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Is Book the Same as Libro? A Comparative Study of Lexical Access in Heritage Speakers and L2 Learners

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ABSTRACT

The Revised Hierarchical Model (RHM) posits an organization of the bilingual lexicon based on conceptual and lexical links between first (L1) and second (L2) language words (Kroll & Stewart, 1994). This model predicts that increasing L2 proficiency would lead to the strengthening of conceptual links between L1 and L2 words (Cheng & Leung, 1989; Dong et al., 2005, Francis et al., 2014). The question arises, however, whether proficiency is the only predictor of conceptual link strength. Some studies suggest that L2 word processing may be different in heritage speakers and adult L2 learners who have similar L2 proficiency, but differ in age and context of initial exposure to L2 (Cheng & Leung, 1989; Montrul & Foote, 2014). The purpose of this study was to examine word processing in three types of bilinguals: high proficiency heritage speakers, advanced L2 learners and novice L2 learners. We expected to find differences between heritage speakers and adult L2 learners.

Thirty English-Spanish bilinguals (ten participants per group) were recruited based on a thorough assessment of Spanish language proficiency. All of them performed a Spanish→English word translation task and a picture naming task. For both tasks, accuracy and reaction time (RTs) in milliseconds from the onset of stimulus to the moment when the articulation of a response began were measured. Analyses of variance confirmed that the groups were significantly different in all four measures. Post-hoc Tukey tests showed that the novice L2 learners group differed from both the high proficiency groups.

In sum, the results showed that the novice L2 learners had significantly lower accuracy and higher RTs in both tasks than the two high proficiency groups. This is
consistent with previous studies, suggesting that bilingual performance in lexical retrieval tasks that require conceptual access is affected by L2 proficiency level (Cheng & Leung, 1989; Dong et al., 2005, Francis et al., 2014). However, no differences were found between the high proficiency heritage speakers and advanced L2 learners in any task performance. This suggests that proficiency has a greater effect on word processing than combined age and context of acquisition on lexical access.
CHAPTER I
INTRODUCTION

The study of the mental lexicon constitutes a vast field in psycholinguistic research (see Carroll, 2008 for a review). Several models have been proposed in order to explain how speakers store and access different words in their minds. However, the organization of the mental lexicon and the process of lexical retrieval become more complex when the speaker is a bilingual or multilingual person. In both the bilingual and multilingual scenarios, research has focused on independence or interdependence of the languages. This means a focus on the existence of conceptual versus lexical storages, as well as the factors that affect the mental lexicon (Kroll & de Groot, 1997). Among the several models that account for the organization of the bilingual lexicon, the Revised Hierarchical Model (Kroll & Stewart, 1994) has been the most influential in the field and thus is the model of focus in the current study. This model focuses on the effect of second language proficiency on the bilingual lexicon and on lexical access. It does not account for other factors that may also affect lexical processing in bilinguals, such as age and context of L2 acquisition.

The purpose of this study is to analyze two factors that may affect lexical access in bilinguals: 1) age and context of second language acquisition and 2) second language proficiency (Kroll & de Groot, 1997; Marian, Blumenfeld & Kaushanskaya, 2007; García, 2012; Pelham, 2012; Montrul, 2013a). The definition of bilingualism and the types of bilinguals as related to differences in word processing are discussed below. Adult heritage Spanish speakers and adult L2 learners of Spanish participated in the study.
1.1. What is Bilingualism?

Previous research shows that more than half of the world population is bilingual or multilingual (Grosjean, 1992; Kroll & De Groot, 1997; Marian, 2008; Silva-Corvalán, 2014; Edwards, 2013). However, there is no consensus among scholars regarding what it means to be bilingual.

One of the earliest definitions of the term was proposed by Bloomfield (1935), who believed that only individuals possessing a native-like command of two languages are bilinguals. Similar to Bloomfield’s ideas, Malmberg (1977) emphasized that bilinguals should be equally proficient in both of their languages. Additionally, he suggested that the languages must be acquired at the same time from early childhood and in a natural setting (e.g. immersed in a country and/or family where both languages are spoken). Bloomfield and Malmberg’s definitions refer to balanced bilinguals or individuals that have equal proficiency and command in every domain of their languages. This definition is highly restrictive since balanced bilinguals are extremely rare (Kroll & de Groot, 1997; Cenoz et al., 2003). In fact, Valdés (2001a) calls them "mythical bilinguals", thus highlighting the idealization behind the concept.

Contrasting with Bloomfield (1935) and Malmberg (1977), Edwards (2006) proposed a broader definition of bilingualism and stated that everyone who can produce, reproduce or understand at least a phrase in a foreign language is bilingual. However, Edwards’ (2006) argument is a misconception since the ability to reproduce a memorized phrase in a foreign language does not necessarily reflect the ability to communicate in that language. Therefore, his definition also fails to accurately describe the phenomenon of bilingualism.
The aforementioned definitions represent two extreme ideas regarding bilingualism, but there is also a vast array of definitions that focus on different aspects of it. Wei (2007) focuses on linguistic competence, which is the knowledge of grammar and other components that pertain to the structure of a language (Hymes, 1972; Bachman, 1990). He defines bilingualism as “the possession of two languages” (Wei, 2007, p. 7). In contrast to Wei (2007), other authors concentrate on pragmatic competence or the use of language in context (Bachman, 1990). From the pragmatic competence standpoint, bilingualism is the use of more than one language by the same individual, regardless of the level of proficiency (Haugen, 1953; Mackey, 1962; Kroll & de Groot, 1997; Silva-Corvalán).

Regarding pragmatic competence or language use, Baker (1988) and Altarriba and Heredia (2008) underline that language usage is not an ability itself. Instead, fluency depends on particular tasks and contexts of use. For example, reading comprehension does not demand the same skills as oral conversation. Thus, an individual can be highly proficient when reading in a second language and have a low proficiency in speaking skills. In addition, being bilingual entails more than mere input-output, because social and pragmatic skills are also necessary for effective communication (Vega, 2008). Therefore, the individual dimension of bilingualism, linguistic competence, should not be dissociated from its social dimension, pragmatic competence (Cook, 2008). A later definition by Wei (2013) integrates the individual dimension of bilingualism with its social dimension. He states that bilinguals are those who can engage in conversation in two languages. Wei (2013) also says that a bilingual status can be achieved in different contexts of acquisition and ages. He does not emphasize proficiency as a prerequisite to consider someone
bilingual, but rather focuses on the ability to "function in two or more languages in conversational interaction".

For the purpose of this study, Wei’s definition (2013) is considered the most useful. A bilingual is any person who can effectively communicate with other people in two languages; that is, a person who is able to produce as well as interpret oral and written speech in two languages. In the next subsection, the types of bilingualism that pertain to this study are defined.

1.2. Degrees and Types of Bilingualism

Degrees of bilingualism refer to the levels of proficiency a bilingual may attain in each language. Valdés (2001a) considers these levels as a continuum of possibilities rather than predetermined states (see Figure 1). In other words, according to her definition, being bilingual is not a static endpoint of second language acquisition that involves a balanced command of both languages. Instead, Valdés’ (2001a) bilingualism continuum shows that between the extremes (being monolingual in language A or in language B) a person can potentially have different levels of command in each language, and that these levels may vary over time.

Figure 1 – The Bilingualism Continuum (from Valdés, 2001a, p. 42)
The levels and types of bilingualism as Valdés (2001a) presented them are influenced by various factors other than proficiency in the second language. For instance, after acquiring a second language (L2) a speaker may lose the first one (L1) (i.e., subtractive bilingualism) or preserve both (i.e., additive bilingualism). Regarding ultimate attainment, an individual may only understand the L2 (passive or receptive bilingualism) or be able to communicate in it (active or productive bilingualism) (Wei, 2000; García, 2012; Edwards, 2013).

Research suggests that language processing differs across types of bilinguals and is affected by the factors that influence bilingualism (Pelham, 2012). The current study focuses on lexical processing, more specifically lexical access. Hence, in order to classify bilinguals, factors that affect lexical processing were considered: age of L2 acquisition, context of L2 acquisition and L2 proficiency (Kroll & de Groot, 1997; Marian, et al. 2007; García, 2012; Pelham, 2012; Montrul, 2013a). The following subsections focus on each of these three factors and their effect on bilingualism.

1.2.1. Context of Acquisition

Context of acquisition is the learning environment of the second language. An L2 can be learned either in a formal or informal context. The most common formal context of acquisition is the classroom setting where the L2 is learned through explicit instruction. In contrast, informal contexts of acquisition are natural settings in which acquisition of the L2 takes place implicitly through exposure in an immersion environment (Muñoz, 2008; Montrul & Foote, 2014; Sanz, 2014).

Within a formal context of L2 acquisition, interlanguage plays a key role in an L2 learner’s language representation and processing. The term interlanguage (IL) is defined as
the internal linguistic system or competence of L2 learners. It contains elements of the speaker's L1 as well as rules or abstractions from the target language (TL). The learner infers TL rules based on the input they receive (Selinker, 1972; Han & Tarone, 2014). There are also elements constructed in the IL that are neither from the L1 nor the TL (White, 2007). Although IL is variable and liable to be affected by individual differences (i.e., the intrinsic characteristics of each learner), it is highly systematic (Ortega, 2007). As Ortega (2007) states, systematicity is a logical feature of IL, since it is a form of linguistic knowledge and language itself is systematic.

IL is constructed mainly through five different processes: 1) language transfer (transference of aspects of the L1), 2) transfer of training (aspects of language that are affected by the type of instruction or input received), 3) strategies of second language learning (the way the learner incorporates knowledge, what strategies they use), 4) strategies of second language communication (what the learner incorporates through communication with native speakers) and 5) overgeneralization (simplification and transfer of rules within the TL) (Selinker, 1974; Han & Tarone, 2014). The third of the aforementioned processes seems to be tightly connected to the incorporation of new vocabulary into the bilingual lexicon. The strategies a learner uses to learn L2 vocabulary will ultimately impact how they access this vocabulary (Cheng & Leung, 1989). When L2 learners acquire new vocabulary in a formal context they usually accomplish this through a translation strategy (Kroll & Stewart, 1994; Marian, 2008). Therefore, it is a regular practice for L2 learners to establish connections between new L2 words and the closest L1 translation equivalent. It is possible that with increasing proficiency the L2 learner does

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1 *they* is used in this and other similar contexts throughout the thesis as a gender neutral pronoun, replacing the expression “he/she”.

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not need to resort to a translation strategy. However, language acquisition is not a linear process, but a highly dynamic one where new knowledge is incorporated into the linguistic system of the learner via restructuring (Selinker, 1974; De Bot, Lowie & Verspoor, 2007). As new knowledge is incorporated, “backsliding” occurs causing the learner to resort back to the IL structures and strategies. Although Selinker (1974) interpreted this as fossilization, the impossibility of overcoming some aspects of IL and achieving native-like proficiency, this is actually related to the phenomenon known as U-shaped learning (see Figure 2) (Strauss & Stavy, 1982; Carlucci & Case, 2013).

Carlucci and Case (2013) posited that U-shaped learning is a three step cognitive process of learning that can be applied to first and second acquisition. They explained that the first stage of this process consists of the mastery of a grammar point. For example, learning the proper conjugation of an irregular Spanish verb into the preterit tense, e.g. *hice* (‘I did’). As new knowledge is incorporated, the learner goes through a second stage (the bottom of the U-shaped curve) in which they make mistakes in grammar points previously mastered. An example of this “backsliding” is *hací* instead of *hice* (Selinker, 1974). Finally, the L2 learner goes back to the upper end of the curve and ceases to make those mistakes.

This notion of U-shaped learning describes the development of IL better than fossilization since the linguistic system is continuously evolving as new knowledge is acquired in the L2. Considering the structure of the bilingual lexicon, the learner may achieve a level of proficiency in which they perform at faster rates in L2 lexical access. Shorter reaction times in lexical access may have two possible explanations, such as the bilingual no longer needing to translate words into the L1 in order to understand their meaning or increasing experience with the L2 allowing them to translate faster (García,
2012). However, the lexicon is constantly being enlarged in both the L1 and the L2. As new vocabulary is learned, the learner may resort back to this translation strategy in order to understand and incorporate new words.

![Figure 2 – U-Shaped Learning](Adapted from Shrum & Glisan, 2010, p. 19)

The context of language acquisition has an effect on the organization of the lexicon. The lexicon of an L2 learner differs from a native speaker’s lexicon. Native speakers develop a network of words based on semantic associations, whereas L2 learners’ network relies more on phonological and orthographic similarities (Meara, 1984). However, a comparison between L2 learners and native speakers is not always productive, since ultimate attainment of L2 proficiency does not equal native-like attainment (Muñoz, 2008). Thus, it is more suitable to compare the mental lexicon of L2 learners and heritage speakers (HS), because they are both bilinguals and have acquired their languages in different contexts. The following subsection will discuss HSs and their relationship with their heritage language.

**1.2.1.1. Heritage Speakers in the U.S.**

In the United States, although there is no official language, at the federal level English is the majority language due to its status in the country (Peréra & García Coll, 2008).
Therefore, most of the other languages spoken within the U.S. territory are considered minority languages, that is, with lower prestige or no official status (e.g. Spanish).

When a child is raised in a family where a minority language is spoken (e.g. Hispanic families in the US) they are not considered native speakers of that language (e.g. Spanish), but instead they are heritage speakers (HSs). Unlike native speakers, HSs are not immersed in a community where their heritage language is the official or majority one (Valdés, 2001a). Therefore, the input they receive is circumscribed mainly to their family or speech community. HSs’ most salient characteristic is that they have a personal connection with their heritage language (Fishman, 2001; Valdés, 2001a).

Heritage languages are not typically used at school (Valdés, 2001a). Thus, HSs learn their heritage language in a natural setting (their home) mainly through oral input. Typically, HSs are usually highly proficient in their heritage language’s oral skills (listening and speaking), while not always performing as highly in their written skills (writing and reading) (Carreira, 2014). As soon as the child begins school, they are immersed into the official language of education. Consequently, the majority language (in the U.S., English) usually becomes the HSs’ dominant language (Dorian, 1982; Polinsky, 2008). This often leads to heritage language attrition, that is, loss of language by either an individual or a speech community (Freed, 1982), or to incomplete acquisition of the minority language, that is, not achieving all the stages of language development and competence as other native speakers of that language at the same age (Montrul, 2012; 2013b).

In addition to attrition and incomplete acquisition, gaps or transfer from the dominant language can also be observed in a HS. In this way, a heritage language is similar to the interlanguage of L2 learners. This is the reason why heritage languages are often
treated as the second language of an L2 learner (Montrul, 2012; Montrul & Foote, 2014). However, this does not mean that HSs and L2 learners should be considered the same, because their circumstances of L2 acquisition are different. It is crucial to take into consideration the differences between HSs and L2 learners in order to ensure validity to any research. The inclusion of HSs as mere bilinguals (or even as native speakers) without further distinction often leads to inaccurate results, such as Francis et al.’s (2014) study, which will be addressed in the next section (Gass, 2008). Therefore, this study differentiates HSs and L2 learners, since context of L2 acquisition affects lexical processing.

Recent research on the differences between L2 learners and HSs suggests that HSs perform better than L2 learners at tasks that require the use of oral skills, like oral production and comprehension (Au et al., 2002; Montrul, 2008). On the other hand, L2 learners perform better than HSs in tasks that require explicit or metalinguistic knowledge (Ellis, 2005; Bowles, 2011a). Montrul (2008) suggests that these differences in performance between HSs and L2 learners are not due to context of acquisition alone. It is possible that these differences are also a result of age of language acquisition, because HSs acquire both languages before the end of a critical period, and L2 learners do not. The following subsection will discuss the effects of age on the acquisition of language and its impact on language processing in L2 learners and HSs.

