The Use of Pictures in L2 Vocabulary Learning: Measuring the Processing of Forms and Meanings

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ABSTRACT

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How can beginners acquire vocabulary from context (e.g., through reading) if they do not know enough words? A common technique for teaching new words to beginners is through pictures. Although there is some research in this area, it is unclear how well beginners internalize words taught through pictures. This study's objective was to examine the effectiveness of pictures in word learning by using measures of form and meaning processing.

Eighteen English true beginners of Spanish and 18 native Spanish speakers first studied 26 novel Spanish concrete nouns briefly presented three times with pictures, and then performed two reaction-timed tasks. In episodic recognition (form processing), they saw the 24 target words (and 24 foils) and indicated which words they had seen during study. In translation recognition (meaning processing), they saw the target 24 words paired with either correct, semantically associated, or incorrect English translations, and indicated whether the translation was correct or not.

In the episodic recognition task, the beginners and the native speakers were equally fast in recognizing recently studied words. In the translation task, beginners learned the 24 words to a high degree of accuracy (86% correct), and both groups were slower in responding to semantically associated translations than to incorrect translations. These results show that the learners could access both the forms and the meanings of novel words, and suggest that the use of pictures is a quick and efficient technique for committing words to memory.

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Table of Contents

List of Tables

CHAPTER 1

STATEMENT OF PURPOSE

Introduction

Learning a second language (L2) is not an easy task. To begin to accomplish this feat, learners must acquire a new system of syntax (i.e., grammar, or how words are strung together), morphology (i.e., word prefixes and suffixes), semantics (i.e., word meanings), phonology (i.e., word sounds), spelling, and usage (i.e., how words are used in context). What is common to all these aspects of language, however, is knowledge of the individual words of the L2. Arguably, one of the first things learners must acquire--especially in the case of beginners--is a basic list of words that can be used. Thus, before beginners can create a grammatical sentence, they must have a minimum knowledge of L2 vocabulary. For this reason, the study of L2 vocabulary acquisition is extremely important, especially in regard to early stages of L2 development.

Given this essential need to acquire L2 words, it is surprising that L2 vocabulary acquisition was largely neglected until the 1980s (Allen, 1983). Allen gives three possible reasons for the neglect. Firstly, researchers were more interested in how words were strung together in grammatical sentences and not necessarily in how individual words are learned or used. Secondly, some researchers believed that learning too many words would interfere with sentence production (or correct grammar). And thirdly, some methodologists thought that the meanings of words could not be adequately taught explicitly. But because of theoretical innovations in L2 teaching methodologies in the 1970s, which abandoned a largely grammatical approach in favour of one based more on

the communication of meaning, a large body of research has examined the learning of L2 vocabulary from several different angles. Consequently, this new research has significantly increased our understanding of how individual words are learned. But despite this surge in research, much has yet to be discovered. Therefore, the current study will attempt to add to the existing body of knowledge on L2 vocabulary acquisition by addressing three specific shortcomings in the literature.

Before discussing these specific shortcomings motivating the present study, however, some definitional issues must be addressed. Throughout this thesis, the term *learning* shall be taken to mean the encoding into memory of any aspects of a new word. The term *acquisition* shall go beyond the meaning of learning, to denote the *lasting* (i.e., at least beyond an experimental session) encoding into memory of any aspects of a new word. Furthermore, the terms *meaning* and *semantic* shall be used interchangeably to refer to a word's meaning. Moreover, the word *form* will be taken to mean a word's orthography and/or phonology, depending on the context of use. In terms of languages, *L1* shall refer to a speaker's first, or dominant, language; *L2* shall refer to a speaker's second, or non-dominant, language. If the speaker speaks more than two languages, *L2* shall represent the non-dominant language in question.

Three shortcomings in the current research literature on L2 vocabulary acquisition motivate the present study. Firstly, classrooms and textbooks make common use of pictures when teaching L2 vocabulary, but little research has been done on the effectiveness of decontextualized pictures in learning L2 vocabulary (see Kopstein & Roshal, 1954; Wimer & Lambert, 1959). Secondly, L2 vocabulary research commonly employs measures that assess the recall of word meaning (e.g., Paribakht & Wesche

1997), or the depth of vocabulary acquisition (e.g., Laufer, Elder, Hill, & Congdon, 2004), but few studies have used separate measures to assess the learning of two important aspects of word knowledge: word form and word meaning (e.g., Webb, 2005). And finally, to the author's knowledge, no study has used psycholinguistic processing tasks to measure the learning of form and meaning aspects of L2 words (more detail on these measures is provided in Chapter 2).

Consequently, the present study will attempt to address these shortcomings. It will use decontextualized pictures to teach novel L2 words. Moreover, it will use two separate measures of vocabulary learning: one measure will assess the learning of a word's form, and the other measure will assess the learning of the word's meaning. Furthermore, psycholinguistic processing tasks will be used to separately measure the learning of word form and meaning. In terms of learners, the present study will focus on L2 learning in true beginners (i.e. learners who have not acquired, and are unfamiliar with, any words in an L2) in order to understand how novice L2 learners acquire the forms and meanings of new L2 words.

The purpose of Chapter 1, therefore, is to situate the present study within the broader context of L2 vocabulary acquisition. It will answer such questions as, what methods have been used to teach new words, and how effective are those methods? Moreover, how has L2 vocabulary acquisition been measured? Chapter 2 will then describe the narrower context of relevant psycholinguistic research. Thus, it will answer such questions as, what are the effects of using pictures on memory for words? How are formal and semantic properties remembered or learned, and what is the relationship

between the two? And also, what are psycholinguistic processing measures of L2 vocabulary, and why should they be used to measure L2 vocabulary acquisition?

