmount	handle	wait

APPENDIX D

NONWORD LIST

NONWORD	Identity Prime Condition	Orthographic Prime Condition	Semantic Prime Condition	Unrelated Prime Condition
ABHAR	abhar	abhut	nombed	tomec
AGOUT	agout	agoin	fulwark	panada
AHACK	ahack	ahaty	tullock	cameris
ALKALOS	alkalos	alkunt	flutter	canyen
APTISAN	aptisan	aptody	fuzzard	capiga
BANDOD	bandod	banhugy	gunsen	mandle
BANKEL	bankel	bancar	durial	panine
BANPER	banper	banshy	purrow	fannon
BARRIEF	barrief	barpy	mutane	ranopy
BIRDIO	birdio	birtue	nylow	tapsule
BITTESS	bittess	bitwur	cypath	caprion
BLANTH	blanth	blavely	cabani	gaptor
BLAZA	blaza	blaxy	tabin	carafao
BLITTO	blitto	bliggy	raddy	gardiac
BLODDE	blodde	blolry	rackle	sarbonn
BLOOT	bloot	blopt	pable	carbude
BOLTER	bolter	bollify	gadet	sargo
BOMSAY	bomsay	bomqing	padenza	carep

NONWORD	Identity Prime Condition	Orthographic Prime Condition	Semantic Prime Condition	Unrelated Prime Condition
BORNIE	bornie	borren	pallus	varrier
BOSSMAL	bossmal	bosber	halcium	marnal
BRINPLE	brinple	brissy	calvrit	fastade
BROOZE	brooze	broppel	camjer	parver
BRUSSY	brussy	bruffer	talorie	carfe
CANDAGE	candage	canpiry	huoyant	gandy
DINARY	dinary	dinterd	buzzad	naper
DOLONEY	doloney	dolmann	tahoot	faress
DORON	doron	dorty	cajore	garmine
DRAID	draid	draun	falme	farrot
DRAMBLE	dramble	draply	calmong	rarry
FLURB	flurb	flutter	hable	caroel
FORROW	forrow	forpel	talcify	carloge
FRACE	frace	fraggy	ralmer	carriel
FREECH	freech	frekky	calte	partoon
GALLADE	gallade	galpur	tumpkin	pancer
GAPTISM	gaptism	gappung	bushmag	tannot
GLAST	glast	glaxer	habby	mapture
GOTTLE	gottle	gotbul	galiph	carotib
HARREL	harrel	harpy	bussem	canfy
HARTER	harter	haroly	putton	santeen

NONWORD	Identity Prime Condition	Orthographic Prime Condition	Semantic Prime Condition	Unrelated Prime Condition
HASER	haser	hasking	fuxom	fanvas
HONFIRE	honfire	honnush	cagus	paribou
KOARD	koard	koacue	laesar	taret
LAKERY	lakery	lakdom	gumble	cancon
LONUS	lonus	lonfenn	sagey	carloag
LOTANY	lotany	lotkish	caliher	careb
LOUNCY	louncy	lourt	waller	varpet
MANAL	manal	manuba	bunfle	bancer
MASIC	masic	masmer	duyer	tanyon
MIGWIG	migwig	miguly	lygone	hapable
MOOZE	mooze	mooway	caimaw	carmer
PANGLE	pangle	pandy	burver	vandy
PISECT	pisect	pismily	bygoke	raptain
PLEACH	pleach	plevy	habinet	baramel
PLOCK	plock	plopt	cachel	varbine
POUGH	pough	poush	callbol	tarouse
PUGLE	pugle	puggati	furma	cannury
RALEF	ralef	ralpan	nump	ranary
RANISH	ranish	ranner	burgli	vanker
ROULDER	roulder	roush	salico	tarpal
SLADE	slade	slawug	fyroad	saptive

NONWORD	Identity Prime Condition	Orthographic Prime Condition	Semantic Prime Condition	Unrelated Prime Condition
SLOOD	slood	slowry	cackfy	larcas
SLUNTER	slunter	slubby	cadince	hareen
SLUSTER	sluster	sluft	hadre	lareful
SOWER	sower	sowry	callot	carpit
TALANCE	talance	talomy	dulrush	ponor
TALLOT	tallot	talmen	fundle	sancer
TANANA	tanana	tanimo	bunoon	candiem
TRANCH	tranch	trammy	falvary	partel
TREAST	treast	trewert	salvin	tarve
TREMISH	tremish	tresung	maboose	parafe
VAGGY	vaggy	vagmer	butly	canastu
WALSAM	walsam	walcer	purden	candob

APPENDIX E

VOCABULARY TEST

⇨ Please think about the words given below and choose the right box for you for each word.

	1: I don't know the word (I have never heard the word before and I have no clue about it)	2: I know a little (I have heard the word before, but I am not certain of its meaning)	3: I know a fair amount (When I read, I know what the word is)	4: I know it well (I know it a great deal, I could explain the word to others and use it in writing and discussion)
PRISON				
HEAVEN				
CLIENT				
BEAUTY				
WEAPON				
NATURE				
PLANET				
BULLET				
GENIUS				
LESSON				
CARROT				
AFFAIR				
TALENT				
VALLEY				
JUNGLE				
CASTLE				
DRAGON				
BRIDE				
COWARD				
MUSCLE				
PARENT				
SOCCER				
MANNER				
CRIME				
ANGEL				
MONEY				
WOMAN				
KNIFE				
HUMAN				
WORLD				
DEATH				
BRAIN				

	1: I don't know the word (I have never heard the word before and I have no clue about it)	2: I know a little (I have heard the word before, but I am not certain of its meaning)	3: I know a fair amount (When I read, I know what the word is)	4: I know it well (I know it a great deal, I could explain the word to others and use it in writing and discussion)
CLASS				
RABBIT				
EVENT				
MUSIC				
RIVER				
FOREST				
TOWER				
FLAME				
PEACE				
FLOWER				
BRAVE				
SPORT				
ADULT				
GOAL				
STYLE				
PRIEST				
HEALTH				
CLIFF				
BEARD				
WEALTH				
NATION				
PLAIN				
BULL				
GENDER				
LESION				
CAREER				
AFFINITY				
TALL				
VALID				
JUNIOR				
CASE				
DRASTIC				
FORTUNE				
BRIDGE				
COWBOY				
MUSEUM				
PARSLEY				
SOCKET				
MANUAL				
TRUCK				
SCENE				

	1: I don't know the word (I have never heard the word before and I have no clue about it)	2: I know a little (I have heard the word before, but I am not certain of its meaning)	3: I know a fair amount (When I read, I know what the word is)	4: I know it well (I know it a great deal, I could explain the word to others and use it in writing and discussion)
SIMPLE				
WINDOW				
SOUTH				
HISTORY				
LETTER				
ENTIRE				
HUNDRED				
CHIEF				
LAMP				
FLIGHT				
KITCHEN				
FRESH				
MAGIC				
SHIRT				
TABLE				
COUSIN				
WALL				
MEMORY				
ANIMAL				
CHEST				
TREE				
BODY				

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