1.2.2. The Effect of Age on L2 Acquisition

The existence of an optimal or critical period in language acquisition does not mean that a second language cannot be learned after that period or a high level of proficiency is impossible to achieve. It only entails that the means of acquisition and the brain structures involved are not the same in early and late bilinguals (García, 2012).
In language acquisition research, nativists assume the existence of an inherent capacity for language in humans. Their main argument is the Poverty-of-Stimulus argument, also known as the logical problem of language acquisition (Hummel, 2014). According to this argument, the input the child receives is chaotic and insufficient, and therefore language acquisition cannot be possibly accomplished only through exposure to input. Chomsky (1968) first set the basis for nativist theories of acquisition by postulating the presence of this inherent capacity, as well as the existence of a so called “Universal Grammar” (UG). UG is a set of general principles and conditions that can be found in any human language. It is imprinted in the mind of every member of the human species from birth. Thus, when a child is first exposed to a particular language, they acquire the grammar and vocabulary of such language based on the UG they already possess. Access to UG explains why bilingual first language acquisition (BFLA) is possible: children can potentially learn any number of languages at the same time from birth if they have equal exposure to them. However, if second language acquisition occurs sequentially, after the basis of the L1 has been acquired, then only partial or no access to UG is available to a child (Brown, 2007). This would be a potential reason why developing a second language after a certain age requires more effort.

Some early theories propose the existence of a critical age after which a language cannot be successfully acquired (Penfield & Roberts, 1959; Lenneberg, 1967). Penfield and Roberts (1959) first postulated the Critical Period Hypothesis (CPH) stating that after the age of nine a child cannot acquire language, due to inflexibility of cognitive functions after that age (as cited in Hummel, 2014, p. 170). Note that the existence of an optimal or critical period concerns both first and second language acquisition. Lenneberg (1967) extended
the CPH to second language acquisition, and explained that acquiring a second language unconsciously and through mere exposure is only possible before puberty. He suggested that linguistic functions lateralize to the left hemisphere between the approximate ages of two and thirteen years. After puberty, foreign languages can be learned by the means of conscious effort. Native-like pronunciation cannot be achieved, and foreign accents are not easily overcome.

Birdsong (1999) points out that all versions of the CPH share a deterministic feature that after a certain age the ability to learn a language, either L1 or L2, begins to decline. This reduces the possibility of native-like final attainment. In his own work with late bilinguals, Birdsong found that most of the participants had achieved a native-like level of proficiency in their L2 in syntactic competence (1992). Additionally, researchers have found late L2 learners who have attained native-like pronunciation (see review in Birdsong & Paik, 2008). Therefore, the question of whether there is a CPH for language acquisition is still unresolved (Birdsong, 1999).

From a neurolinguistic standpoint, age differences in acquisition can be the result of differences in memory usage for language processing. In his Declarative/Procedural Model (DPM), Ullman (2004) emphasized that language relies on the same brain structures as any other cognitive function. He suggested that the mental lexicon and all word-specific knowledge are processed using the declarative memory, that stores knowledge of facts. On the other hand, mental grammar relies on the procedural memory, which memorizes and executes automatic or sequential motor and cognitive skills.

Paradis (2009) suggested a relationship between the declarative/procedural memory systems and the critical period for attainment of language. He argued that when
acquiring L1 or L2 before age seven, an individual learns that language's grammar as a cognitive automatic skill, because the procedural memory comes to play. In contrast, for later acquisition of a language to take place, a person has to resort to their declarative memory and learn the language consciously. Note that Paradis (2009) suggested seven years as the "critical age" instead of nine or puberty. By that age, childhood culminates or arrives to its final stage of development, and a series of neurocognitive events take place towards maturation of the brain, which set the end of the optimal period for language acquisition (García, 2012). Following Paradis (2009) and García (2012), the age of seven is adopted in this study as a cut off age differentiating early and late bilinguals.

Indeed age and context of acquisition cannot be easily teased apart within an individual learner. Early bilinguals tend to acquire the L2 in an informal context, whereas late bilinguals usually acquire the L2 in a classroom setting. Thus, a caution is needed when classifying bilinguals and explaining their linguistic behavior based on this typology. It is possible to attribute the causes of a specific linguistic phenomenon only to age of acquisition without considering context too as a possible confounding variable. In fact, age seems to have a greater effect on informal acquisition contexts than in formal ones. Early L2 acquisition is only beneficial to ultimate attainment when associated with exposure to significant input (Muñoz, 2008). Hence, the present study analyzes the combined effects of age and context of acquisition as a single composite independent variable. In the following subsection, the third factor used to classify bilinguals for this study, level of L2 proficiency, is discussed.
1.2.3. Proficiency in the L2

Although bilinguals may be assessed as having a certain level of proficiency in each of their languages, proficiency is not a uniform level of achievement. It depends on the skills assessed. For example, a speaker may be highly proficient in Spanish reading skills, but not in speaking (Altarriba & Heredia, 2008). The American Council of the Teaching of Foreign Languages (ACTFL) recommended to assess L2 proficiency according to language dominance in the four basic skills of speaking, writing, listening and reading (2012). For this thesis, the Speaking section of the ACTFL Proficiency Guidelines was used to classify bilinguals into novice or advanced L2 learners, which depended on their oral conversation skills.

Proficiency is a relevant factor in bilingualism research, since, as L2 proficiency increases, language processing in the brain undergoes a change (Kroll & Stewart, 1994; Kroll & de Groot, 1997). Regarding the bilingual lexicon and the relation between L1 and L2 lexical items, Kroll and Curley (1988) and Cheng and Leung (1989) noticed that less fluent bilinguals are faster to translate words than to name pictures in the L2. These results were replicated by Stewart and Kroll (1994), who concluded that less fluent bilinguals have a strong lexical link between L2 and L1. That is to say, they translate words from the L2 into the L1 in order to understand them, but need to translate from their L1 into their L2 in order to produce an L2 word. Presumably, as proficiency increases L2 learners rely less on translation strategies and are able to access concepts directly from their L2, because their conceptual links become stronger.

By combining the three factors studied - age (early, late), context of acquisition (formal, informal), and proficiency (high, low) - eight different types of bilinguals can be
distinguished. For this study, only three of these bilingual types were recruited. The first group consisted of advanced L2 learners, who were late bilinguals learning the second language (Spanish) in a classroom setting (formal context). The second group consisted of novice L2 learners, who were also late bilinguals learning the L2 in a formal context. The third group comprised of heritage Spanish speakers (HSs), that were early bilinguals exposed to both languages in a natural setting (informal context). These groups represent how age, context, and proficiency interact in typical populations of bilinguals in the U.S. The focus of the present thesis is lexical access in these bilingual groups. Hence, in the next chapter, research on these factors interaction as relevant to lexical processing in bilinguals is reviewed.
CHAPTER II
MODELS OF ORGANIZATION OF THE BILINGUAL LEXICON

In this chapter the main models of organization of the bilingual lexicon are reviewed, with a focus on the Revised Hierarchical Model (Kroll & Stewart, 1994). Empirical evidence regarding the effects of age, context and proficiency as relevant to our study is also analyzed.

According to the Declarative/Procedural Model (Ullman, 2004), the mental lexicon is not affected by age of acquisition, due to it normally utilizing declarative memory. However, it has been suggested that age of acquisition does affect the way vocabulary is stored and has further consequences for lexical access (Carroll, 2008). Different types of bilinguals are shown to have a distinctive organization of their mental lexicon (Weinreich, 1953; Ervin & Osgood, 1954; Zatorre et al., 1982; Furtado & Webster, 1991; Kroll & Stewart, 1994; Marian & Fausey, 2006; Schrauf, 2009; Schwanberg, 2010).

2.1. Early View on Bilingual Lexicon

One of the earliest models was proposed by Weinreich (1953), who presented three possible organizations of the mental lexicon in bilinguals: coordinate, compound and subordinate (see Figure 3). Coordinate bilingual lexicon (A) has separate storages for both languages, with no apparent connection at the lexical or conceptual level between them. In contrast, compound (B) and subordinate (C) lexicons have a shared conceptual storage. In the Compound lexicon, this conceptual storage can be accessed directly from either language, whereas in the Subordinate lexicon the concepts from the L2 can only be retrieved by mediation through the corresponding L1 lexical equivalent. Weinreich (1953)
was also the first to propose a hierarchical model of the bilingual lexicon with separate conceptual and lexical storages (Heredia & Brown, 2007).

![Diagram of the Mental Lexicon Organization](image)

**Figure 3 - The Organization of the Mental Lexicon (Weinreich, 1953)**

(From Heredia & Brown, 2013, p. 270)

There is no consensus regarding the existence of a single conceptual storage or a partially shared conceptual store (de Groot, 1995; Kroll et al., 2010). Even though evidence on the topic is not conclusive, the existence of a single conceptual storage and two lexical ones (Compound and Subordinate lexicons) prevailed and have been the basis for later models (Potter, So, Von Eckardt & Feldman, 1984; Kroll & Stewart, 1994; de Groot, 1995; Paradis, 2004).

### 2.2. Concept-Mediation and Word-Association Hypotheses

Potter et al. (1984) further developed the compound and subordinate bilingualism hypotheses (B and C in Figure 3, respectively). Concept-Mediation Hypothesis states that the corresponding L1 and L2 lexical items are conceptually mediated in bilinguals, in that both of the L1 and L2 lexical storages are connected to the conceptual storage. Hence, a bilingual can access a concept directly from a lexical item in either language. Similarly, listening to a word in either language will trigger in a bilingual the retrieval of the concept (e.g. the mental picture that represents that word), without having to translate it first in
their mind into the other language. This entails that if a bilingual translates a lexical item they perceive the word first in one of the languages, then retrieve the concept and finally translate it into the other one.

In contrast, the Word-Association Hypothesis proposes that the bilingual lexicon is lexically mediated. This means that concepts are only connected to the lexical storage of the bilingual’s L1 and the lexical items of the L2 are linked to the L1 (similar to C in Figure 3). Therefore, in order to retrieve a concept for an L2 lexical item, the bilingual needs to translate the lexical item into their L1, and only then they will be able to access the concept. This process may be accomplished directly without accessing the corresponding concept of a word.

It is important to clarify that language representation is not equivalent to language processing. Language representation refers to architectonical aspects, how language is structured in the mind and how different aspects of language interact. Language processing, on the other hand, includes the mechanisms and stages required to accomplish a linguistic task (Marian, 2008). When referring to the bilingual lexicon, studying its representation means constructing and testing hypothetical models of how the lexical items of each language are stored and interrelated. The study of lexical processing, on the other hand, involves mainly two aspects: 1) determining what steps are necessary in order to accomplish a certain task, and 2) measuring how long it usually takes an individual to execute those steps. Although language representation and processing are not interchangeable and must be differentiated, the study of processing allows drawing inferences about representation. A useful instrument used to examine both representation and processing is the measure of reaction time (RT) when performing a certain task
RT is usually gauged in milliseconds from the onset of a stimulus to the execution of a response. This response can be a vocal one or a mechanical one, such as pressing a key. Regarding bilingual lexicon, if a bilingual performs a task that requires concept retrieval (e.g., picture naming) with shorter reaction times than other bilingual, this may suggest that this task demands less cognitive effort for the former. It is possible that for some bilinguals retrieving concepts is easier than for others, due to direct connections between the concept (represented by a picture) and the lexical item that names that picture. This thesis examines lexical access in different types of bilinguals and their performance on the tasks they are required to complete. This allows for inferences to be drawn regarding lexical and/or conceptual links between L1 and L2 in these bilinguals.

Table 1 – Predictions of the Concept-Mediation and Word-Association Hypotheses (Potter et al., 1984), and the Revised Hierarchical Model (Kroll & Stewart, 1994)

<table>
<thead>
<tr>
<th>Task</th>
<th>Concept-Mediation (RT)</th>
<th>Word-Association (RT)</th>
<th>Revised Hierarchical Model (RT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1 vs. L2 picture naming/word reading</td>
<td>L1 = L2</td>
<td>L2 &gt; L1 (C&amp;L)</td>
<td>L2 &gt; L1 (Sholl et al.)</td>
</tr>
<tr>
<td>L2 picture naming vs. L1 → L2 translation</td>
<td>L2 = L1 → L2 (P et al)</td>
<td>L2 &gt; L1 → L2 (C&amp;L; E&amp;G child beginners)</td>
<td></td>
</tr>
<tr>
<td>L1 → L2 vs. L2 → L1 translation</td>
<td></td>
<td></td>
<td>L2 → L1 &lt; L1 → L2 (K&amp;S; Sholl et al.)</td>
</tr>
</tbody>
</table>


Returning to the discussion regarding the Concept-Mediation and Word-Association hypotheses, each model entails specific predictions about language processing (see Table 1). The concept-mediation hypothesis predicts that there will be little to no difference in RT between L2 picture naming and L1-L2 translation. This is because they both involve the same four stages: recognition of the picture/lexical item in L1, retrieval of the concept,
retrieval of the L2 word, and response in L2. In addition, picture naming in L1 and L2 will also be accomplished with similar RTs, since there is direct connection between the concept and both lexical storages (L1 and L2). Therefore, retrieving a lexical item in either language encompasses the same number of steps.

In contrast, the word-association hypothesis predicts that L2 picture naming will take longer than L1 picture naming. It predicts this because L2 picture naming conveys more stages (recognition of the picture, retrieval of the concept, retrieval of the L1 word, translation into L2, and response in L2) than L1 picture naming (recognition of the concept, retrieval of the L1 word, and response in L1). Also, picture naming in L2 will be slower than L1-L2 translation, due to the direct link between L1 and L2 words allowing for shorter RTs.

Potter et al. (1984) hypothesized that low proficiency bilinguals will most likely respond in accordance with the word-association model, since in the first stages of L2 learning the new vocabulary is usually linked to the corresponding L1 translation. Thus, strong connections are created from word to word. High proficiency bilinguals, on the other hand, will respond in accordance with the concept-mediation model. This is because increasing experience with the L2 helps develop and strengthen links between L2 words and concepts.

Potter et al. (1984) carried out two experiments where they tested the effect of proficiency on word processing. The first experiment was conducted with twenty-four high proficiency bilinguals (L1 Chinese, L2 English), divided into two groups. The first group named pictures in their L1 or L2 and read or translated lexical items from their L1 to their L2 or from their L2 to their L1. Response language for each task was counterbalanced across the participants. The stimuli were presented in two blocks, with the first block being
the response language L1 (Chinese) and the second block, L2 (English). The second group of participants was presented with the same set of stimuli, but instead of naming or translating they had to match each item to a superordinate category (i.e. an item like “apple” would be matched to “fruit”). The authors found that picture naming in L2 was accomplished slightly faster than L1-L2 translation, but not significantly. L2 picture naming was significantly slower than L1 picture naming, with a difference of 147ms. Also, pictures were recognized and understood as fast or slightly faster than written English words.

The second study looked at twenty-eight non-fluent bilinguals (L1 English, L2 French). The participants were presented with pictures in two blocks or sections. In the first block they had to name the picture in English and in the second block, in French. Then, they were presented with English words in two blocks. In the first one they had to read the word, while in the second one they had to translate it (L1-L2 translation). The main result found was an advantage for naming pictures in L2 (shorter RTs) over L1-L2 translation (longer RTs). The authors concluded that there exists no evidence for the word-association hypothesis, and only the predictions of the concept-mediation hypothesis were supported by their results. They concluded that this is due to the existence of concept mediation even at the beginning stages of L2 learning.

Cheng and Leung (1989) also tested the concept-mediation and word-association hypotheses in three experiments. They recruited three types of Cantonese-English bilinguals: highly proficient English bilinguals, adult beginners of English and children beginners of English. Participants had to complete three tasks: read aloud Cantonese words, name pictures in their L2 (English) or L1 (Cantonese), and translate the words from L1 to L2 and vice versa. Language of response and direction of translation was
counterbalanced across participants. Cheng and Leung (1989) found that all the subjects performed better at reading aloud words when the response language was L1 than when it was L2. Differences were found across groups of bilinguals in the other two tasks, picture naming and translation. Proficient bilinguals performed similarly in both tasks, meaning that they can access L2 words through concepts (pictures) or through L1 words with similar RTs. Adult beginners were faster translating than naming pictures, and the opposite was observed for child beginners. The authors interpreted this as evidence for the word-association model, contradicting Potter et al.’s (1984) results. There were also differences between child and adult beginners. Cheng and Leung (1989) concluded that age of L2 acquisition and learning strategies have an effect on lexical processing. In other words, children use a learning strategy based on concept-word association, making it easier for them to retrieve picture names, whereas adults rely more on translation equivalents to learn new L2 vocabulary. This present study also investigated this hypothesis that age and context of acquisition influence lexical processing by comparing adult heritage speakers and adult L2 learners.