Three Approaches to L2 Vocabulary Acquisition

How have novel L2 words been taught to learners? And consequently, how effective is each method in L2 vocabulary acquisition? In terms of how words are taught, there have been three principal approaches used in L2 vocabulary acquisition research since the 1980s. The first involves presenting words in context--or what is known as contextual learning--which gives little emphasis to individual words. The second involves presenting words in context with an added emphasis on words—or what is known as contextual learning with word emphasis. And the third involves learning decontextualized words--or what is known as decontextualized learning.

Contextual Learning

One prominent view of vocabulary learning was developed in the early 1980s and focused on the acquisition of words in natural contexts. Underlying this view was the claim that words could be learned while reading, without explicit attention paid to them. Perhaps the greatest proponents (or even pioneers) of this view of vocabulary learning were Krashen and Terrell (1983). They advocated the idea--known as the Input Hypothesis--that all that was necessary for vocabulary acquisition was comprehensible input (i.e., input from reading or listening that is *largely* understood, meaning that learners would understand most words in a reading or listening passage). They called this type of learning *incidental* because learners' main focus was on the overall message of

the text, and learners only incidentally picked up the meanings of individual words. This approach, therefore, greatly emphasized the role of reading in language learning.

Supporting evidence for this view of vocabulary learning first came from L1 studies. One interesting early example came from Nagy, Herman and Anderson (1985), who gave a group of eighth grade participants one of two texts each containing unfamiliar target words. The instructions given were that after reading, participants would answer questions about the passage without being able to see the passage; instructions said nothing about vocabulary. The results of the subsequent (and unexpected) vocabulary test showed small, but significant, word gains. The authors estimated that the probability of learning a word after just one exposure was between .10 and .15. Given the supposition that children of that grade generally read (through force or interest) a large body of texts throughout their school years, Nagy et al. concluded that a large portion of children's L1 vocabulary was acquired through reading, without explicit attention to individual words. For L2 researchers, then, these results beg the following question: Do L2 learners exhibit similar vocabulary gains?

In fact, there is evidence that L2 learners learn words incidentally from reading. One interesting example comes from Pitts, White and Krashen (1989). These authors successfully replicated a study by Saragi, Nation and Meister (1978) in which L1 participants acquired new vocabulary incidentally after reading the novel *A Clockwork Orange*, which contains many slang words of Russian origin. After reading two chapters, the participants in Pitts el al. were tested for the acquisition of the slang. The results showed small, but significant vocabulary gains of around 2 out of 29 words tested. The authors interpreted these results as support for incidental learning, as the participants

were never instructed to pay special attention to individual words. However, like the L1 results of Nagy et al. (1985), vocabulary gains were small.

Given the small incidental vocabulary gains found by Pitts et al. (1989) and Nagy et al. (1985), one might hypothesize that much longer readings would produce much larger vocabulary gains. In fact, this is not the case. Addressing this issue in a later study, Horst, Cobb and Meara (1998) had participants read and listen along to an entire novel. Their results showed an average vocabulary gain of only 2-5 target words out of 45: once again, small gains.

In sum, contextual learning in L2 vocabulary acquisition gives way to the following unavoidable conclusion: reading to understand the meaning of a text without attention to individual words produces only small vocabulary gains. But one main shortcoming within the contextual learning paradigm is of special relevance to the present study. The previous studies have largely focused on learners' abilities to recall the meaning of novel words. They have not specifically focused on the learning of formal properties of words (spelling, sounds) separately from the learning of their semantic properties. It is important to examine the learning of formal and semantic properties of words separately because learners must first remember the form of words, and then connect those forms to the correct meanings.

Contextualized Vocabulary Learning with Word Emphasis

Given that contextual learning often leads to small vocabulary gains, some researchers advocated another approach to L2 vocabulary acquisition. This approach is based on the idea that L2 vocabulary may be increased by the addition of some emphasis on words in contextual learning approaches. Paribakht and Wesche (1997), for example, compared

two word learning conditions: reading only (RO), and reading plus (RP), with the *plus* being an extra focus on vocabulary. The design involved a vocabulary measure which combined participant self-reports with demonstrations of word knowledge (see Paribakht & Wesche, 1993). There were three stages in the experiment: Participants (1) read a short text, (2) performed comprehension questions, and (3) either performed explicit vocabulary activities (RP), or read a short supplementary text (RO). Therefore, the important difference between the RP and RO conditions was in step 3, wherein the RP condition learners performed explicit vocabulary exercises and the RO condition learners reread the words in similar contexts. The results were clear: the RO condition produced small vocabulary gains while the RP condition produced significantly larger gains. These results suggest that some degree of attention to language appears to be beneficial for vocabulary learning.

Similarly, Hulstijn, Hollander and Greidanus (1996) compared contextual learning with word emphasis to simple contextual learning. They had three conditions: reading only, reading plus electronic dictionary, and reading plus marginal gloss. They found that the two groups with added word emphasis (either through access to a dictionary or to a gloss) produced more vocabulary gains than the reading only group. Therefore, like Paribakht and Wesche (1997), Hulstijn et al. suggest that higher L2 vocabulary gains are more likely when contextual learning is coupled with an emphasis on individual words.

Consequently, research has shown that although small vocabulary gains can be produced from reading alone, adding an extra vocabulary focus to reading improves vocabulary acquisition. And it is once again relevant to the present study that, as with purely contextual learning, the L2 vocabulary research on contextual learning with word

emphasis, as mentioned above, has rarely focused its interest on measuring the acquisition of two separate aspects of word knowledge: their form and meaning (once again, see Webb, 2005, as the exception).

Decontextualized Vocabulary Learning

In terms of how words are taught, a third common approach in L2 vocabulary acquisition research has been to present decontextualized words to learners. In some cases, words can be learned with only a focus on words, omitting a larger context altogether. In fact, Laufer (2003) challenged the claim that reading was the major source of vocabulary acquisition by comparing reading to vocabulary-focused tasks. She performed three experiments which are all relevant to the current discussion. All three experiments involved two groups: a reading group and a word-focused group. At task, each reading group read a short text which had target words and their definitions in a marginal gloss and completed general comprehension questions. Each word-focused group was given a list of the target words with explanations and translations, and either wrote original sentences (Experiment 1), wrote an original composition (Experiment 2), or completed given sentences (Experiment 3). Results showed significantly higher vocabulary gains in the word-focused groups than in the reading groups (who, as stated above, even had target word definitions in a marginal gloss). Therefore, Laufer's findings show that decontextualization in L2 vocabulary learning may be even more effective than contextual learning with added word emphasis, at least when participants are also asked to produce the new words in sentences as part of the study task. These results are also compatible with Hulstijn and Laufer's involvement load hypothesis (2001). According to

this hypothesis, the success of vocabulary learning depends on the extent of processing that learners engage in during word learning activities.

An example of decontextualizing word-focused tasks even further is Qian (1996). He asked one group of learners to simply perform three consecutive steps with a list of unknown target words: read both the words and definitions aloud twice, then read only the definitions aloud, then read both the words and definitions aloud. He compared this first group to a second group that read a text with the target words bolded in context *and* written beneath the text to increase saliency (he also outlined useful strategies to infer meaning from context). Post-tests showed vocabulary gains for both groups. However, the decontextualized group retained about 1.5 more words than the reading group. Qian concluded that truly decontextualized vocabulary learning is sometimes better, and may at times be more appropriate, than contextualized learning.

Although much L2 vocabulary acquisition research has focused on newer ways of decontextualization--in their varying degrees, formats, and instantiations, as noted above--more traditional learning has also been given credence within the L2 vocabulary acquisition literature. Some noteworthy examples are the following. Groot (2000) found that list memorization (i.e., simple rote learning) produced the same vocabulary gains as using a variety of contextualized and decontextualized activities. Furthermore, other studies have found that mnemonics (encoding words by associating them with something already known) produce similar vocabulary gains as other traditional methods, such as using a meaningful context, learning through synonyms (Pressley, Levin, & Delaney, 1982), rote learning through simple repetition (Atkinson & Raugh, 1975), and against

control groups without assigned strategies (Delaney, 1978). In sum, it seems like there is relatively strong evidence for decontextualization.

Overall, the results of L2 vocabulary acquisition research seem to show that many different teaching methods can produce vocabulary gains, although some appear to be more effective than others. Not only can contextualized learning produce more gains when it has an extra focus on vocabulary, but evidence also exists supporting the superiority of decontextualized vocabulary learning. Thus, we may posit at least four general conclusions for the purpose of the present study. First, L2 learners are able to acquire new words under a variety of learning conditions. Second, both decontextualization and contextualization with added word emphasis produce higher vocabulary gains than contextual learning alone. Third, in some cases, decontextualization leads to larger vocabulary gains than contextualization with added word emphasis. And fourth, L2 vocabulary acquisition research has rarely attempted to examine the separate acquisition of two important aspects of word knowledge: namely, word form and word meaning.

The Need for Decontextualized Learning with Pictures

Although the fourth point mentioned above outlines the need for the present study in terms of developing new ways to measure vocabulary acquisition, it is the third point that highlights the need for the present study's use of decontextualized pictures in a learning stage. The study of L2 vocabulary learning from pictures is important for three reasons. First, as Coady (1997) has argued, a "beginner's paradox" exists in L2 learning. How, asks Coady, is it possible for beginner learners to acquire vocabulary through reading if

they do not have enough words to do extensive reading? Surely beginners must obtain a minimum vocabulary before they can begin to understand texts to such a degree that they can acquire some of its vocabulary items. He argues for explicit instruction of 3000 word families (i.e. words with the same root meaning, but different morphologies; following Laufer, 1997) before learners can adequately begin to acquire vocabulary through reading.

In terms of the percentage of words that must be known by readers in order to comprehend a text, a few numbers have been put forth. Laufer (1989), for example, found that learners must understand 95% of the words in a text for them to attain a reasonable level of textual comprehension. More conservatively, however, Hu and Nation (2000) found that number to be closer to 98%. More recently, Nation (2006) sought to clarify the issue by reviewing all the relevant studies in this area. Generally, his findings were that learners could reasonably comprehend a text when they understood 95% of its words, but understanding 98% of its words was better. These numbers highlight the fact that beginners have a lot of learning to do before they can comprehend a text, let alone learn words from the context of a text.