Cheng & Leung’s (1989) conclusions about the effects of age of L2 acquisition and learning strategies on lexical processing, led Emirmustafaoğlu and Gökmen (2015) to conduct a study on the effect of different types of foreign language instruction on lexical access. They studied seventy five Turkish-English bilingual children who were approximately twelve years old. They were all taught twenty English concrete nouns in two sessions using different instruction methods. Half of the participants were exposed to each new word accompanied by a picture illustrating the concept. The other group had the L1 (Turkish) translation equivalent of the same words, instead of the picture. Ten new words
were taught in each of the two sessions. The children were tested immediately after each session with the testing method resembling the teaching method. One week after the sessions, a delayed post-test was administered that was also congruent with each group’s teaching method. Finally, one month later a second delayed post-test that combined questions both congruent and incongruent with the teaching method was conducted. Results of the second delayed post-test suggested that the learners were better at retrieving L2 words through picture naming than through L1-L2 translation, regardless of the instruction method to which they were exposed. Emirmustafaoğlu and Gökmen (2015) concluded that pictures are more effective at eliciting L2 vocabulary in children. These results were consistent with Chen & Leung’s (1989) study.

In sum, Potter et al. (1984), Chen and Leung (1989) and Emirmustafaoğlu and Gökmen (2015) suggested that L2 proficiency and age and context of L2 acquisition affect the organization of the mental lexicon and lexical processing. The following section will present the Revised Hierarchical Model (Kroll & Stewart, 1994) and the evidence that supports and contradicts it.

2.3. The Revised Hierarchical Model

The studies discussed in the previous section did not take into consideration the possibility that the direction of translation may affect the results. These results showed a balance between translation and picture naming (Potter et al., 1984) or an advantage of picture naming over translation (Cheng & Leung, 1989; Emirmustafaoğlu & Gökmen, 2015). Note that they focused mainly on L1-L2 translation compared to picture naming performance. Kroll and Stewart (1994) hypothesized in their Revised Hierarchical Model (RHM) that there is an asymmetry between L1-L2 and L2-L1 translation (see Figure 4).
The RHM treats the bilingual mental lexicon as an interaction of lexical and conceptual items. There is a conceptual storage shared by languages, and two lexical storages, one for the L1 and one for the L2. The L1 lexical storage is larger, because it is assumed that the bilingual knows more lexical items in the L1 than in the L2 (Kroll & Stewart, 1994; Kroll & de Groot, 1997).

Figure 4 - Revised Hierarchical Model (Kroll & Stewart, 1994, p. 158)

Weinreich's (1953) and Potter et al.'s (1984) models of the mental lexicon were static. The former did not account for the possibility of bilinguals to change the organization of their lexicon. The latter, suggested the possibility of shifting from word-association to concept-mediation with increasing proficiency. However, this shift meant that lexical mediation was apparently lost and replaced by conceptual mediation. As opposed to these hypotheses, the RHM possesses a dynamic relationship between the three storages, one conceptual and two lexical storages. This relationship conveys two-way links; such as conceptual links between L1 and concepts, and L2 and concepts; as well as lexical links between L1 and L2 lexical storages.

Even though there is interaction between the storages, the strength of links is not the same, as may be observed in high RTs (weak links) or low RTs (strong links). The RHM
proposes a relatively strong conceptual link between L1 and concepts and a weaker link between L2 and concepts. Furthermore, there are strong lexical links from L2 to L1, but weaker lexical links from L1 to L2. Kroll and Stewart (1994) said that their model accounts for the lexicon of late bilinguals, that is, those who acquired their L2 in late childhood or early adulthood. They explained that after the L1 is already established, late bilinguals learn L2 words by associating them with their L1 translation equivalents. These authors also posit that as proficiency in the L2 increases the connection between L2 and concepts strengthens. This does not mean that the lexical link between L2 and L1 is lost, but instead both coexist.

Depending on the demands of the task, the RHM predicts that bilinguals will perform with shorter or longer RTs. For example, in a picture naming task the subject is asked to say aloud in L1 or L2 the name of a picture, which requires conceptual activation (Potter et al., 1984; Kroll & Curley, 1988; Cheng & Leung, 1989; Stewart & Kroll, 1994). In either the L1 or L2, picture naming is accomplished within longer RTs than word reading (Kroll & Stewart, 1994). In fact, naming a picture is 200-300 milliseconds slower than reading the word that corresponds to the same item (Potter et al., 1984). Picture naming is usually compared to performance in translation, because researchers have found that for less fluent bilinguals translation is faster than picture naming in L2 (Kroll & Curley, 1988; Cheng & Leung, 1989; Stewart & Kroll, 1994). This supports the RHM, since lexical links between L1 and L2 allow for translation in three steps (recognizing the word in one language, retrieving its translation equivalent in the other language, and providing an answer), whereas the weaker conceptual links for the L2 demands from the bilingual an
additional step (recognizing the picture, retrieving the corresponding lexical item in L1, retrieving the translation equivalent in L2, and providing an answer in L2).

The RHM also accounts for asymmetries in translation direction, that the Word-Association and Concept-Mediation Models (Potter et al., 1984) failed to explain. Some researchers found asymmetries between forward (L1-L2) and backward (L2-L1) translation (Keatley, Spinks & De Gelder, 1994; Roufca, 1992; Klein et al., 1995; Kroll et al., 1995). The former was found to be slower and less accurate than the latter. Asymmetry is predicted in the RHM due to the mentioned difference of strength of links. Since the L1 is strongly connected to the concepts, forward translation is thus conceptually mediated. In contrast, backward translation is lexically mediated, due to the L2 having a stronger connection to the L1. This means that forward translation involves more stages and longer RTs (recognizing the lexical item in L1, retrieving the concept, finding the translation equivalent in L2, and providing a response in L2) than backward translation (recognizing the lexical item in L2, finding its translation equivalent in L1, and providing a response in L1).

Sholl, Sankaranarayanan & Kroll (1995) tested conceptual mediation in forward translation and lexical mediation in backward translation, predicted by the RHM. They measured the performance in oral picture naming and translation of twenty four English-Spanish bilinguals (L1 English and L2 Spanish). These participants had studied Spanish for an average of 9.3 years and were English dominant and relatively fluent in their L2 as they reported in a self-rating questionnaire. The authors did not mention the age of L2 acquisition. Sholl et al.’s (1995) study consisted of a picture naming and a translation task. The first one was carried out in two sections, where in one section the participants had to
name the pictures in English and in the other one in Spanish. Afterwards, they performed a translation task, also in two blocks, one L1-L2 translation and the other one L2-L1 translation. Half of the lexical items used for the translation task were names of the pictures in the first task, and the other half consisted of new lexical items. This repetition was intended to verify if the picture naming task would produce a priming effect on the translation task, and if so, under what conditions (L1 or L2 picture naming, and the direction of translation). The priming effect in this case would be observable through shortening of RTs in this second task. If picture naming which involves conceptual access facilitates L1-L2 translation, then this direction of translation is conceptually mediated. This would support the predictions of the RHM. In addition, no priming effect should be found for lexically mediated L2-L1 translation.

Sholl et al.'s (1995) results supported all the aforementioned hypotheses (see Table 1). Picture naming in L2 was accomplished with longer RTs than picture naming in L1, and forward translation was slower and less accurate than backward translation. Further, there was an observable priming effect for conceptually mediated L1-L2 translation when the lexical items were repeated from the picture naming task, either in L1 or L2. In contrast, lexically mediated L2-L1 translation did not show transfer from the picture naming task. This evidence supports the interaction of the three storages in the mental lexicon hypothesized by the RHM. Therefore, it refutes Potter et al.'s (1984) hypotheses of concept-mediation vs. word association as the only two possibilities.

2.3.1. L2 Proficiency Effect on Word Processing in RHM

In regards to proficiency, the RHM predicts that low proficiency bilinguals will have strong lexical links between L2 and L1. As proficiency in L2 increases, the links between L2
lexical items and concepts strengthen. This would mean that L2-L1 translation would be conceptually mediated in high proficiency bilinguals (Sánchez-Casas, Davis & García-Albea, 1992; de Groot, 1992a; de Groot, Dannenburg & Van Hell, 1994; Kroll & Stewart, 1994; Francis, Agustini & Sáez, 2003; Dong, Gui & McWhinney, 2005; Menenti, 2006; Francis et al., 2011). Based on the predictions of the RHM, Dong et al. (2005) tested the conceptual and lexical links between L1 and L2 in bilinguals with different L2 proficiency.

Dong et al. (2005) conducted two experiments. The first one was done with two groups of native Chinese speakers (L1) who were English majors (L2) at a university. The high-proficiency participants had studied their L2 for six years in middle school and around three years in college. They had also passed the Test for English Majors (TEM-4). The participants performed a lexical decision task where they were presented with pairs of letter strings. The first item of each pair was a word, and the second item either a word or a non-word. The letter strings (“words”) in each pair could be semantically related or unrelated to each other and have a similar or not similar form. Participants were asked to decide if the second item was a word or not. If the fluent bilingual subjects showed priming effects for the form-related pairs, then that would be evidence for lexical mediation. On the other hand, if associative priming effect was observable in semantically related word pairs, it would support conceptual mediation. They found that associative priming effects were larger than form priming effects. Additionally, this effect was noticeable in both the within-language and the cross-language conditions. Dong et al. (2005) concluded that this is evidence for conceptual mediation in the bilingual lexicon of fluent bilinguals, thus supporting the RHM’s predictions regarding proficiency. However, the authors should have
incorporated a proficiency assessment tool in order to verify that the participants were highly proficient in English, because years of formal study does not necessarily account for this.

The second experiment included four groups of participants: 1) L1 Chinese first-year English majors, 2) L1 Chinese third-year English majors, 3) monolingual adult Chinese speakers with little knowledge of English, and 4) native English speakers whose L2 was Chinese and were teaching at a Chinese university. All the participants were presented with groups of words constituted by a main word and eight more words that were semantically related to the main word. They had to rank the eight words within each group for semantic closeness in relation to the main word. Results suggested that high English proficiency bilinguals performed similarly to native English speakers. In contrast, lower proficiency bilinguals’ performance was similar to that of the monolingual Chinese speakers’. Dong et al. (2005) interpreted these results as evidence for the RHM since early stages of L2 learning encompasses more reliance on the L1, whereas higher levels of proficiency in the L2 leads to a stronger L2-concept linking.

Menenti (2006) also provided evidence for the predictions of the RHM regarding higher levels of proficiency. Her results suggested that high proficiency bilinguals have strong conceptual links, with the caveat that even when able to access concepts directly from the L2, bilinguals do not use this skill unless necessary. She studied the performance in lexical decision and semantic decision tasks of German-Dutch bilinguals (L1 German), who acquired their L2 after puberty and were relatively fluent in it. In addition, there was a control group of Dutch native speakers. The task was completely monolingual, since the word pairs used for the study were all Dutch words. However, the German translation of
the first word of each pair rhymed with the second Dutch word of the pair. This German translation was not visible for the participants, but if cross-language activation occurred, this would produce a cross-language priming effect. She found that cross-language phonological priming was observable in the lexical decision task, but not in the semantic decision task. Also, the priming effect was only present in the German subjects but not in the Dutch control group. Therefore, she concluded that high proficiency bilinguals are able to access concepts from their L2 directly. However, they do not use the conceptual route unless it is necessary, because the lexical route through their L1 is still available. Hence, the use of lexical or conceptual mediation would highly depend on the demands of the task proposed.

Francis, Tokowicz & Kroll (2014) investigated translation performance (RTs and error rates) in bilinguals with different proficiency levels (high, low) and experience in their L2 (English dominant, English-Spanish bilingual). The first group consisted of forty English-Spanish bilinguals from Penn State University (PSU) immersed in an English dominant environment. The first language in this group was either English (58% of the participants) or Spanish (42% of the participants). They were all late bilinguals, since their first exposure to the L2 occurred at an average age of 22.2 years old. They had an average of 2.1 years of experience with their L2. The second group of forty eight participants consisted of proficient English-Spanish bilinguals from the University of Texas at El Paso (UTEP). UTEP is immersed in a bilingual context (i.e., United States-Mexico border), thus suggesting that participants are in permanent contact with both languages in a natural setting. 90% of the participants in this group had learned Spanish first, 6% of them had learned English first, and the remaining 4% had acquired both languages simultaneously.
from early childhood. All of them reported Hispanic ethnicity, but Francis et al. (2014) did not mention explicitly if they were Spanish heritage speakers. The authors stated that both groups of participants were proficient bilinguals. Proficiency was determined, however, by years of exposure to the language and self-ratings of language dominance of the participants. Language proficiency was not formally assessed.

Both groups of participants performed an oral translation task (forward and backward translation) in two sessions. Some of the items from the first session were repeated in the second task. As predicted by the RHM, during the first session, the PSU group was significantly faster and more accurate at backward translation than at forward translation. Also, at the second session, repetition priming was stronger for L1-L2 translation than for L2-L1 translation. On the other hand, the UTEP group performed both directions of translation at the first session with no significant differences in RTs, although L2-L1 translation was more accurate. These similar RTs in both directions of translation were maintained for the second session. Additionally, the authors observed repetition priming only when direction from the encoding phase matched the one from the test phase. Francis et al. (2014) concluded that proficiency affects L1-L2 translation (conceptually mediated in RHM) to a greater extent than L2-L1 translation (lexically mediated in RHM).

Francis et al. (2014) focused on lexical proficiency, that is, the amount of pre-experimental exposure that a person had to a word in a natural setting. The authors argued that the main variable affecting translation performance is quantitative rather than qualitative because performance depends on how much exposure and experience a bilingual has in a language, rather than on how or when they acquired it. Although the bilinguals had indeed different levels of proficiency and exposure, they had also learned
their L2 at different ages (the PSU group around 22.2 years of age, and the UTEP group at around 7.9 years of age), thus establishing a clear difference between late and early bilinguals (Paradis, 2004; García, 2012; Montrul, 2013a, 2013b). This means that the context of acquisition (formal or informal) was also a variable present in the study, and that age and context of acquisition were probably confounding variables in Francis et al. (2014). The current study accounts for age and context of L2 acquisition of participants and takes this composite factor into consideration when classifying participants as HSs or L2 learners.

The studies reviewed in this section provide evidence for the development of conceptual links in the mental lexicon with increasing proficiency. Their conclusions are based on shortened RTs in conceptually mediated tasks, which are interpreted as a shift from a lexically mediated lexicon to a conceptually mediated one. It is worth noting, however, that lower RTs can also suggest that the process of forward translation has been automatized, and therefore the steps of the process do not change (from conceptual mediation to lexical mediation), but they are accomplished faster (García, 2012). This casts a doubt over the conclusions regarding proficiency as explained by the RHM.

2.3.2. Limitations of the Revised Hierarchical Model

RHM has two major limitations (Brysbaert & Duyck, 2010). First, the idea of separate lexical storages is refuted by evidence of parallel activation and language non-selectivity (Kroll et al., 2005; Kaushanskaya & Marian, 2007; Gullifer, Kroll & Dussias, 2013). When performing a monolingual task, parallel activation of both languages has been observed in bilinguals. In response to this criticism, Kroll et al. (2010) clarified that the model was originally intended to account for translation asymmetries in bilinguals in
production tasks, instead of word recognition. That is why studies using word recognition tasks, like Montrul and Foote’s (2014) study, provide no evidence for the RHM. Furthermore, Kroll et al. (2010) argued that parallel access does not necessarily imply an integrated lexicon, and thus this evidence does not contradict the RHM.

Second, Kroll & Stewart’s (1994) model does not consider the existence of lexical items that do not share conceptual features in both languages and cannot be directly translated. For instance, one of the meanings of the word ‘bachelor’ in English refers to an unmarried male, who may one day marry. In Spanish, however, there is no word that encompasses the same features. The closest translation equivalent to this entry of ‘bachelor’ is soltero, which only means single male, but it could also refer to a priest or an elder man who is neither available nor willing to get married. Therefore, for this study we apply the RHM to the study of concrete nouns (e.g. chair, apple, dog), because these lexical items present a major overlap of conceptual features in most languages and are easily translated (Kroll & de Groot, 1997; Kroll & Sunderman, 2003).

The following chapter will explain the methodology used for the present study.
CHAPTER III
METHODOLOGY

This chapter develops the methodology used to carry out the present study. The first section is dedicated to the description of the current study, the characterization of participants and tasks and the presentation of research questions and hypotheses.