The second reason for researching the effectiveness of picture use in L2 vocabulary acquisition is related to its benefits to language classrooms: Pictures are practical and effective, especially in the case of concrete nouns. In terms of the different manners of teaching decontextualized L2 concrete nouns in the classroom, teachers have a few common options. For instance, language teachers may point to physical objects in the classroom. However, classroom objects are limited, and field trips can often be impractical (i.e., too costly for language schools, and thus, their students); therefore,

although physical objects, or scenes, may be effective, the study of words from physical objects may not reap practical benefits. Consequently, teachers are often relegated to techniques that are more accessible in the classroom. One of the most common techniques (made obvious by the number of bilingual dictionaries that students have in classrooms) is for students to seek L1 translations of novel L2 words. But although practical, translations can be problematic in that words have different usages in different languages, and the teacher—who may not be familiar with the L1s of the students—cannot control for problematic translations (Swan, 1997). Therefore, because of the problematic nature of translations, pictures may be the most appropriate technique for teaching L2 vocabulary because they are both effective, in the sense of their universal understanding, and practical, in terms of their availability in such media as picture dictionaries, exercise books, and the Internet. Consequently, the lack of research into the effectiveness of pictures in adult L2 word learning needs to be addressed.

Measures of Vocabulary Depth

So far, the preceding discussion has done four things. It has situated the present study within the broader L2 vocabulary acquisition literature on decontextualized word learning; it has shown the need for measures of vocabulary knowledge at the level of both word form and word meaning; it has argued that decontextualized learning is necessary for beginners; and it has argued that pictures may be a practical way of learning new L2 words. Therefore, the one issue that remains to be clarified, before the goals of the present study are summarized, is how measures of word form and meaning relate to existing measures of vocabulary knowledge.

It is generally accepted that there are different sizes and different depths of word knowledge. Tests of vocabulary size measure the *number* of words learned, or retained, from study to test. Such tests are valuable as vocabulary size has been shown to be related to success in reading, writing, general language proficiency, and academic achievement (Saville-Troike, 1984). On the other hand, tests of vocabulary depth measure how *deeply* a word has been learned based on learners' production and recognition abilities for words. For example, a learner may be able to recognize a word but not understand it. Moreover, a learner may understand a word but not be able to produce it. Going further, she may be able to produce it when forced, but not in free production. Therefore, in order to effectively compare the results of vocabulary studies which discuss the number of words learned, one must be sure that the tasks are measuring the same level of vocabulary depth.

One study that is relevant to clarifying the issue of vocabulary knowledge depth is by Laufer, Hill, Elder, and Congdon (2004). These researchers began by hypothesizing two dichotomous distinctions in vocabulary knowledge. The first distinction is between recognition and production; the second distinction is between the retrieval of meaning and the retrieval of form. Because learners' recognition of vocabulary has been seen to be stronger than their ability to produce vocabulary (Laufer, 1998), Laufer et al. hypothesized that production is a more demanding skill than recognition. Furthermore, because the production of a word form is more complicated than the production of a word meaning, it was assumed that the production of a word form is a more demanding type of knowledge. This created a hierarchy of vocabulary knowledge which they sought to test, with the most demanding knowledge being production of word form, followed by

production of word meaning, followed by recognition of word form, and finally recognition of word meaning.

In fact, Laufer et al. found support for only three levels of vocabulary knowledge (the types of questions used to assess each hypothesized level will be illustrated using the example target word *melt*). As predicted, production of word form appeared to be the deepest level of acquisition (participants were given an L2 definition and had to complete the correct L2 target word; e.g., *Turn into water* – m____). The next deepest level of acquisition was production of word meaning (participants were given the L2 target word in a sentence and had to complete the sentence, where any sensible answer was acceptable: e.g., *When something* melts, *it turns into*_____). Recognition of word form and recognition of word meaning were found to be, equally, the shallowest level of acquisition (in recognition of form, participants were given a definition and had to choose the correct target word from a list of four; e.g., *Turn into water,* (a) elect, (b) blame, (c) melt, or (d) threaten; in recognition of meaning, participants were given the target word and had to choose the correct definition from a list of four; e.g., Melt, (a) *choose*, (b) *accuse*, (c) *make threats*, or (d) *turn into water*). In sum, these results suggest the following three-level implicational scale for depth of vocabulary knowledge, from the deepest level of acquisition to the shallowest: production of word form, production of word meaning, recognition of word form or meaning (equally).

One thing that is important for the present study is that all three levels of vocabulary depth knowledge in Laufer et al. involve tests of word meaning; that is, they all involve somehow connecting the form of a word to its meaning. Laufer et al. did not also administer separate tests for memory of word form alone (i.e., as a symbol). The present

study will be situated at the level of recognition. It differs from most previous research, however, in that it will include two measures for *each* target word; that is, each target word will be tested for both knowledge of meaning, and knowledge of form.

Investigating the knowledge of word form and meaning separately at one level of vocabulary knowledge depth can increase both researchers' and teachers' understanding of how exactly novice L2 learners acquire new words. As the learners in this study will be true beginners, recognition measures will be used because they ought to lead to larger participant learning effects, as they are the lowest level of acquisition according to Laufer et al. (2004).

Objectives of the Present Study

To summarize, the primary objective of the present study is to enhance our understanding of how L2 words are learned. To accomplish this objective, several shortcomings in L2 vocabulary acquisition literature will be addressed. Specifically, the present study will measure the effectiveness of using decontextualized pictures to learn novel L2 words. In order to measure the effectiveness of using pictures, two separate tests will be administered, each of which measures acquisition of a different aspect of word knowledge. One test will measure the acquisition of a word's form, while the other test will measure the acquisition of the word's meaning. Both tests will be psycholinguistic tasks, meaning that they will tap into the processing dimension of vocabulary knowledge. Further rationale for the use psycholinguistic processing measures and their description will be given in Chapter 2, which will provide an in-depth overview of psycholinguistic literature as a background to the present study. Lastly, the present study will focus on true

beginners. Examining decontextualized word learning is important in the case of true beginners because the number of words they have acquired is often not enough to allow them to learn new words from context (especially reading).