3.1. The Present Study

Although the RHM explains the organization of the bilingual lexicon and predicts its consequences for lexical retrieval in relation to type of task, direction of translation and level of proficiency, it does not account for differences in age and context of acquisition of the L2. In general, most studies on bilingual lexical access have focused on the effects of proficiency (Potter et al., 1984; Chen & Ho, 1986; Tzelgov et al., 1990; Kroll & Stewart, 1994; Dong et al., 2005; Menenti, 2006; Francis et al., 2014). The importance of age of L2 acquisition for bilingual lexicon has only been acknowledged in relatively recent research (Snodgrass, 1993; Francis, Agustini & Sáenz, 2003; Silverberg & Samuel, 2004; Francis et al., 2011; van Hell & Tanner, 2012; Montrul & Foote, 2014). It has been pointed out that highly proficient bilinguals may have different organization of their mental lexicon depending on the age of acquisition of the L2 (Sunderman & Kroll, 2006). Namely, late bilinguals may not be able to fully access semantic content in the L2, even when the conceptual links of their L2 have become stronger. Alternatively, proficiency may be more important than the age of acquisition for lexical access and semantic processing, while the factor weighting may be reversed for grammatical processing (Van Hell & Tanner, 2012). This study examined whether age and context of acquisition have an effect on the organization of the lexicon and also affects lexical access. The groups considered for this
study (HSs and L2 learners) do not allow for age and context of acquisition to be studied separately. Early bilinguals usually acquire their languages in informal contexts, whereas late bilinguals normally acquire the L2 in formal contexts. Hence, comparing two high proficiency groups (HSs and L2 learners) with the novice L2 learners allowed for investigation of the combined effects of context and age of acquisition versus the effect of proficiency for lexical access. Thus, by working with these three groups in this study it is possible to follow Sunderman and Kroll's (2006) ideas.

Studying heritage speakers is important because research on this bilingual group is limited. Montrul and Foote (2014) studied the differences between heritage speakers and second language learners regarding their mental lexicon. Participants for this study were fifty six English-Spanish bilinguals: half heritage speakers and the other late L2 Spanish bilinguals. The variables manipulated were global age of acquisition (early or late bilinguals) and age of acquisition of the lexical item. For this last variable, the researchers compared the lexical items selected for the experiment with the vocabulary list of a textbook of beginning level Spanish. If a word appeared in the glossary of the textbook, it was considered a word to be acquired early; otherwise, it was considered a word to be acquired late.

The participants performed lexical decision and translation decision tasks. They had to decide whether an item was a word or not for the first task. For the second task, they decided if L1-L2 word pairs were translation equivalents or not. The results showed no significant difference in performance between groups. In conclusion, the authors said that age of acquisition of a second language does not affect lexical retrieval and lexical access in bilinguals. However, due to the nature of the tasks involved in the experiment, this
conclusion can only be made for word recognition. It is possible that results would differ if word-production tasks were involved. The reason for this is because word recognition and production are essentially different and therefore do not encompass the same stages or steps for lexical access (Kroll & Tokowicz, 2001; Kroll et al., 2005; Sunderman & Kroll, 2006; Kaushanskaya & Marian, 2007; Kroll et al., 2010; Tokowicz et al., 2013). This study was focused on lexical production tasks, and expected to see a difference in performance between HSs and L2 learners. Therefore, HSs were expected to perform better at tasks involving conceptual access from the less dominant language, whereas L2 learners would accomplish tasks that activate their lexical links more easily.

Among the studies reviewed, picture naming and translation were the typical experimental tasks used to test the RHM by Kroll & Stewart (1994). The main variable in these oral production tasks was the level of L2 proficiency. The results suggested that there is a shift from lexical mediation to conceptual mediation with increasing proficiency for language production (Kroll & Stewart, 1994; Dong et al., 2005; Menenti, 2006; Francis et al., 2014). This shift is noticeable through the diminishing of RTs in forward L1-L2 translation (conceptually mediated), which resembles backward L2-L1 translation (lexically mediated).

For the purpose of this study, the participants performed an L2 picture naming task and a backward L2-L1 translation task. The direction of translation (L2-L1) was selected based on previous findings that suggest it is lexically mediated (Sholl et al., 1995). Picture naming, on the other hand, is conceptually mediated thus allowing a comparison between tasks for the intended purposes. Spanish was considered the L2 for the three groups, since
they were all expected to be English dominant. This included heritage speakers as well (Montrul & Foote, 2014).

Given the extensive and contradictory evidence regarding the effects of proficiency in the bilingual lexicon, the present study considers other variables that affect language representation and processing. It addresses the following questions: How do age and context of L2 acquisition affect the performance (accuracy and RTs) of HSs and L2 learners in lexical access when word production tasks are involved? How does L2 proficiency affect the performance (accuracy and RTs) of HSs and L2 learners in lexical access when word production tasks are involved? What does performance on these tasks suggest about the organization of the bilingual lexicon in HSs and L2 learners?

Three predictions were made. First, HSs were expected to perform better than L2 learners in the picture naming task in their less dominant language (Spanish), as seen in their shorter RTs and higher accuracy. This would suggest that HSs can access concepts directly from both their languages (conceptual mediation), and retrieving a lexical item in Spanish will take them less steps (recognizing the picture, retrieving the concept, retrieving the lexical item in Spanish, and producing a response) than it would take an L2 learner to perform the same task (recognizing the picture, retrieving the concept, retrieving the lexical item in English or L1, translating L1 lexical item into Spanish or L2, and producing a response).

Second, both groups of L2 learners were hypothesized to perform better in the backward L2-L1 translation task. The inference could be drawn that lexical links between L2 and L1 remain strong regardless of learners’ level of proficiency. This is because their context of acquisition (classroom setting) involved mainly translation from L2 to L1 as a
strategy to learn new L2 vocabulary. Therefore, translation for them would involve less steps (recognizing the L2 lexical item, translating into L1, and producing a response in L1) than for HSs (recognizing the lexical item in their less dominant language, retrieving the concept associated with that lexical item, retrieving the lexical item in English, and producing a response).

The third prediction was a difference between novice and advanced L2 learners, especially in the picture naming task. This is because the RHM predicts the latter group will have stronger conceptual links than the former (Kroll & Stewart, 1994). The study did not expect to find a significant difference between novice and advanced L2 learners in the translation task, due to both groups having acquired the L2 in a classroom setting and using L2-L1 translation as a strategy to learn new L2 vocabulary. This similarity between L2 learners with different proficiency is expected because previous studies suggest that L2-L1 translation is relatively fast for low proficiency bilinguals and it is affected by proficiency to a smaller degree than L1-L2 translation (Francis et al., 2014). Moreover, RHM does not make explicit predictions about the performance of low proficiency bilinguals in L2-L1 translation task (Kroll & Stewart, 1994).

Next, the methodology used to gather and analyze data is presented. First are presented the description of the participants’ selection process and their linguistic and demographic characteristics by group.

3.2. Participants

Forty six participants were recruited for the present study: fourteen of them were heritage Spanish speakers and the remaining thirty two were L2 learners. They were all
students or former students at a large Tier 1 college. They were majoring at the graduate or undergraduate level in different subject areas, including Spanish.

Demographic and linguistic information was obtained from each participant in order to classify bilinguals as HSs or L2 learners. This information was gathered using an adaptation of Marian et al.’s (2007) Language Experience and Linguistic Questionnaire (LEAP-Q) (see Appendix B). It was designed to elicit information regarding the context of L2 acquisition, basic demographic data and proficiency self-assessment.

The criteria for participant selection are summarized in Table 2. The HSs identified themselves with at least one Hispanic culture, were U.S.-born or moved to the U.S. before the age of seven (Paradis 2009; García, 2012); had come in contact with both languages by the age of seven and acquired them in an informal context (immersed in a Spanish-speaking family who lived in the U.S.), and had spent most of their lives immersed in a Spanish-speaking family. The criteria for the L2 learners selection included: were U.S.-born and did not identify with a Hispanic culture, had acquired Spanish after the age of seven in a formal context (through explicit instruction), and had spent no more than three years immersed in a Spanish-speaking environment (family and/or country) (Fortune & Tedick, 2003).

<table>
<thead>
<tr>
<th></th>
<th>Heritage Speakers</th>
<th>L2 Learners</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.-born</td>
<td>YES (or moved here before age 7)</td>
<td>YES</td>
</tr>
<tr>
<td>Identification with Hispanic Culture</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Age of L2 acquisition</td>
<td>Before 7 years old (range 0-4 yrs. old)</td>
<td>After 7 years old (range 7-20 yrs. old)</td>
</tr>
<tr>
<td>Context of L2 acquisition</td>
<td>Informal (natural setting)</td>
<td>Formal (classroom setting)</td>
</tr>
<tr>
<td>Immersion (family or country)</td>
<td>Most of their lives</td>
<td>Less than 3 years</td>
</tr>
</tbody>
</table>
Moreover, two proficiency assessment exams were administered for each participant. The proficiency exams consisted of two adapted sections of the *Diplomas de Español como Lengua Extranjera* or DELE [Certificates of Spanish as a Foreign Language] level B1 (see Appendix A). These sections from the DELE measured reading comprehension and oral fluency. Skills were consistent with the tasks the subjects performed. They were required to produce an oral response in both tasks as well as comprehend visual input, i.e., pictures and L2 words. The skills chosen to be assessed were determined by the tasks performed, because proficiency is not a uniform feature, but it depends on the skill at play (Altarriba & Heredia, 2008). This assessment allowed for classification of the L2 learners as novice or advanced depending on their proficiency level. If an L2 learner scored as an intermediate level speaker, then the data collection stopped. This was the case of nine L2 learners who qualified as intermediate level. Regarding HSs, only those who scored a high level of proficiency were admitted in the study.

Reading comprehension exam was a fill-in-the-blank test. The expository text had ten blank spaces and a subsequent list of ten fragments extracted from the text. Participants had to then match fragments and blank spaces. Text from the original exam had only six blanks and eight fragments (i.e. two extra fragments), but these numbers were increased to ensure a more rigorous test. A pilot version of the expanded exam with fifteen blank spaces and seventeen fragments (including two extra fragments) was tested on an advanced L2 learner of Spanish. She reported to have spent approximately ninety minutes completing this task. Due to time limitations, a shorter exam version was used with ten blank spaces and ten fragments. This final version was piloted with another advanced L2 learner, who reported completing the activity in approximately ten to fifteen minutes.
An oral interview consisted of an approximately two minute conversation between the participant and the researcher, who is a native Spanish speaker majored in Spanish language and literature. During the interview, the participant chose one of two pictures and described it in detail. Both pictures showed two people interacting in an everyday environment, such as an office, and a produce market. The interviews were recorded using a Sony® ICD-PX333 digital voice recorder. The participants’ oral interviews were rated from 10 to 100 (100 being the highest possible score), depending on their fluency, pronunciation, vocabulary use and grammatical accuracy (rubric on Appendix A).

An exam to assess English proficiency was not administered. All the participants had been schooled in English and reported their highest degree obtained as “Some College”, “College”, “Some Grad School” and “MA”. Their years of formal education ranged from 12 to 19 years. Moreover, they reported to use mainly English in their daily lives. Therefore, it was assumed that they were highly proficient in English. Except for the oral interview in Spanish, all the oral interactions between the researcher and the participants during the experiment were carried out in English due to it being the participants’ dominant language. This also ensured the instructions were clear for all of them.

3.1.1. Heritage Spanish Speakers

The heritage speakers were Spanish-English bilinguals who had learned their heritage language mainly through oral input in their homes. Thus, some of them were not schooled in Spanish. In fact, four participants of the HSs group reported never to have been in a school or work environment where Spanish is spoken. From this group, the data of four participants was discarded, leaving ten participants in it. Participant 5 reported to have Hispanic heritage but started studying Spanish at the age of thirteen through formal
instruction, and therefore did not qualify as an early bilingual who acquired Spanish in a
natural setting. Participant 11 did qualify as a Spanish heritage speaker, but due to a
technical problem during the experiment the RTs were not recorded. Participant 37 was
not born in the U.S. and moved here at the age of nine. Finally, participant 40 did not meet
the proficiency levels required for this experiment.

HSs included three male and seven female participants (age $M = 22.30$, range 19-
25). They were born in the U.S., except for participant 15 who moved here when she was
four years old. All of them identified with different Hispanic countries (e.g., Honduras, El
Salvador, Mexico, and Nicaragua). Although they considered themselves English dominant
(except one), all learned Spanish as their native language at home while living in the U.S.,
i.e., they reported being immersed in a Spanish-speaking family all their lives. On a scale
from zero to ten, the participants rated themselves close to ten (the highest mark) in their
proficiency in English and Spanish for their speaking skills (English $M = 9.80$, $SD = .42$;
Spanish $M = 8.70$, $SD = 1.42$), listening (English $M = 9.90$, $SD = .32$; Spanish $M = 9.50$, $SD = .85$) and reading (English $M = 10.00$, $SD = 0.00$; Spanish $M = 8.40$, $SD = 1.43$). All HSs
invariably rated their English reading skills with the highest possible scores, whereas their
reading skills in Spanish received the lowest mean score and the highest variability
between scores. As previously mentioned, most of them did not receive formal instruction
in Spanish. Therefore, their speaking and listening skills were likely to be much more
developed than their reading and writing skills (Valdés, 2001a; Carreira, 2014). In addition
to self-ratings, proficiency was also assessed through two objective measures adapted from
the DELE B1, which were already discussed in detail in the previous section of this chapter.
These proficiency exams supported to a certain extent the participants’ self-ratings. With
100 being the highest possible score in each exam, they scored lower at the reading comprehension exam \((M = 59.00, SD = 38.86)\) than in the oral interview \((M = 100.00, SD = 0.00)\). There was also high variability in the reading comprehension exam \(\text{range 10-100}\). This does not mean that the HSs were not highly proficient, but these scores instead reflect an informal acquisition situation. While not all of them are highly proficient in their reading skills, however, they have a native-like proficiency in oral skills.

3.1.2. Advanced L2 Learners

In the advanced L2 learners group, due to technical difficulties RTs of participant 10 were not properly recorded. Thus, the data of this participant was discarded, leaving a total of ten participants in the group.

The L2 learners group with advanced level of proficiency included three male and seven female participants \((\text{age } M = 26.10, \text{range 21-37})\). All of them were born in the U.S., were English dominant and started studying Spanish after the age of seven \((M = 12.90)\). Two of the participants reportedly identified with the Hispanic culture due to studying abroad experiences. However, none of them had Hispanic heritage nor were they raised in a Spanish speaking family. They had three years or less of immersion in a Spanish speaking family and/or country \((M = 9.25 \text{ months})\) \((\text{Fortune & Tedick, 2003})\). One of the participants reported “interacting with family” as one of the factors that contributed to her learning of Spanish, but she did not report Hispanic heritage. Additionally, she is not currently exposed to Spanish in a family context, therefore she possibly did not refer to her own family, but to it in a study abroad context. On a scale from zero to ten, the participants rated themselves close to ten \((\text{their highest mark})\) in their English and Spanish proficiency for their speaking \((\text{English } M = 10.00, SD = 0.00; \text{Spanish } M = 7.00, SD = 1.41)\), listening \((\text{English } M = 10.00, SD = 0.00; \text{Spanish } M = 7.00, SD = 1.41)\).
= 0.00; Spanish $M = 7.60, SD = 1.17$) and reading (English $M = 9.90, SD = .32$; Spanish $M = 7.95, SD = 1.07$) skills. There was a high uniformity in self-ratings across skills in both languages. This indicates that advanced L2 learners perceived their different skills to be more balanced and equally developed than the HSs. In addition to these self-ratings, the advanced L2 learners also completed two proficiency assessment exams. Similar to HSs, they also scored higher in the oral interview ($M = 95.5, SD = 3.69$) than in the reading comprehension exam ($M = 92.00, SD = 13.17$). However, the difference between both exams was not as noticeable as in the HSs group. The objective measures of proficiency in this case also supported the self-assessment ratings.

### 3.1.3. Novice L2 Learners

For the novice L2 learners, the data of two participants was discarded, leaving a total of ten participants. Participant 21 had a novice low level of Spanish, but he did not qualify as an L2 learner, since in the questionnaire he reported having Hispanic heritage and being raised in a Spanish speaking home. He could not be included in the HSs group either, because he was not highly proficient in Spanish. Finally, due to technical difficulties, RTs of participant 26 were not recorded.

The L2 novice learners group included four male and six female participants (age $M = 20.60, range 19-24$), who were enrolled in a beginner level Spanish class. They were all U.S. born and English dominant and had started studying Spanish after the age of seven ($M = 14.90$). One of them reportedly identified with Hispanic culture, but only spent half a month immersed in a Spanish-speaking family and began studying Spanish as a second language at the age of fifteen. Thus, he was not raised in a Spanish-speaking environment with natural exposure to this language. All the participants had up to one month of
immersion in a Spanish-speaking context ($M = .25$ months). Six of the participants reported “interacting with family” as one of the factors contributing to their learning of Spanish, but they did not report Hispanic heritage or immersion in a Spanish-speaking family. On a scale from zero to ten, the participants in this group also rated their language skills in speaking (English $M = 9.70$, $SD = .95$; Spanish $M = 3.40$, $SD = 1.35$), listening (English $M = 9.65$, $SD = 1.11$; Spanish $M = 3.80$, $SD = 1.87$) and reading (English $M = 9.80$, $SD = .42$; Spanish $M = 5.90$, $SD = 1.66$). The novice L2 learners gave themselves low ratings in oral skills, i.e. listening ($M = 3.80$) and speaking ($M = 3.40$), whereas they rated their reading skills almost twice as high ($M = 5.90$). This is due to the fact that when a second language is learned in a classroom setting after a certain age, it is taught mainly through written input (Krashen, 1989). The objective measures for proficiency assessment followed the self-assessment patterns, since the participants scored higher at the reading comprehension test ($M = 34$, $SD = 60.41$) than in the oral interview ($M = 25.50$, $SD = 19.67$). Some of the participants scored between 40 and 60 on the reading comprehension exam, placing them in an intermediate level instead of novice. However, this was a multiple choice exam, meaning it is subject to a guessing component, which reduces its reliability (Burton, 2001). Therefore, if the scores of the reading comprehension exam are analyzed together with the oral interview results, it is accurate to classify these L2 learners at the novice level of proficiency.

3.2. Materials

3.2.1. Stimuli

Two sets of stimuli were used for the study. For the picture naming task, forty black and white drawings of objects were selected, twenty-one of them coming from the Bonin et
al. (2003) corpus of pictures for psycholinguistic experiments (see Appendix C). Each of them represented a concrete noun. For the translation task, forty concrete nouns in Spanish were used (see Appendix D).

Concrete nouns were selected, because they are words that usually share conceptual representation across languages and tend to have a sole translation equivalent (Van Hell & de Groot, 1998). The nouns were selected from a variety of semantic fields, such as clothing, food, parts of the body, means of transportation, etc. Also, since the Spanish language has a high variability of vocabulary across dialects (e.g., a cake in Mexico is called *pastel*, in Argentina, *torta*, in Colombia, *bizcocho*, and so forth), the vocabulary selected for both tasks was neutral, i.e., vocabulary that did not differ across different Spanish speaking countries. This was to gauge for the response accuracy, due to the participants (specially, the HSs) being exposed to different dialects of Spanish (for further discussion of vocabulary variation in different varieties of Spanish in the U.S., see Lipski, 2008 and Moreno Fernández, 2009).

Finally, cognates and false cognates were avoided. The study did not intend to analyze cognate effects since previous research has found it to affect reaction time and accuracy in translation (Kroll & de Groot, 1997). No words were repeated across tasks because priming effects were not being studied (Potter et al., 1984; Kroll et al., 1995). In both sets of stimuli, the number of letters, syllables, and syllable types were similar, in order to minimize the effect of these variables on word processing.

For both tasks, high frequency words were selected. To account for frequency, the names of the pictures in Spanish, as well as the Spanish nouns for the translation task, were extracted from the list of the 5000 most frequent words in the Spanish language. This list
The list of nouns used for both tasks was checked against the vocabulary lists in three textbooks: *Dicho y Hecho*, *Conéctate* and *Interacciones* (procedure similar to Montrul & Foote, 2014). The first two books are for beginning Spanish and the third one is for intermediate level of Spanish. Each word selected for the picture naming and the translation task was found in at least one of these textbooks.

### 3.3. Procedure

First, the participant signed the informed consent form approved by the Institutional Review Board (IRB). Subsequently, the proficiency assessment exams were administered. The reading comprehension exam was administered first, followed by the oral interview. While the researcher graded the reading comprehension exam, the participant completed the LEAP-Q. Finally, if all the requirements already described (see

was compiled by the *Real Academia Española* [Royal Academy of the Spanish language], and based on the *Corpus de Referencia del Español Actual* or CREA [Corpus of Reference of Current Spanish]. The selected nouns had concrete meaning and a mean frequency of 67.28 per million (picture naming task) and 95.64 per million (translation task).

In bilingual research that uses words as stimuli, it is necessary to account for word frequency effects across studied languages (Marian, 2008). Thus in addition to the frequency of the Spanish lexical items, their English translation equivalents were checked against the Word Frequency Data based on the Corpus of Contemporary American English. All of the items were found within the 5000 most frequent forms, with a mean frequency of 93.42 per million (picture naming task) and 108.08 per million (translation task).

Furthermore, selected words were not only highly frequent for native speakers of Spanish, but are also typically acquired early by L2 learners of Spanish. The list of nouns used for both tasks was checked against the vocabulary lists in three textbooks: *Dicho y Hecho*, *Conéctate* and *Interacciones* (procedure similar to Montrul & Foote, 2014). The first two books are for beginning Spanish and the third one is for intermediate level of Spanish. Each word selected for the picture naming and the translation task was found in at least one of these textbooks.
Table 2) were met and the participant qualified as an HS with advanced level of proficiency or an L2 learner, either at the advanced or novice level, the two experimental tasks were administered.

Each participant completed the two tasks in one session in a sound proof psycholinguistic laboratory. Each task took approximately five minutes to complete and was carried out using E-Prime® 2.0 and a Serial Response Box (SRBox) connected to a microphone. Participants' RTs were recorded automatically in E-Prime®, whereas accuracy was recorded manually using a Response Registration Sheet (see Appendix E). The order of the tasks was counterbalanced across participants to avoid order effects. The order of the stimuli was randomized for both tasks as well. Before completing each task, participants went over a short practice set of five stimuli, so they could become familiar with the procedure. The participants did not have a break between tasks.

For both tasks, a fixation cross was presented on the center of the screen for 500ms. (Kroll & Stewart, 1994), followed by a stimulus. The participant was instructed, through written instructions on the screen and oral explanation by the researcher, to provide a response as quickly as possible while speaking into a microphone attached to the SRBox. The computer registered RT in milliseconds from the moment the stimulus appeared on the screen to the moment the participant began articulating a response. For the picture naming task, the response required was the name of the picture in Spanish, whereas for the translation task, the response was the translation equivalent in English for the Spanish word on the screen.

In the picture naming task, each stimulus remained on the screen for 4000 ms, after which the fixation cross for the next stimulus was presented whether the participant had
provided a response or not. For the translation task, each stimulus remained on the screen for 2000 ms. The allowed time for response in this task was shorter than for the picture naming task, since previous studies suggested that translation is performed faster than picture naming in L2 (Kroll & Curley, 1988; Cheng & Leung, 1989; Kroll & Stewart, 1994). After the 2000 ms had passed, the program automatically moved on to the fixation and the following word, regardless if the participant had provided a response or not.

3.4. Data Analysis

Each performed task measured accuracy and RTs (40 stimuli x 30 participants per task). To analyze accuracy, responses were coded as 0 (incorrect or no-response provided) and 1 (correct). Overall accuracy was tallied for each individual, with 40 being the highest possible score.

When a person provided an incorrect response and then self-corrected it, then it was considered incorrect (0). If a participant responded correctly, but began articulating the response after the time limit (i.e., when the picture or word was no longer on the screen), then this was considered no-response provided or incorrect (0). Additionally, even though the participants were explicitly instructed not to articulate anything but their response (i.e., fillers, e.g. *am, eh*), on occasion the participants would provide a correct response after a false start. If this occurred, e.g. when they saw the picture of a tear and had to respond *lágrima*, but they said *eh, lágrima*, this was considered an incorrect response (0). These data points were not considered for the RT analysis either, because the false start altered the measure. These false starts constituted 1.40% of the picture naming task data set and 0.71% of the translation task data set. Responses were considered correct (1) when the participant mentioned the correct noun preceded by an article, even if the article
did not agree with the noun. An example is *la horno instead of el horno for the oven picture. Similarly, an incorrect final morpheme that did not change the meaning of the word, e.g. hueva instead of huevo, for the egg picture, were considered correct responses (1). This only occurred in two instances. Likewise, mispronunciations, e.g. relo instead of reloj, for the clock picture, were all considered correct responses (1). Two stimuli were found that elicited responses with different morphological complexity: escalera/s (‘stair/s’) and huevo/s (‘egg/s’). Some participants responded in the singular form (lower morphological complexity) and others did in the plural form of the noun (higher morphological complexity). Both responses were considered correct (1), but were also coded for their number of morphemes (1 singular and 2 plural) to analyze if this factor affected reaction times.

Finally, even though vocabulary selected did not differ across different varieties of Spanish, during task completion some of the pictures used for the picture naming task elicited responses other than the ones expected. An example is a picture of a bird that could be named pájaro or ave. Similarly, the picture of an oven could be called horno or estufa. Additionally, when a picture was ambiguous and two or more interpretations were possible, all of these responses were considered correct. Examples of such lexical items would be the picture of a coin being named moneda (‘coin’), dinero, plata (‘money’) and centavo (‘cent’); or the picture of a pocket being called bolsillo (‘pocket’) and camisa (‘shirt’). When the unexpected name was extended to at least five participants, the alternative response was considered correct (1), and attributed to ambiguity of the picture. If less than five participants provided that alternative response, then it was considered incorrect (0). The alternative responses provided that were considered correct are detailed
in Appendix C under the corresponding pictures. Note that these unexpected responses were congruent with the stimuli selection criteria, since they were concrete nouns with high frequency in English and Spanish, with a similar number of letters and syllable types. The only exceptions were the words centavo (‘cent’), which was not among the 5000 most frequent in either language; and pavo (‘turkey’), which was not one of the most frequent in Spanish, but is highly frequent in English. A similar situation occurred with one word in the translation task, nieve, which is commonly translated as ‘snow’ in English, but in Mexico nieve also means ‘ice cream’. One of the subjects who reported to have Mexican heritage translated nieve as ‘ice cream’ instead of ‘snow’. Therefore, since this dialectal difference is not an error, these responses were coded as correct (1).

Accuracy of the three groups for each task was compared in a One-Way Between-Subjects ANOVA with Group as a fixed factor with three levels (heritage speakers vs. advanced L2 learners vs. novice L2 learners). In addition, accuracy of each group across tasks was compared using dependent t-tests. This was done to assess if there was a difference or a balance of performance across tasks, with Task as a fixed factor with two levels (picture naming vs. translation).

To analyze RTs, the descriptive statistics of each participant were first computed. The correct responses with false starts and the outlier scores were eliminated. RTs that were below 200 ms or 2.5 standard deviation units above the mean were considered to be outliers (Dong et al., 2005). For the picture naming task, a total of 635 RTs were recorded, 17 of these were eliminated as outliers (2.68%). When it came to the translation task, out of a total of 845 RTs recorded, 21 were discarded as outliers (2.49%). The descriptive statistics of each participant were calculated using the relevant scores. Then the three
groups’ performance in each task was compared in a One-Way Between-Subjects ANOVA. Group as a fixed factor with three levels (heritage speakers vs. advanced L2 learners vs. novice L2 learners). Similar to accuracy, the RTs of each group across tasks were compared through dependent t-tests with Task as a fixed factor containing two levels (picture naming vs. translation). Finally, to further confirm significance, effect size was calculated in each pairwise comparison. All the statistics were computed using SPSS® 23.0.
CHAPTER IV
RESULTS

In this chapter the results are presented in three sections. First, the picture naming performance is compared across groups. In the second section, translation performance across groups is compared. Finally, the third section compares performance (accuracy and RTs) across tasks within each group.

4.1. Picture Naming Task

4.1.1. Accuracy

Thirty English-Spanish bilinguals performed a picture naming task in the language they were less dominant in (Spanish). Their tallied accuracy score is presented in Table 3 and Figure 5 by group. A one-way between subjects ANOVA with Group (3) as a fixed factor showed that the groups were significantly different from one another, \( F(2,27) = 77.05, p < .001 \). Group variable accounted for 85.1% of the variance (as indicated by the adjusted \( R^2 \) value), which is a strong effect (Privitera, 2016). In other words, 85.1% of the variance in the picture naming task scores can be explained by the fixed factor (Group). Post-hoc Tukey tests showed that the novice L2 learners group differed from the other two groups in relation to accuracy in the picture naming task, \( p < .001 \) in both tests. However, heritage speakers and advanced L2 learners were not different from each other.

Table 3 – Descriptive Statistics for Accuracy in Picture Naming Task

<table>
<thead>
<tr>
<th>Group</th>
<th>M (%)</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heritage Speakers</td>
<td>79.50</td>
<td>12.68</td>
<td>10</td>
</tr>
<tr>
<td>Advanced L2 Learners</td>
<td>73.50</td>
<td>9.87</td>
<td>10</td>
</tr>
<tr>
<td>Novice L2 Learners</td>
<td>21.50</td>
<td>11.74</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>58.17</td>
<td>28.71</td>
<td>30</td>
</tr>
</tbody>
</table>
Even though the pictures selected for this task represented high frequency nouns of early acquisition, the high proficiency bilinguals did not approach 100% accuracy as expected. This is possibly due to the fact that some pictures were ambiguous (e.g. lengua, ‘tongue’) and the participants were not able to provide a response within the 4000 ms allowed before the next fixation cross and picture. The participants had difficulties particularly with items like bow (arco) and bridge (puente), which were highly frequent in Spanish and English according to the consulted corpora, but apparently the bilinguals in the study were not familiar with them or did not use them frequently. Additionally, the item copa (wineglass) was frequently named vaso (glass), probably because in English both objects can be named glass indistinctively. Thus this generalization was incorrectly transferred to Spanish.

On the other hand, high proficiency bilinguals outperformed the low proficiency bilinguals, indicating that proficiency had an effect on accuracy in the picture naming task in the less dominant language. The lack of significant differences between HSs and
advanced L2 learners indicates that age and context of L2 acquisition (early informal acquisition for HSs and late formal acquisition for advanced L2 learners) did not significantly influence accuracy in this L2 picture naming task. In the following subsection the results of picture naming RTs are compared across groups.

4.1.2. Reaction Time

In the picture naming task, RTs were measured in milliseconds for the three groups: heritage speakers, advanced L2 learners and novice L2 learners (see Table 4 and Figure 6). A one-way between subjects ANOVA with Group (3) as a fixed factor showed that the groups were also significantly different in this measure, $F(2,27) = 15.51, p < .001$. The group variable accounted for 53.5% of the variance (as indicated by the adjusted $R^2$ value), which is a strong effect (Privitera, 2016).

<table>
<thead>
<tr>
<th>Group</th>
<th>$M$ (ms)</th>
<th>$SD$</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heritage Speakers</td>
<td>1471.56</td>
<td>160.60</td>
<td>10</td>
</tr>
<tr>
<td>Advanced L2 Learners</td>
<td>1513.58</td>
<td>201.30</td>
<td>10</td>
</tr>
<tr>
<td>Novice L2 Learners</td>
<td>1985.38</td>
<td>301.93</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>1656.84</td>
<td>324.05</td>
<td>30</td>
</tr>
</tbody>
</table>

Post-hoc Tukey tests showed that the novice L2 learners group differed from the other two groups in their RTs, for both tests with $p < .001$. However, heritage speakers and advanced L2 learners were not different from each other.
In sum, the results for RTs in the picture naming task showed a pattern similar to the one observed for accuracy measures. The only group that was significantly different from the other two was the novice L2 learners. This suggests that neither accuracy nor RTs were affected by age and context of L2 acquisition in this L2 picture naming task. In the next section, the performance of the three groups in the L2-L1 translation task is analyzed.

4.2. Translation Task

4.2.1. Accuracy

Response accuracy was tallied in the L2-L1 (Spanish-English) translation task. It is presented in Table 5 and Figure 7 by group. A one-way between subjects ANOVA with Group (3) as a fixed factor showed the groups were significantly different from one another, F(2,27) = 102.39, p < .001. Group variable accounted for 88.4% of the variance (as indicated by the adjusted R Squared value), which is a strong effect (Privitera, 2016).
Post-hoc Tukey tests showed that the novice L2 learners group differed from the other two groups in their response accuracy, $p < .001$ in both tests. However, heritage speakers and advanced L2 learners were not different from each other. This is similar to the findings for the picture naming task. In the translation task, the HSs were slightly more accurate ($M = 94.50$) than the advanced L2 learners ($M = 91.00$), but this difference is even smaller than the one found between the same groups for the picture naming task.