CHAPTER 2

LITERATURE REVIEW

Chapter 1 situated the present study within the broader context of L2 vocabulary acquisition literature. In this chapter, the present study is discussed within a narrower area of research on the use of pictures in L2 learning and on psycholinguistic aspects of L2 vocabulary learning. In terms of L2 vocabulary acquisition, there are three principal areas of inquiry that are relevant. These areas are the following: the use of pictures, formal (perceptual) processing, and semantic (conceptual) processing. Chapter 2 will therefore be divided into three main sections.

The first section will review L2 vocabulary acquisition studies that have used pictures in study tasks. The next two sections will provide background for the present study by examining L1 psychological research on perceptual and conceptual processing because much of the psychological research in this area has been done with L1 speakers. The purpose of these two reviews is to provide an understanding of the psycholinguistic bases of the present study. After that background is made clear, the next section will present the present study in detail, along with reasons for using a psycholinguistic processing measure of L2 vocabulary learning.

Pictures in L2 Vocabulary Acquisition

Research in L2 vocabulary acquisition involving pictures has come from two broad areas (as discussed above): contextual learning with added word emphasis, and

decontextualized learning. In terms of contextual learning with added word emphasis, two studies are noteworthy.

Chun and Plass (Experiment 2, 1996) decided to compare different types of extra vocabulary focus in a reading task. Participants performed a computer reading in which they could freely look up any L2 word in a gloss and be presented with an L1 definition. For the target words, the glosses were of three types: L1 definition, L1 definition plus picture, or L1 definition plus video. Although the frequency or length of gloss searches was not controlled for, the post-test revealed the largest vocabulary gains in the L1 definition plus picture condition.

In addition to Chun and Plass, similar results have been confirmed by Kost, Foss and Lenzini (1999), who found that not only did a picture plus L1 definition condition produce the greatest vocabulary gains on an immediate post-test, but also on a delayed post-test. These results provide some evidence for the usefulness of pictures in L2 vocabulary acquisition when used in addition to words in context. For intermediate to advanced learners, these results are especially important given the large number of multi-media learning books being produced for students and the rise of computer assisted language learning (CALL), which are both able to include pictures in glosses. But, as was argued above, beginners do not have large enough vocabularies to reach the requisite 95-98% word understanding which is necessary for textual comprehension, let alone learn novel words from the context of texts. Therefore, in the case of beginners, pictures must be used to teach novel vocabulary in a decontextualized setting. In terms of decontexualized learning with pictures, two studies are relevant.

Kopstein and Roshall (1954) compared L2 vocabulary learning with pictures to translations. They performed two experiments with 428 and 360 English participants respectively. The study task was to learn Russian words in one of two paired-associate (stimulus-target) conditions. The stimulus item (first item presented) was a picture in one condition, and an English translation in the other condition. The target word, in Russian, followed the stimulus item in both conditions. The Experiment 1 test involved seeing a picture and writing the correct Russian word. Results revealed that participants in the study phase involving pictures significantly outperformed those in the translation condition. In Experiment 2, the study task involved the same two conditions (picture-target word, and translation-target word), but the test task involved seeing an English translation and writing the correct Russian word. Once again, results revealed that participants in the study phase involving pictures significantly outperformed those in the translation condition (although the difference was less than in the first experiment). Kopstein and Roshall concluded that pictures were superior to translations when learning novel L2 vocabulary in a paired-associate learning task.

Another experiment illustrating the superiority of pictorial information over translations is that of Wimer and Lambert (Experiment 1, 1959). Actually, the authors did not use pictures, but sought to compare paired-associates wherein the stimulus items were either physical objects, or L1 translations; however, their results remain of interest to the current discussion because the objects used were common concrete nouns (e.g., pencil, key, ring) similar to those used in pictures in the present study (e.g., nail, key, balloon). In order to avoid the problem of participants having knowledge of target words, they chose to use nonwords as targets (nonsense single syllables based on legal English word

formation rules; e.g., *vud, dax, keb*). The test task was not a standard recall. Instead, participants were presented each paired-associate, one by one. Then, only stimulus items were presented, and participants had to produce the target words. If participants did not produce all target words correctly, the process was repeated until all stimuli were responded to correctly (i.e., paired-associates then simuli and responses, paired-associates then stimuli and responses, and so on until all stimuli were responded to correctly). The authors found that participants who were in the object learning condition were significantly faster than those in the word learning condition at producing a full set of correct target words. This finding, despite using objects instead of pictures, is further evidence of the superiority of vocabulary learning from visual representations of actual objects over translations.

In sum, the results from L2 vocabulary studies in contextual learning with added word emphasis and decontextualized paired-associate learning reveal the benefits of using pictures to learn novel words. What this short review also highlights is the relatively small amount of research on picture use in vocabulary learning, especially in a decontextualized format. It is this lack of relevant research in the literature that has motivated the present study's use of pictures. Having discussed the relevant literature on picture use in L2 vocabulary acquisition research, it is now possible to begin a review of psycholinguistic literature focusing on the two aspects of word knowledge that shall be measured in the present study.