Table 5 – Descriptive Statistics for Accuracy in Translation Task

<table>
<thead>
<tr>
<th>Group</th>
<th>$M$ (%)</th>
<th>$SD$</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heritage Speakers</td>
<td>94.50</td>
<td>5.37</td>
<td>10</td>
</tr>
<tr>
<td>Advanced L2 Learners</td>
<td>91.00</td>
<td>8.76</td>
<td>10</td>
</tr>
<tr>
<td>Novice L2 Learners</td>
<td>42.75</td>
<td>11.81</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>76.08</td>
<td>25.55</td>
<td>30</td>
</tr>
</tbody>
</table>

Figure 7 – Translation Accuracy
These results suggest that translation accuracy was also affected by proficiency since the only significantly different group was the novice L2 learners group. However, there was no observable effect of age and context of L2 acquisition. In other words, HSs and L2 learners with high proficiency performed with similar accuracy in the L2-L1 translation task. For the next subsection, the performance of the three groups in translation RTs is compared.

4.2.2. Reaction Time

The translation task RTs were measured in milliseconds and are presented in Table 6 and Figure 8 by participant group. A one-way between subjects ANOVA with Group (3) as a fixed factor showed that the groups were significantly different from one another, $F(2,27) = 8.73, p = .001$. Group variable accounted for 39.3% of the variance (as indicated by the adjusted $R$ Squared value), which is a strong effect (Privitera, 2016).

<table>
<thead>
<tr>
<th>Group</th>
<th>M (ms)</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heritage Speakers</td>
<td>1039.22</td>
<td>119.70</td>
<td>10</td>
</tr>
<tr>
<td>Advanced L2 Learners</td>
<td>948.83</td>
<td>82.49</td>
<td>10</td>
</tr>
<tr>
<td>Novice L2 Learners</td>
<td>1164.68</td>
<td>138.78</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>1050.91</td>
<td>143.66</td>
<td>30</td>
</tr>
</tbody>
</table>
Post-hoc Tukey tests showed that the novice L2 learners differed from the advanced L2 learners in their RTs, $p = .001$. The difference between the novice L2 learners and heritage speakers was nearly significant, $p = .057$. The two high proficiency groups were not significantly different from each other, and the effect size in this pairwise comparison was medium, accounting for 17.6% of the variance (Privitera, 2016).

In sum, the novice L2 learners performed significantly different from the high proficiency groups in picture naming accuracy, picture naming RTs, and translation accuracy. The same trend was observed in translation RTs, although novice L2 learners were marginally different from heritage speakers. Next, the performance across tasks is compared within each group.

4.3. Comparisons within Groups

A series of two-tailed dependent $t$-tests were conducted in order to compare performance in both tasks within each group of participants. In the following subsections, the results are presented by group.
4.3.1. Heritage Speakers

The response accuracy of the heritage speakers group in the picture naming task and the translation task is summarized in Table 7. A two-tailed dependent $t$-test revealed a significant difference in performance between the tasks, $t(9) = -4.62, p = .001$. The effect size was strong with accuracy relative to the task, accounting for 70.3% of the variance (Privitera, 2016).

<table>
<thead>
<tr>
<th></th>
<th>$M$ (%)</th>
<th>$N$</th>
<th>$SD$</th>
<th>$SE$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture Naming Accuracy</td>
<td>79.50</td>
<td>10</td>
<td>12.68</td>
<td>4.01</td>
</tr>
<tr>
<td>Translation Accuracy</td>
<td>94.50</td>
<td>10</td>
<td>5.37</td>
<td>1.70</td>
</tr>
</tbody>
</table>

The RTs of the heritage speaker group in the picture naming task and the translation task is summarized in Table 8. A two-tailed dependent $t$-test found a significant difference in performance between picture naming and translation tasks, $t(9) = 8.69, p < .001$. Effect size was strong with RTs relative to the task accounting for 89.4% of the variance (Privitera, 2016).

<table>
<thead>
<tr>
<th></th>
<th>$M$ (ms)</th>
<th>$N$</th>
<th>$SD$</th>
<th>$SE$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture Naming RT</td>
<td>1471.56</td>
<td>10</td>
<td>160.60</td>
<td>50.79</td>
</tr>
<tr>
<td>Translation RT</td>
<td>1039.22</td>
<td>10</td>
<td>119.70</td>
<td>37.85</td>
</tr>
</tbody>
</table>

Overall, these results suggest that the HSs group performed significantly better (with higher accuracy and shorter RTs) in the L2-L1 translation task than in the L2 picture naming task. In the following subsection, the performance of advanced L2 learners across tasks is analyzed.
4.3.2. Advanced L2 Learners

The response accuracy in the advanced L2 learners group in the picture naming task and the translation task are presented in Table 9. A two-tailed dependent t-test showed a significant difference in performance between the tasks, $t(9) = -9.21$, $p < .001$. Here effect size was strong with accuracy relative to the task accounting for 90.4% of the variance (Privitera, 2016).

Table 9 – Descriptive Statistics for Accuracy in Picture Naming and Translation Tasks in Advanced L2 Learners

<table>
<thead>
<tr>
<th></th>
<th>M (%)</th>
<th>N</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture Naming Accuracy</td>
<td>73.50</td>
<td>10</td>
<td>9.87</td>
<td>3.12</td>
</tr>
<tr>
<td>Translation Accuracy</td>
<td>91.00</td>
<td>10</td>
<td>8.76</td>
<td>2.77</td>
</tr>
</tbody>
</table>

Reaction times in this group are presented on Table 10 by task. A two-tailed dependent t-test showed a significant difference in performance between the tasks, $t(9) = 8.36$, $p < .001$. The effect size was strong with RTs relative to the task that accounted for 88.6% of the variance (Privitera, 2016).

Table 10 – Descriptive Statistics for RTs in Picture Naming and Translation Tasks in Advanced L2 Learners

<table>
<thead>
<tr>
<th></th>
<th>M (ms)</th>
<th>N</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture Naming RT</td>
<td>1513.58</td>
<td>10</td>
<td>201.30</td>
<td>63.66</td>
</tr>
<tr>
<td>Translation RT</td>
<td>948.83</td>
<td>10</td>
<td>82.49</td>
<td>26.09</td>
</tr>
</tbody>
</table>

Similar to the findings for the HSs group, advanced L2 learners were also significantly more accurate and faster at the L2-L1 translation task than at the L2 picture naming task. In the next subsection of this chapter, the performance of novice L2 learners is compared across tasks.
4.3.3. Novice L2 Learners

Accuracy scores of novice L2 learners in the picture naming and translation tasks are presented in Table 11. A two-tailed dependent $t$-test revealed a significant difference in performance between picture naming and translation tasks, $t(9) = -9.60, p < .001$. The effect size was strong with accuracy relative to the task and accounted for 91.1% of the variance (Privitera, 2016).

Table 11 – Descriptive Statistics for Accuracy in Picture Naming and Translation Tasks in Novice L2 Learners

<table>
<thead>
<tr>
<th></th>
<th>$M$ (%)</th>
<th>N</th>
<th>$SD$</th>
<th>$SE$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture Naming Accuracy</td>
<td>21.50</td>
<td>10</td>
<td>11.74</td>
<td>3.71</td>
</tr>
<tr>
<td>Translation Accuracy</td>
<td>42.75</td>
<td>10</td>
<td>11.81</td>
<td>3.74</td>
</tr>
</tbody>
</table>

Finally, reaction times of this group in the same tasks are shown in Table 12. A two-tailed dependent $t$-test found a significant difference in performance between the tasks, $t(9) = 9.66, p < .001$. The effect size was strong with RTs relative to the task thus accounting for 91.2% of the variance (Privitera, 2016).

Table 12 – Descriptive Statistics for RTs in Picture Naming and Translation Tasks in Novice L2 Learners

<table>
<thead>
<tr>
<th></th>
<th>$M$ (ms)</th>
<th>N</th>
<th>$SD$</th>
<th>$SE$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture Naming RT</td>
<td>1985.38</td>
<td>10</td>
<td>301.93</td>
<td>95.48</td>
</tr>
<tr>
<td>Translation RT</td>
<td>1164.68</td>
<td>10</td>
<td>138.78</td>
<td>43.88</td>
</tr>
</tbody>
</table>

In sum, all of the groups performed significantly different across tasks. They were more accurate and faster in the translation task than in the picture naming task. These results and their implications are further discussed in the following chapter.
CHAPTER V
DISCUSSION

The main results of this study showed that the novice L2 learners were significantly less accurate and had longer RTs than the two high proficiency groups. In addition, all groups were significantly faster and more accurate in the translation task than in the picture naming task. Next, the implications of these results as related to our hypotheses are developed and compared to previous findings.

5.1. Early Informal Acquisition and Picture Naming Task Performance

HSs were hypothesized in the present study to perform better than both groups of L2 learners in the L2 picture naming task. This would mean that HSs have strong conceptual links in their bilingual lexicon, due to their early age and informal context of L2 acquisition (Cheng & Leung, 1989; Emirmustafaoğlu & Gökmen, 2015).

This hypothesis was not supported by the data, since there was no significant difference between HSs and advanced L2 learners. Therefore, age and context of L2 acquisition did not have an effect on performance in the L2 picture naming task. This result is inconsistent with previous studies which found that age of L2 acquisition and learning strategies affect lexical access (Cheng & Leung, 1989; Emirmustafaoğlu & Gökmen, 2015). Cheng and Leung (1989) compared the performance in picture naming and translation of adult and child beginner L2 learners. They found that children performed better at L2 picture naming than at translation, while the opposite was observed in adults. Cheng and Leung (1989) concluded that when L2 vocabulary is acquired early, conceptual links are formed for the L2. Late acquisition, on the other hand, leads to reliance on L1 to learn new vocabulary. Emirmustafaoğlu and Gökmen (2015) found similar results to Cheng & Leung.
(1989) when studying acquisition of L2 vocabulary by beginner child learners. They also concluded that early acquisition of L2 vocabulary creates conceptual links for the L2. Adults HSs in the present study were expected to perform better than advanced L2 learners under the assumption that if conceptual links were formed for the L2 in heritage speakers, they would be preserved over their life time. The lack of the difference between HSs and advanced L2 learners in this study suggests that either those conceptual links were not formed in our HSs participants, or that those links might have existed in their childhood but were not preserved through adolescence and early adulthood. It is possible that age and context of L2 acquisition does affect lexical access, but rather this difference is only significant during the beginning stages of L2 acquisition. In other words, early informal L2 acquisition creates conceptual links in child learner situations, whereas late formal L2 acquisition depends on lexical links at the beginning stages of acquisition. As L2 proficiency increases, conceptual links become stronger and age and context of L2 acquisition become less influential in lexical processing (Kroll & Stewart, 1994). This entails that age of L2 acquisition in formal contexts would not have a significant effect for ultimate attainment in the bilingual lexicon, since proficiency appears to have a greater effect on lexical processing. Instead, age of acquisition appears to influence L2 acquisition only in informal contexts (Muñoz, 2008).

5.2. Late Formal Acquisition and Translation Task Performance

Advanced L2 learners were expected to perform better at the L2-L1 translation task than the HSs. This would suggest that L2 learners have stronger lexical links due to their formal late L2 acquisition, whereas HSs have stronger conceptual links. However, the
results do not support this hypothesis. Similar to the findings for the picture naming task, there was no significant difference in this task between advanced L2 learners and HSs.

With regards to accuracy, novice L2 learners were significantly less accurate than the high proficiency groups. A similar trend was observed for translation RTs, since novice L2 learners were significantly slower than advanced L2 learners. The difference between HSs and novice L2 learners was marginally significant ($p = .057$). Therefore, these results suggest that age and context of L2 acquisition did not influence performance in the L2-L1 translation task.

The results of the present thesis discussed so far suggest that lexical processing in word production tasks is not influenced by age and context of L2 acquisition. This supports the Declarative/Procedural Model, which explains that vocabulary is processed by the declarative memory, not being subject to the effect of age of acquisition (Ullman, 2004; Paradis, 2009).

In sum, this study found no significant differences between HSs and advanced L2 learners in word processing for either task. Hence, age and context of L2 acquisition did not have an effect on lexical access for neither conceptually mediated tasks nor lexically mediated tasks. These results support previous findings where no significant differences were found between HSs and L2 learners in L1-L2 translation recognition tasks (Montrul & Foote, 2014). Consequently, age and context of L2 acquisition seems to have an effect neither in word production nor word recognition tasks. However, proficiency appears to affect lexical access performance. This will be discussed further in the following subsection.
5.3. The Effect of Proficiency in Picture Naming and Translation Tasks

Novice L2 learners were hypothesized to perform significantly slower and less accurately in the L2 picture naming task than both high proficiency groups. This suggests that the higher proficiency of advanced L2 learners and HSs has strengthened their conceptual links, thus allowing them to retrieve L2 words faster than novice L2 learners in conceptually mediated tasks (Cheng & Leung, 1989; Kroll & Stewart, 1994; Dong et al., 2005; Menenti, 2006). Additionally, novice L2 learners were expected to translate with similar RTs as advanced L2 learners, since the similar age and context of acquisition of both groups would convey strong lexical links for their bilingual lexicon (Cheng & Leung, 1984; Marian, 2008).

The findings partially support the aforementioned hypotheses regarding the effect of proficiency in lexical access. Novice L2 learners performed with significantly higher RTs and lower accuracy than the two groups with higher proficiency on the picture naming task. This difference in performance between high proficiency and low proficiency groups is consistent with findings in previous research (Cheng & Leung, 1989; Kroll & Stewart, 1994; Dong et al., 2005; Menenti, 2006; Francis et al., 2014).

These results support the predictions of the Revised Hierarchical Model (Kroll & Stewart, 1994). The model predicts that low proficiency bilinguals possess weak conceptual links for their L2. Therefore, they have to accomplish more steps to perform a task that requires conceptual retrieval, such as a picture naming task. This means they must 1) recognize the picture, 2) retrieve the concept, 3) retrieve the lexical item in their L1, 4) translate L1 lexical item into L2, and 5) produce a response in L2. The number of steps would explain why low proficiency bilinguals have higher reaction times than high
proficiency bilinguals, who are able to accomplish picture naming in fewer steps. For this group steps include 1) recognizing the picture, 2) retrieving the concept, 3) retrieving the lexical item in L2, and 4) producing a response in L2. Therefore, high proficiency bilinguals are able to access concepts directly from their L2, because their lexicon has stronger conceptual links for their L2. To explain, when high proficiency bilinguals perform a conceptually mediated task that requires lexical production (e.g. picture naming), they do not need to translate from their L1, but are instead able to access L2 words directly.

The Revised Hierarchical Model’s interpretation of the aforementioned result is that high proficiency bilinguals develop strong conceptual links and perform faster and more accurately in tasks such as picture naming. An alternative interpretation is that L2 learners, even with high proficiency, resort to a translation strategy that uses their lexical links when needed (Menenti, 2006). Therefore, it is possible that advanced L2 learners do not develop stronger conceptual links, but instead have mastered and automatized the translation strategy in their lexically mediated route. This means they are able to access L2 words faster, which would potentially mean that advanced L2 learners do not retrieve L2 words in fewer steps than novice L2 learners, but instead they complete the same number of steps at a faster rate, due to having more experience and practice (García, 2012).

In sum, this study replicated the findings that the learners’ L2 proficiency affects their word processing in picture naming tasks. However, the explanation of this effect is not clear. More research is needed in order to determine whether differences between low and high proficiency bilinguals are due to reorganization of the lexicon or merely automatized processing.
The second part of our hypothesis was that novice and advanced L2 learners would perform similarly in the translation task, because both acquired their L2 at a similar age and context and would thus have a strong lexical links. This prediction was based on previous findings which suggest that low proficiency bilinguals can perform L2-L1 translation relatively fast. Additionally, this direction of translation does not seem to be affected by proficiency to the same extent as L1-L2 translation (Kroll & Stewart, 1994; Francis et al., 2014). The results did not support this prediction. Instead, they showed that HSs and advanced L2 learners were not significantly different from each other in the L2-L1 translation task, while novice L2 learners were significantly less accurate and had higher RTs than the high proficiency groups. Therefore, novice and advanced L2 learners did not perform similarly in this task, instead an obvious difference was present between groups with different L2 proficiency level. It is possible that the difference between novice and advanced L2 learners is due to the fact that both have a lexically mediated bilingual lexicon. However, novice L2 learners may still be in the process of making connections between L2 and L1 words, whereas advanced L2 learners have more experience and practice that allows them to translate at faster rates.

The current results support some of the previous findings and contradict others. Consistently with the Revised Hierarchical Model, high proficiency bilinguals were able to translate at faster rates than low proficiency bilinguals. While high L2 proficiency entails the strengthening of conceptual links, the lexical links with the L1 do not disappear (Kroll & Stewart, 1994). Therefore, advanced L2 learners are able to use one route or the other (the conceptual route or the lexical route) depending on the demands of the task (Menenti, 2006). Additionally, the results of the current study showed a significant difference
between novice and advanced L2 learners in an L2-L1 translation task. This suggests that the performance in L2-L1 translation, even if lexically mediated, can be improved with higher proficiency, thus becoming faster and more accurate. These results partially contradict Francis et al. (2014) who found that L2 proficiency level affects L1-L2 translation (conceptually mediated) to a greater extent than L2-L1 translation (lexically mediated). The authors did not specify if proficiency had a significant effect on L2-L1 translation, but only stated that proficiency affected L1-L2 translation more than it affected L2-L1 translation. However, it should be noted that proficiency was not formally assessed in Francis et al.’s (2014) study and the authors confounded proficiency with age and context of L2 acquisition. The present study, on the other hand, analyzed the effects of proficiency versus age and context of L2 acquisition. This may account for different results obtained in the two studies. Finally, unlike Francis et al. (2014), this study did not include L1-L2 translation, making it impossible to compare the results in detail.

5.4. Post Hoc Tests: Task Effect and Morphological Complexity

As a post hoc test, the performance of each group across tasks was compared and contrasted. All groups were able to perform the translation task at faster rate and more accurately than the picture naming task. These results were expected and in accordance with previous research, showing that translation tends to be faster and more accurate than picture naming (Kroll & Curley, 1988; Cheng & Leung, 1989, Kroll & Stewart, 1994).

However, previous research found these tasks effect focused mainly on L2 learners and there is relatively little research in HSs. As far as it can be seen, some studies have compared adult heritage speakers with other groups of bilinguals in word recognition tasks (Montrul & Foote, 2014), but no studies have compared the performance of HSs in picture
naming and translation tasks. This study has contributed to the field by showing that heritage speakers with high proficiency performed better in an L2-L1 translation task than in an L2 picture naming task.

Although all groups demonstrated performance difference for picture naming and translation, this difference was larger in some groups than the others. The most important difference was between HSs and advanced L2 learners as seen in the percent variance accounted for with accuracy relative to the task. The effect size computed for HSs was smaller (70.3%) than the one computed for advanced L2 learners (90.4%). While both have strong effect sizes (Privitera, 2016), the difference between them is substantial. This means that the task effect accounted for a higher percentage of the variance in advanced L2 learners than in HSs. In addition, this better performance of advanced L2 learners in the translation task supports our previous discussion regarding their bilingual lexicon. Even with high levels of L2 proficiency, advanced L2 learners have not lost their lexical links between L2 and L1 in their lexicon. In other words, they are able to access concepts directly from their L2, but they may be still using direct translation and the lexical route when the task demands it (Kroll & Stewart, 1994; Menenti, 2006).

Also regarding task effect, previous studies found that low proficiency bilinguals performed significantly better at translation than picture naming (Kroll & Curley, 1988; Cheng & Leung, 1989), which is supported by our results. In contrast, higher proficiency bilinguals showed a balanced performance between L1-L2 translation and picture naming (Potter et al., 1984; Emirmustafaoğlu & Gökmen, 2015). It should be noted that these studies and others used L1-L2 translation for their comparison. As the Revised Hierarchical Model predicts, there is an asymmetry between the two possible directions of translation,
thus possibly altering the results (Kroll & Stewart, 1994). L2-L1 translation tends to be faster and more accurate than L1-L2 translation, because the former is thought to be lexically mediated, whereas the latter is conceptually mediated (Sholl et al., 1995). Therefore, when L1-L2 translation is compared to picture naming, there is no contrast between lexical mediation and conceptual mediation, since both tasks require conceptual mediation. Hence, in order to test the differences between lexical and conceptual mediation for lexical retrieval in the L2, the contrast should be between a task that requires conceptual mediation, e.g. picture naming, and one that can be accomplished through lexical mediation, such as L2-L1 translation. For the present study the difference between lexical and conceptual mediation was considered to select the tasks: L2-L1 translation and L2 picture naming. Thus, the different direction of translation may explain the discrepancy of results with previous research.

Finally, another factor that was analyzed in post-hoc tests was morphological complexity in the picture naming task response. As previously noted, for two stimuli (escalera, ‘stair’ and hueso, ‘egg’) some participants provided a response in the singular form and others in the plural form of the noun. The number of tokens was insufficient to analyze significance in HSs (N = 4 for singular and N = 10 for plural) and advanced L2 learners (N = 6 for singular nouns and N = 10 for plural nouns). However, a possible effect of morphological complexity on RTs was observed. For HSs, when the response was singular, RTs were shorter (M = 1050.25; SD = 73.82) than when the response was plural (M = 1412.30; SD = 323.06). A similar trend was noticed for advanced L2 learners, for whom singular nouns were retrieved with shorter RTs (M = 1774.50; SD = 970.03) than plural nouns (M = 1962.00; SD = 821.93). Thus, it is possible that lexical access in
production tasks is affected by morphological complexity. This could mean that nouns with higher number of morphemes are slower for participants to retrieve than those with just one morpheme. While it is possible to make these observations for the high proficiency groups, the data obtained for the novice L2 learners group did not allow for morphological complexity analysis.

5.5. Limitations of the Present Study

In order to interpret the results correctly, it is necessary to take into consideration some of the limitations of this study and how they could be resolved in the future. These limitations are related to three factors: participants, proficiency assessment, and experimental tasks.

As for participants, it is possible that the size of the sample ($N = 10$ per group) was not large enough to find a significant difference between HSs and advanced L2 learners. No difference in lexical access between these two groups was found, but a larger scale study should be conducted in order to verify this. In addition, since the effects of two factors are compared in the bilingual lexicon (age and context of L2 acquisition versus L2 proficiency) it would be desirable to include low proficiency HSs group in the study design. It was not possible to incorporate this participants group in the present study, due to time constraints.

In addition to the limitations related to participants, proficiency assessment is also a factor that may have influenced the results. Although the two high proficiency groups had a similar level of proficiency, the advanced L2 learners outperformed HSs in the reading comprehension exam. A future study should revise proficiency assessment tools to ensure accuracy. One possible solution would be to incorporate literacy assessment tools in
Spanish previous to the proficiency assessment. This would provide evidence to explain that low scores in reading comprehension exams are not due to low proficiency, but to informal context of acquisition in HSs and their lack of schooling in Spanish (Bigelow & Tarone, 2004; Carreira, 2014).

Finally, there are limitations with regards to both experimental tasks. For the picture naming task, ambiguous pictures may affect RTs, due to it being more difficult for the participant to understand and name them. This could be solved by conducting a pilot study with a small number of participants who could help judge the clarity of the concept represented by each picture. When it comes to the translation task, although only L2-L1 translation was incorporated, it would have been useful to complete the comparison with L1-L2 translation. This may provide a broader understanding of the phenomenon of lexical access in bilinguals and a direct comparison with previous studies (Cheng & Leung, 1989; Potter et al., 1994; Francis et al., 2014; Emirmustafaoğlu & Gökmen, 2015). Thus, an L1-L2 task should be considered in future research.

In sum, the results of the current study show that the novice L2 learners performed significantly different than the high proficiency groups in all four measures. They were less accurate and responded with longer reaction times in both tasks. Since no differences between the HSs and advanced L2 learners were found, it is possible to conclude that word processing in production tasks is not affected by age and context of acquisition of the L2. This contradicts previous findings, if one assumes that conceptual links formed in HSs’ childhood are preserved over their lifespan (Cheng & Leung, 1989; Emirmustafaoğlu & Gökmen, 2015). Instead, word processing is affected highly by L2 proficiency, thus contributing to existing evidence on the subject (Kroll & Stewart, 1994; Dong et al., 2005;
Francis et al., 2014). Further, there was a significant task effect in all groups: performance in the translation task was more accurate and faster than performance in the picture naming task. Finally, there was a possible morphological complexity effect, since plural nouns appear to be retrieved with longer RTs than singular nouns. This effect should be investigated further with a larger number of tokens.
CHAPTER VI
CONCLUSION

The first chapter of this thesis was dedicated to define the concept of bilingualism, as well as different bilingual types (Wei, 2007). Moreover, it mentioned the factors that have an effect on the bilingual status, in particular those that affect the mental lexicon: age of L2 acquisition, context of L2 acquisition and L2 proficiency. It also defined and characterized heritage speakers and L2 learners, and their differences as related to their circumstances of L2 acquisition.

The second chapter developed the main models and hypothesis of organization of the bilingual lexicon, emphasizing the Revised Hierarchical Model (RHM) (Weinreich, 1953; Potter et al., 1994; Kroll & Stewart, 1994). The predictions and limitations of the RHM were also presented in this chapter, as well as the empirical evidence that supports and contradicts the model. The subsequent chapters were dedicated to the present study, its methodology, results and discussion.

In this study two factors that impact the organization of the bilingual lexicon and consequently affect lexical access were analyzed: 1) age and context of L2 acquisition, and 2) L2 proficiency. Word processing was examined in thirty bilinguals residing in the U.S., divided into three groups: Spanish heritage speakers, advanced L2 Spanish learners, and novice L2 Spanish learners. These participants performed an L2 Spanish picture naming task and an L2-L1 (Spanish-English) translation task. For all the participants Spanish was assumed to be the L2 based on demographic and linguistic background reported by the participants.
The first research question was: How do age and context of L2 acquisition affect the performance (accuracy and RTs) of HSs and L2 learners in lexical access when word production tasks are involved? HSs were expected to perform better than L2 learners in the picture naming task, as reflected in shorter RTs and higher accuracy. In contrast, both groups of L2 learners were anticipated to perform better than HSs in the backward L2-L1 translation task, as seen in shorter RTs and higher accuracy. The results did not support these hypotheses since there was no difference between the high proficiency groups (HSs and advanced L2 learners). It appears that the combined effect of age and context of L2 acquisition does not affect lexical access. This partially contradicts previous research that suggests that early L2 acquisition helps to develop L2 conceptual links. These links would enhance performance in conceptually mediated tasks (e.g. picture naming) (Cheng & Leung, 1989; Emirmustafaoğlu & Gökmen, 2015). However, these previous studies analyzed the performance of child and adult beginner L2 learners (i.e., different age and similar level of proficiency), whereas this study compares novice and advanced adult L2 learners (i.e., similar age and different level of proficiency). Therefore, age of L2 acquisition and learning strategies may affect lexical access for beginner learners, but this effect does not endure for high proficiency bilinguals.

The second research question was: How does L2 proficiency affect the performance (accuracy and RTs) of HSs and L2 learners in lexical access when word production tasks are involved? Proficiency was expected to affect performance in conceptually mediated tasks. Therefore, as predicted by the Revised Hierarchical Model, high proficiency bilinguals would perform better in the picture naming task than low proficiency bilinguals (Kroll & Stewart, 1994; Sholl et al., 1995; Francis et al., 2014).
The results partially supported this hypothesis. Consistent with previous findings, increasing L2 proficiency would have strengthened conceptual links, thus improving performance in conceptually mediated tasks (e.g., L2 picture naming) (Kroll & Stewart, 1994; Dong et al., 2005; Francis et al., 2014). In the translation task, however, the advanced L2 learners performed significantly faster and with higher accuracy than the novice L2 learners. This means that even though L2-L1 translation is lexically mediated, it also seems to be affected by L2 proficiency. The finding that advanced L2 learners outperformed novice L2 learners in both tasks suggests that the former may use both lexical and conceptual routes when they need to. Novice L2 learners, in contrast, are still in the process of making connections between their lexical and conceptual storages (Menenti, 2006). It is also plausible that advanced L2 learners do not have stronger conceptual links, as predicted by the Revised Hierarchical Model (Kroll & Stewart, 1994). Instead, they still access concepts by translating, but have automatized this process and accomplish it faster than novice L2 learners (García, 2012).

The last research question was: What does performance on these tasks suggest about the organization of the bilingual lexicon in HSs and L2 learners? HSs were expected to access concepts directly from both their languages (concept mediation), due to their early acquisition of Spanish in an informal context. Therefore, HSs would accomplish conceptually mediated tasks like picture naming faster than L2 learners. On the other hand, L2 learners were expected to have a lexically mediated lexicon, regardless of their proficiency, because L2 vocabulary acquisition in a formal context (classroom setting) is usually accomplished through L2-L1 translation strategies (Cheng & Leung, 1989; Marian, 2008). The results of this study did not support these hypotheses. No difference was found
between HSs and advanced L2 learners in either task. Only the novice L2 learners were significantly slower and less accurate in their performance. This suggests that conceptual mediation in the lexicon is a result of high proficiency and is not dependent on age and context of L2 acquisition. This supports the Revised Hierarchical Model (Kroll & Stewart, 1994), but contradicts previous findings suggesting that early acquisition favors conceptual mediation (Cheng & Leung, 1989; Emirmustafaoğlu & Gökmen, 2015). However, as previously stated, these studies compared early and late L2 learners in the beginning stages of acquisition. Since advanced L2 learners were incorporated in this study, this may explain the different results. Hence, it is possible that age and context of L2 acquisition affect conceptual mediation at the beginner level, but in later stages of acquisition L2 proficiency becomes more influential for the organization of the bilingual lexicon.

Although there was no significant difference between the high proficiency groups in any of the four measures, advanced L2 learners translated at a slightly faster rate than HSs. This does not necessarily imply that L2 learners have a lexically mediated lexicon that allows them to translate faster. Heritage speakers are often highly proficient in oral skills (speaking and listening) because of their informal context of acquisition, but are not always schooled in their heritage language. Therefore, they may not be highly proficient in reading and writing skills (Valdés, 2001a; Carreira, 2014). L2 learners, on the other hand, who acquire the L2 in a classroom setting, usually learn it mainly through written input. This possibly explains why advanced L2 learners translated at a slightly faster rate than HSs, because L2 learners have more experience with written words than HSs (Krashen, 1989).

In sum, performance in L2-L1 translation may be affected by context of L2 acquisition and the type and amount of input received.
In conclusion, this study contributed to existing findings regarding lexical access in heritage speakers and L2 learners. Previous research has mostly focused on the effects of proficiency, but has not investigated the effects of age and context of L2 acquisition on lexical access. This study explored these variables and contrasted them with proficiency to provide a broader understanding of bilingual lexical access. The results suggest that L2 proficiency has a greater effect on word production tasks than age and context of L2 acquisition, thus contributing to clarify contradicting results in previous studies. Finally, the incorporation of heritage speakers in this study is valuable and necessary, because relatively little research has been done with this type of bilinguals.


Psychology Software Tools, Inc. [E-Prime 2.0]. (2012)


I- Comprensión lectora

Instrucciones

Lea el siguiente texto, del que se han extraído diez fragmentos. A continuación lea los diez fragmentos propuestos (A-J) y decida en qué lugar del texto (1-10) hay que colocar cada uno de ellos.

Coloque en el espacio en blanco (1-10) la letra que corresponde al fragmento elegido (A-J).