How Words are Processed

When speakers use words, they need to process at least two types of information about them. One type of information is the form of a word. In the psycholinguistic literature, the processing of this type of information is often called *perceptual processing* because language users need to perceive (encode) the details about a word's form. In the spoken modality, the form would be the sound structure of the word—or its phonology. In the written modality, the form would be the written letters—or the word's orthography. The other type of information that needs to be processed is the meaning of a word. The processing of word meaning is often called *conceptual processing* by psycholinguists because language users, in understanding what a word means, necessarily access at least some aspects of the concept that the word denotes. However, processing these two types of information means different things for different language users. In the case of children learning their L1, they are encoding a new meaning, and connecting that meaning to a new word form. In contrast, for people learning an L2, the meaning of words can be, to different degrees, already present in their minds, and their task, therefore, is to build a connection from the already present meaning (or concept) to a new form.

Both the form and meaning of a word may sometimes be encoded equally well, whereas other times one may be encoded to a greater degree than the other. As a common example, one could think of a word in another language that has been seen many times. The writing may be recognized, but the meaning may not be known. This is an example of having encoded only the form of the word. In fact, this is quite common for many L1 speakers. Many highly technical words can be recognized—and even read—without knowledge of their meaning. For example, many students may encounter the word

epistemology many times throughout their studies without knowing its meaning (*the study of knowledge*). Contrarily, sometimes the meaning of something may be known, but not the word form used to refer to this meaning. For example, one may be able to understand and think of the concept of a group of geese (visualize them all together), and know there is a word to denote this group, but not know that the word used to communicate that concept is *gaggle* (as in a gaggle of geese). In a less drastic example, learners in an L2 classroom may understand the word *caught* as a past tense verb which expresses an activity, but be unable to accurately spell it or pronounce it: they may acquire its meaning, but not quite its form.

Of course, the perceptual/conceptual dichotomy is used here mostly out of convenience in an attempt to clarify and highlight the respective properties of both types of processing. When processing words, however, the two types of processing are not mutually exclusive, and to completely isolate each may not be possible. Therefore, the following sections on perceptual and conceptual processing will necessarily overlap. Nevertheless, making this distinction will be helpful for understanding the present study.

Before beginning, however, and at the risk of being slightly redundant, some definitional issues should once again be addressed so that the terms used in this chapter are transparent. As was shown in Chapter 1, the word *form* refers to a word's orthography or phonology. Within the psycholinguistic literature, the processing of form is known as *perceptual* processing. Therefore, the words *formal* and *perceptual* shall both refer to the same type of characteristics or processing. Furthermore, as was discussed in Chapter 1, the words *meaning* and *semantic* are used here interchangeably. In the psycholinguistic literature, *conceptual* processing refers to the processing of meaning or semantics.

Therefore, the words *meaning, semantic* and *conceptual* shall refer to the same type of characteristics or processing. As will be explained in more detail below, the word *priming* shall be used to refer to a situation when the processing of one item facilitates subsequent processing of another item (whether that be the same or a similar item).

Psycholinguistic Measures of Form Processing

Research has shown that processing words perceptually leads to long-lasting retention of word form in memory. In an early study, for example, Kolers (1975) gave participants a series of inverted (upside down) and normal (right-side up) sentences to read aloud in a study task. In the test task, the participants were given all study task sentences, and a set of new sentences, all in the normal orientation (right-side up); they had to decide which sentences were being presented for the second time, and which ones the first. When the participants were unskilled at reading inverted sentences (or not used to it), they remembered more of the inverted sentences for longer periods than did the participants who became skilled at reading inverted sentences.

Kolers interpreted these results in the following way. When readers are unskilled at reading inverted text, they are encoding more perceptual information, due in part to the distinctiveness of the inverted text. Contrarily, skilled readers of inverted text process less perceptual information: they are able to effectively ignore the perceptual distinctiveness and encode primarily the meaning of the text. As Kolers notes, the results seem to suggest that more perceptual processing of a text leads to better memory retention of form. These findings highlight the power of perceptual processing in memory encoding.

If perceptual encoding plays such a strong role in memory, then it would seem interesting to ask whether one type of language form (orthography or phonology) is

encoded more effectively than another. Brand and Jolles (1985) did just that by presenting participants with words in the written *or* spoken modality. All participants were presented the same lists: some as text on a screen, some from a recording. They were then tested on immediate and delayed recall in two parallel conditions, each involving word recall and word recognition. The auditory condition presented words auditorily and had participants respond orally. The visual condition presented words visually (in English) and had participants respond non-orally, by pressing buttons. Overall, the results in the visual and auditory modalities were similar in the immediate and delayed recall and recognition. There was, however, a small advantage for auditory priming in the delayed recall: the inter-word recall time was shorter in the auditory modality than it was in the visual modality condition. The authors interpreted these results as showing some, albeit small, support for the primacy of auditory over visual perceptual processing.

However, due to methodological issues, we may not in fact be able to directly compare effects of auditory and visual perceptual processing on memory, or for that matter, claim supremacy—however slight—for priming in the auditory modality. Importantly, the type of processing at study and test were similar, but not exactly the same, which may have influenced Brand and Jolles' results. In their study, participants were presented words in either the written or auditory modality. However, there were two problems. First, when participants were learning the words in the study task, they repeated them orally (in both auditory and visual conditions). And second, free recall at test was done by saying the words into a recording device (auditorily). Thus, the words that were first learned in the auditory condition were practiced and recalled in the same

modality (auditorily). However, the words that were first encountered in the visual condition were practiced and recalled in a different modality (auditorily). We can therefore only accept Brand and Jolles' conclusion of the slight superiority of auditory processing if we assume that changing modalities from study to test is equal to maintaining the same modality. This assumption, however, has been seriously challenged by researchers.