LA HISTORIA DE LA @ (ARROBA)

Es posible que usted crea que la arroba es un invento propio de la “era Internet”, un símbolo creado para dar forma a las direcciones de correo electrónico. Sin embargo, su origen es mucho más antiguo. (1) __________. En cuanto al símbolo en sí mismo, esa especie de “a” encerrada en un círculo, tiene sus orígenes en una práctica común entre los encargados de copiar libros en latín, por supuesto a mano. (2) __________. Parece lógico que fuera una forma de ahorrar trabajo cuando se tenían que escribir decenas de veces cientos de páginas. Poco a poco, la “@” fue haciéndose popular en otros ámbitos (3) __________. Uno de los documentos más antiguos en el que aparece el símbolo @ es una carta enviada desde Sevilla a Roma por un mercader italiano en 1536. (4) __________. Pueden leerse párrafos como “Así, una @ de vino, que es 1/13 de un barril, vale 70 ducados…” En ese contexto, la arroba representaba sin duda una unidad de medida. Con el paso del tiempo, la arroba dejó de utilizarse de forma generalizada, aunque se siguió usando en algunos lugares. (5) __________. Solía aparecer en medio de la descripción de una operación, “15 cajas @ 5 dólares”, (6) __________. Tiene sentido, ya que en inglés «@» se dice «at», que significa ‘a’ (y también ‘en’, ‘de’ y ‘hacia’). (7) __________. Pero la relación de la “@” con el correo electrónico es muy posterior. Data de 1971, cuando el ingeniero Ray Tomlinson, creador del correo electrónico buscaba un símbolo que sirviese para separar el nombre de la persona de la dirección de destino. (8) __________. “Hubiese sido más fácil usar un corchete, un paréntesis o incluso una coma, pero estos símbolos ya eran utilizados para otros fines, y de los símbolos que quedaban libres, la @ era el mejor”, ha explicado hace algunos años Tomlinson. (9) __________. En los últimos años, para evitar la discriminación por género, se está extendiendo la costumbre de utilizar la «@» como recurso gráfico para integrar en una sola palabra las formas masculina y femenina de los sustantivos y adjetivos. (10) __________.

(Adaptado de www.neoteo.com. España)
FRAGMENTOS

A. Ellos escribían «@» uniendo las letras «a » y «d » para formar la preposición «ad»), que en castellano significa ‘hasta’.
B. En aquel momento uno de los pocos signos disponibles en los teclados era el de la «@»; por eso lo eligió.
C. Con este signo, que incluye en su trazo las vocales «a» y «o», se consigue economizar y evitar el repetitivo «–o/-a».
D. Por ejemplo, el símbolo se mantuvo en Estados Unidos, donde se empleaba en las facturas para referirse al precio de un producto.
E. “Otro punto a favor de este símbolo es que al traducirse como at en inglés daba una sensación de localización”, agregó.
F. Esto hizo que cuando se inventó la máquina de escribir el símbolo de la arroba se incluyera en su teclado.
G. y empezó a aparecer -por ejemplo- en las cartas oficiales redactadas en latín antes del nombre de su destinatario.
H. La mayoría de los historiadores aceptan que la palabra arroba proviene del árabe roub, que significa ‘cuarta parte’.
I. que venía a significar “15 cajas a 5 dólares cada caja”.
J. En dicho escrito se detalla la llegada de tres barcos provenientes de América cargados de tesoros.
II- Producción oral

Instrucciones

Describa con detalle, durante 1 ó 2 minutos, lo que ve en la foto y lo que imagina que está ocurriendo.

Estos son algunos aspectos que puede comentar:

- Las personas: dónde están, cómo son, qué hacen.
- El lugar en el que se encuentran: cómo es.
- Los objetos: qué objetos hay, dónde están, cómo son.
- Qué relación cree que existe entre estas personas.
- ¿De qué cree que están hablando?

Posteriormente, el entrevistador le hará algunas preguntas.
La duración total de esta tarea es de 2 a 3 minutos.

Ejemplos de preguntas del entrevistador:

- ¿Ha trabajado usted en algún lugar parecido al de la imagen? / ¿Conoce usted algún lugar parecido al de la imagen?
- ¿Le gustaría trabajar en/ conocer algún lugar parecido? ¿Por qué? / ¿Por qué no?
Le proponemos dos fotografías para esta tarea. Elija una de ellas y obsérvela con detalle.
Rubrics

I. Comprensión lectora

<table>
<thead>
<tr>
<th>Points (Right Answers)</th>
<th>Percentage</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-10 pts.</td>
<td>90-100%</td>
<td>Advanced High</td>
</tr>
<tr>
<td>8 pts.</td>
<td>80%</td>
<td>Advanced Mid</td>
</tr>
<tr>
<td>7 pts.</td>
<td>70%</td>
<td>Advanced Low</td>
</tr>
<tr>
<td>4-6 pts.</td>
<td>40-60%</td>
<td>Intermediate</td>
</tr>
<tr>
<td>2-3 pts.</td>
<td>20-30%</td>
<td>Novice Mid/High</td>
</tr>
<tr>
<td>0-1 pts.</td>
<td>0-10%</td>
<td>Novice Low</td>
</tr>
</tbody>
</table>

II. Producción oral

<table>
<thead>
<tr>
<th>Points</th>
<th>Percentage</th>
<th>Grade</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>90-100%</td>
<td>Advanced High</td>
<td>Fluent or relatively fluent speech, near native-like pronunciation, accurate use of vocabulary, few concordance errors.</td>
</tr>
<tr>
<td>8</td>
<td>80%</td>
<td>Advanced Mid</td>
<td>Relatively fluent speech, few unnatural pauses, near native-like pronunciation. Some interference of L1 in pronunciation and phrase structure, few errors in vocabulary and concordance.</td>
</tr>
<tr>
<td>7</td>
<td>70%</td>
<td>Advanced Low</td>
<td>Relatively fluent speech, noticeable</td>
</tr>
<tr>
<td>Level</td>
<td>Score Range</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
<td>------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Intermediate</td>
<td>20-60%</td>
<td>Non-fluent but yet comprehensible speech, noticeable interference of L1 in pronunciation and vocabulary, important concordance errors.</td>
<td></td>
</tr>
<tr>
<td>Novice Mid/High</td>
<td>20-30%</td>
<td>Non-fluent speech, short utterances with limited vocabulary. Message somewhat comprehensible but with clear L1 interference in pronunciation and phrasing.</td>
<td></td>
</tr>
<tr>
<td>Novice Low</td>
<td>0-10%</td>
<td>Long pauses and difficulty to keep up with conversation, incomplete utterances with important interference of L1 in pronunciation and vocabulary, concordance errors that render speech incomprehensible at times.</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX B  
QUESTIONNAIRE

Language Experience and Proficiency Questionnaire (LEAP-Q)  
Adapted from Marian, Blumenfeld & Kaushanskaya (2007)

Today’s Date: ________________________________

<table>
<thead>
<tr>
<th>Age</th>
<th>Date of Birth</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
</table>

(1) Please list all the languages you know in order of dominance:

1  2  3  4  5

(2) Please list all the languages you now in order of acquisition (your native language first):

1  2  3  4  5

(3) Please list what percentage of the time you are currently and on average exposed to each language within a week (Your percentages should add up to 100%):

<table>
<thead>
<tr>
<th>Languages:</th>
<th>Percentages:</th>
<th>TOTAL</th>
</tr>
</thead>
</table>

(4) When speaking to a person who is equally fluent in all your languages, what language would you rather use?

-----------------------------

(5) Please name the cultures with which you identify. On a scale from zero to ten (where zero means no identification and 10 means fully identified), please rate the extent to which you identify with each culture. (Examples of possible cultures include US-American, Chinese, Jewish-Orthodox, etc):

<table>
<thead>
<tr>
<th>Cultures:</th>
<th>Scales:</th>
<th></th>
</tr>
</thead>
</table>
(6) How many years of formal education do you have? __________________________

Please check your highest education level (or the approximate US equivalent to a degree obtained in another country):

- Less than High School □
- Some College □
- Masters □
- High School □
- College □
- Ph.D./M.D./J.D. □
- Professional Training □
- Some Graduate School □
- Other: ________

(7) Date of immigration to the USA, if applicable ____________________________

If you have ever immigrated to another country, please provide name of country and date of immigration here:

___________________________________________________________________________________________

(8) Have you ever had a vision problem □, hearing impairment □, language disability □, or learning disability □? (Check all applicable. If yes, please explain (including any corrections):

___________________________________________________________________________________________

Language: English

Check the option that applies. This language is my...

native □    second □    third □    fourth □    fifth □

If it’s not your native language, at what age did you start studying English? __________

All questions below refer to your knowledge of English.

(1) On a scale from zero to ten (zero being the lowest and ten, the highest), please write down your level of proficiency in speaking in informal conversation, understanding spoken
language in informal conversation and reading texts (both academic and non-academic of different genres).

Speaking: _______ Understanding spoken language: _______ Reading: _______

(2) Please list the number of years and months you’ve spent in each language environment:

<table>
<thead>
<tr>
<th>Years</th>
<th>Months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(3) On a scale from zero to ten (zero being none and ten being a lot), please select how much the following factors contributed to your learning:

<table>
<thead>
<tr>
<th>Interacting with friends:</th>
<th>Language tapes/self instruction:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interacting with family:</td>
<td>Watching TV:</td>
</tr>
<tr>
<td>Reading:</td>
<td>Listening to the radio/music/podcasts:</td>
</tr>
</tbody>
</table>

(4) Please rate on a scale from zero to ten (zero being none and ten being a lot), to what extent you are currently exposed to English in the following contexts:

<table>
<thead>
<tr>
<th>Interacting with friends:</th>
<th>Language tapes/self instruction:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interacting with family:</td>
<td>Watching TV:</td>
</tr>
<tr>
<td>Reading:</td>
<td>Listening to the radio/music/podcasts:</td>
</tr>
</tbody>
</table>

**Language: Spanish**

Check the option that applies. This language is my...

native ☐ second ☐ third ☐ fourth ☐ fifth ☐
If it’s not your native language, at what age did you start studying Spanish? __________

All questions below refer to your knowledge of **Spanish**.

(1) On a scale from zero to ten (zero being the lowest and ten, the highest), please write down your level of proficiency in speaking in informal conversation, understanding spoken language in informal conversation and reading texts (both academic and non-academic of different genres).

Speaking: _______  Understanding spoken language: _______  Reading: _______

(2) Please list the number of years and months you spent in each language environment:

<table>
<thead>
<tr>
<th>Environment</th>
<th>Years</th>
<th>Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>A country where Spanish is spoken</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A family where Spanish is spoken</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A school and/or working environment where Spanish is spoken</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(3) On a scale from zero to ten, please select how much the following factors contributed to your learning:

<table>
<thead>
<tr>
<th>Factor</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interacting with friends:</td>
<td></td>
</tr>
<tr>
<td>Language tapes/self instruction:</td>
<td></td>
</tr>
<tr>
<td>Interacting with family:</td>
<td></td>
</tr>
<tr>
<td>Watching TV:</td>
<td></td>
</tr>
<tr>
<td>Reading:</td>
<td></td>
</tr>
<tr>
<td>Listening to the radio/music/podcasts:</td>
<td></td>
</tr>
</tbody>
</table>

(4) Please rate to what extent you are currently exposed to Spanish in the following contexts:

<table>
<thead>
<tr>
<th>Context</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interacting with friends:</td>
<td></td>
</tr>
<tr>
<td>Language tapes/self instruction:</td>
<td></td>
</tr>
<tr>
<td>Interacting with family:</td>
<td></td>
</tr>
<tr>
<td>Watching TV:</td>
<td></td>
</tr>
<tr>
<td>Reading:</td>
<td></td>
</tr>
<tr>
<td>Listening to the radio/music/podcasts:</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX C
PICTURE NAMING TASK STIMULI

Note: The first name provided for each picture in **bold** was the expected canonical response. The subsequent names in *italics* are the alternative responses provided by some participants, which were accepted as correct.

Ajo (Garlic)  
*Cebolla (Onion)*

Árbol (Tree)

Arco (Bow)

Bandera (Flag)

Barba (Beard)

Barco (Ship)
Hueso (Bone)
Huevo / s (Egg / s)
Lágrima (Tear)
Lengua (Tongue)
Mano (Hand)
Mesa (Table)
Moneda (Coin)
Centavo (Cent)
Dinero / Plata (Money)
Nariz (Nose)
Ojo (Eye)
Reina (Queen)
*Princesa (Princess)*

Reloj (Clock)

Sangre (Blood)

Taza (Cup)

Techo (Roof)

Toro (Bull)

Vestido (Dress)
APPENDIX D
TRANSLATION TASK STIMULI

<table>
<thead>
<tr>
<th>Spanish</th>
<th>English</th>
<th>Spanish</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>aceite</td>
<td>Oil</td>
<td>labios</td>
<td>lip(s)</td>
</tr>
<tr>
<td>agua</td>
<td>Water</td>
<td>leche</td>
<td>milk</td>
</tr>
<tr>
<td>arena</td>
<td>Sand</td>
<td>libro</td>
<td>book</td>
</tr>
<tr>
<td>arroz</td>
<td>Rice</td>
<td>llave</td>
<td>key</td>
</tr>
<tr>
<td>avión</td>
<td>Airplane</td>
<td>lluvia</td>
<td>rain</td>
</tr>
<tr>
<td>beso</td>
<td>kiss</td>
<td>luna</td>
<td>moon</td>
</tr>
<tr>
<td>caballo</td>
<td>horse</td>
<td>miel</td>
<td>honey</td>
</tr>
<tr>
<td>cabello</td>
<td>hair</td>
<td>naranja</td>
<td>orange</td>
</tr>
<tr>
<td>cabeza</td>
<td>head</td>
<td>nieve</td>
<td>snow</td>
</tr>
<tr>
<td>canción</td>
<td>song</td>
<td>nube</td>
<td>cloud</td>
</tr>
<tr>
<td>caja</td>
<td>box</td>
<td>oreja</td>
<td>ear</td>
</tr>
<tr>
<td>cama</td>
<td>bed</td>
<td>perro</td>
<td>dog</td>
</tr>
<tr>
<td>camisa</td>
<td>shirt</td>
<td>pimienta</td>
<td>pepper</td>
</tr>
<tr>
<td>casa</td>
<td>house</td>
<td>silla</td>
<td>chair</td>
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<td>onion</td>
<td>sol</td>
<td>sun</td>
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<td>cerveza</td>
<td>beer</td>
<td>sombrero</td>
<td>hat</td>
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<td>heart</td>
<td>tarjeta</td>
<td>card</td>
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<td>star</td>
<td>ventana</td>
<td>window</td>
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<td>fire</td>
<td>vino</td>
<td>wine</td>
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<tr>
<td>hielo</td>
<td>ice</td>
<td>zapato</td>
<td>shoe</td>
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### Task 1: Picture Naming Task

<table>
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<th>STIMULUS</th>
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<td>1.</td>
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<tr>
<td>2.</td>
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<tr>
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### Task 2: Picture Naming Task

<table>
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<td>...</td>
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</tr>
</tbody>
</table>
APPENDIX F
IRB APPROVAL

ACTION ON EXEMPTION APPROVAL REQUEST

TO: Maria Puscama
   Foreign Languages and Literatures
FROM: Dennis Landin
       Chair, Institutional Review Board
DATE: June 23, 2015
RE: IRB# E9393
TITLE: Comparing Lexical Access in Heritage Speakers and Late Bilinguals
Review Date: 6/22/2015
Approved ______ X ______ Disapproved ________
Approval Date: 6/22/2015 Approval Expiration Date: 6/21/2018
Exemption Category/Paragraph: 2a,b
Signed Consent Waived?: No
Re-review frequency: (three years unless otherwise stated)
LSU Proposal Number (If applicable):
Protocol Matches Scope of Work in Grant proposal: (If applicable)
By: Dennis Landin, Chairman

PRINCIPAL INVESTIGATOR: PLEASE READ THE FOLLOWING –
Continuing approval is CONDITIONAL on:

1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report,
   and LSUs Assurance of Compliance with DHHS regulations for the protection of human subjects*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of
   subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request
   by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants,
   including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
8. SPECIAL NOTE:

*All Investigators and support staff have access to copies of the Belmont Report, LSUs Assurance with DHHS, DHHS
(45 CFR 40) and FDA regulations governing use of human subjects, and other relevant documents in print in this
office or on our World Wide Web site at http://www.lsu.edu/irb
VITA

María Gabriela Puscama, a native from Mendoza, Argentina, received her bachelor's degree in Language and Literature from Universidad Nacional de Cuyo (UNCuyo). She has taught Linguistics at Universidad del Aconcagua (Mendoza, Argentina) and conducted a research project on translation studies at UNCuyo. She is a member of the Hispanic Honor Society Sigma Delta Pi, Alpha Lambda chapter. She was accepted at Louisiana State University majoring in Hispanic Studies with concentration in Linguistics. She anticipates graduating with her MA degree in May 2016. Her research interests include bilingualism, translation studies and second language acquisition.