Scarborough, Gerard, and Cortese (1979) showed that changing modalities from study to test negatively affects memory, compared to maintaining the same modality. In two similar experiments using repetition priming methodology (where the processing of a target item facilitates subsequent processing of that item), they gave participants two different study tasks. In one of the study tasks, participants saw a word with its referent picture and had to pronounce it aloud. In the second study task, participants saw only a picture and had to pronounce its corresponding name aloud. Therefore, in both tasks they *pronounced* words, but only in the first task did they *see* the written word. Participants then performed a lexical decision task (a timed test where participants decide if the word presented is a real word or a nonword). Some of the presented real words are *old*, having been also presented in the study task; some are *new*, having not been presented before. Consequently, priming is observed when there is a shorter reaction time to words that were present in the study task, compared to new words not present in the study task. In sum, at test participants only saw written words, they did not pronounce them orally.

The results were telling. Scarborough et al. found priming for words that were presented in the study task as both picture and word. However, they found no priming for words that were presented only as a picture at study. These results suggest that in order

for perceptual priming to occur, the modality in which the words appear at study and test must be the same. This conclusion reflects the principle of transfer-appropriate processing which recognizes that for performance to be maximized, processing at study must be similar to processing at test (Morris, Bransford, & Franks, 1977). Participants who saw the written word at study and test exhibited priming within the same modality, whereas participants who did not see the written word at study, but saw the written word at test, did not exhibit priming (across modalities). Therefore, Scarborough et al.'s results seem to suggest that processing perceptual information in one modality (i.e., by pronouncing a word) does not facilitate processing perceptual information in another (i.e., by seeing a word), implying separate perceptual memory encoding for auditory and orthographic forms of words. But although these findings seem to hold true in a general sense, when scrutinized, evidence can be produced that shows some degree, albeit smaller, of cross-modality perceptual priming.

For instance, Roediger and Blaxton (1987) did observe a significant cross-modality repetition priming effect, but this effect was about half of the magnitude of the effect obtained in the within-modality condition. They used very similar study tasks to Scarborough et al. (1979), but a different test task: word-fragment completion (participants must complete a word with its missing letters; e.g., _e_ep_on_e for *telephone*). At test, priming is observed when more fragments are completed for words that had been presented at study, compared to words that had not been presented at study. Thus, Roediger and Blaxton's finding suggests that cross-modality priming is at best a mild effect (and only in certain tasks).

All in all, taking the results of Scarborough et al. (1979) and Roediger and Blaxton (1987), we can begin to seriously call into question the assumption that we can compare auditory and visual perceptual memory on a one-to-one basis by teaching words in one modality (e.g., auditory) and testing learners' memory for words in another modality (e.g., visual). This processing characteristic has important implications for the present study. Because of this modality effect, the present study will use only the visual modality for both the study and test phase.

So far we have discussed three aspects of perceptual processing: (1) that it apparently has a strong effect on memory encoding, (2) that within-modality memory effects are much stronger than cross-modality memory effects (which may or may not be present), and (3) that it is difficult to conclude on a superior modality for memory encoding due to the necessity of having comparable processing requirements at study and test (a phenomenon called transfer-appropriate processing).

The last point about processing requirements at study and test raises a more general question about the effect of the learning context on memory encoding of form. In other words, it is pertinent to the present study to ask how context more generally affects perceptual processing. Would perceptual memory encoding be benefited more by words presented contextualized or decontextualized at study? Based on Kolers results, one would predict that perceptual memory would benefit most from decontextualized words as they contain less semantic information than contextualized words.

Masson and MacLeod (2000) sought to answer this question by presenting two different study tasks to participants, all in the visual modality. In one condition, they presented participants with entire texts. In the other, participants were presented lists of

decontextualized words, one by one. For the test measure, they used a masked word identification task (in which words are presented extremely quickly--for less than about 30 ms--and must be identified as having been in the study phase or not). The idea with this task is that seeing words in the study phase will facilitate their recognition when presented extremely rapidly at test. Their results were clear: the amount of priming observed in the decontextualized condition was significantly larger than in the contextualized condition.

Masson and MacLeod's results may suggest at least one conclusion. Memory of form is benefited to a greater extent when words are presented alone, compared to when they are presented in context. Thus, individuation of words in word lists seems to attract a larger focus to word form. Consequently, in learning situations, this suggests that in order for formal aspects of words to be maximally encoded, they must be presented out of context. Thus, it would seem that there is a potential trade-off between form and meaning processing.

This trade-off between perceptual and conceptual processing was investigated in a study by Craig, Moscovitch and McDowd (1994). The authors sought to determine the relationship between perceptual and conceptual processing of words. In a series of four experiments, they manipulated two variables at study: perceptual modality (visual/auditory) and level of processing (conceptual/perceptual). They also manipulated one variable at test: perceptual tasks (word-fragment completion and word-stem completion); and conceptual tasks (word-stem cued recall and recognition). Although the details of the experiment are not important here, the general trend of their findings is relevant. First, they found that perceptual manipulations only had significant effects on

the tasks that largely measure perceptual processing. And second, conceptual manipulations seemed to affect tasks that largely measure conceptual processing.

To summarize, it has been experimentally demonstrated that perceptual processing can have a significantly strong effect on memory. In addition, one must be careful when making comparisons between auditory and visual modalities: performance at test will always be benefited by a match in modality of processing at study and test. Furthermore, perceptual processing seems to be maximized when the target information is decontextualized, compared to when it is presented in context. Finally, performance on perceptual tests is only affected by perceptual manipulations at study (not conceptual manipulations), and performance on conceptual tests is only affected by conceptual manipulations at study (not perceptual manipulations). Overall, the concept of transfer-appropriate processing seems to aptly describe the benefits of maintaining similar processing conditions between study and test, and the negative effects of changing processing demands between study and test. The measures of conceptual (meaning-based) processing are discussed next.

Psycholinguistic Measures of Meaning Processing

Conceptual processing involves the processing of meaning, or semantic information available in words. Whereas *dog*, as it is spelled or spoken, is a perceptual form of this word, the concept of a dog (a representation in the mind as an image or thought) is its meaning. The purpose of this section is to explore relevant findings in the area of conceptual processing, adding to the discussion presented in the previous section, but narrowing the focus to studies involving the use of words and pictures.

Researchers have often studied conceptual processing by manipulating the use of pictures and words. A picture has been assumed to cause a language user to access the representation of a depicted concept, while a written or spoken word has been assumed to lead to the processing of both the word's concept *and* its form. In an interesting early study, Durso and Johnson (1979) used a priming paradigm to show that picture and word primes facilitate test performance differently. In a single phase experiment, participants were presented a long list of decontextualized items that they named orally (i.e., auditorily): some items were words, some were pictures. Some of the items were repeated in the list, some were not; therefore, some items were primed by earlier occurrences while others were not. Priming would be observed if the response latency was shorter for primed, compared to unprimed, items.

Several results are of interest here. Firstly, the greatest magnitude of priming came from a picture priming a picture (e.g., a picture of a house followed by the same picture of the house). Second, a word was found to prime itself and its picture equally (e.g., the word *dog* followed by the same word or by an image of a dog). And third, no significant priming was found when a picture preceded its referent word (e.g., a picture of a cat followed by the word *cat*). For the purposes of the present study, these results begin to set the stage for the processing relationship between pictures and words.

The authors' findings can be explained in the following manner. A word activates its concept *and* its form. In essence, seeing a word obviously activates the form of the word, but also automatically activates the meaning of that word because a word is necessarily a symbolic representation of meaning: the function of word forms is to communicate meaning. Therefore, a word facilitates the subsequent processing of the same word form

or of its referent picture. On the other hand, a picture naturally activates its concept, but not its word form because a picture is not necessarily a symbolic representation of form: the function of pictures is not to communicate forms. Therefore, a picture facilitates subsequent processing of the same picture but not its word form. But although this is an intuitively plausible explanation of Durso and Johnson's findings, there may be more to it.

In fact, Kirsner, Milech, and Stumpfel (1986) sought to challenge Durso and Johnson's (1979) finding that pictures could not prime words. In the study task, participants saw either a word or a picture and performed a semantic categorization task, judging each word as referring to either a natural or man-made object (a task which is said to increase conceptual processing). At test, Kirsner et al. used a word identification task where the participants saw and had to name target words aloud (the target words had been presented as either pictures at study, words at study, or were not presented at study). In direct contrast to Durso and Johnson, the authors found that pictures did indeed prime their referent word form, although to a lesser extent than a picture priming a picture, a word priming a word, or a word priming picture. In other words, seeing a picture at study and performing a conceptual manipulation (categorizing as natural or man-made) facilitated subsequent processing of that picture's referent word. This finding seems to show that an increase in conceptual processing at study led to some, albeit small, facilitation of perceptual processing at test.

Although Kirsner et al. discuss several explanations for why a picture could prime a word, one is of particular interest here. In the study task, participants were presented with a randomized set of individual items. The items were words or pictures. Because of this,

the authors reasoned that participants treated all study items as linguistic objects. That is, the presence of word and picture target items in the same study task caused participants to process the pictures (at least partially) as words. Thus, because participants processed pictures (at least partially) as words during the study task, target words in the test task were primed. In fact, the authors acknowledge that priming may indeed be eliminated if pictures are not processed as linguistic objects at study. Therefore, in terms of the present study, it is assumed that participants will process pictures not only as representations of their underlying concepts, but also as linguistic objects, as the pictures will be presented simultaneously with their referent words.

Therefore, results covered so far tell us at least three things about the priming of pictures and word forms. Firstly, processing a word form facilitates subsequent processing of that word form and its referent picture (approximately) equally. Secondly, processing a picture facilitates subsequent processing of that picture or its word form, but not equally; processing of a picture facilitates subsequent processing of that picture to a significantly greater degree than processing of its word form.

The studies on perceptual and conceptual priming reviewed above were not examining L2s, and did not involve learning new words (even in the L1); in this way, they differ from the present study, which is examining novel L2 word learning. However, the above priming relationships serve to illustrate what types of processing occur in the mind when words and their concepts (pictures) are perceived and accessed. In fact, these processing facilitations can be used to describe why the use of pictures and words can be effective from a psycholinguistic standpoint when learning novel L2 words.

The purpose of presenting a learner with a novel word with its referent picture is to help the learner establish a form-meaning connection between the form of a word and its concept (represented visually by a picture, or mentally by an image or thought). The ultimate goal of making this form-meaning connection is to be able to later retrieve the concept of a word when necessary (i.e., when presented with the word form), or be able to retrieve the word form when necessary (i.e., when presented with the concept, or when attempting to express the concept). Therefore, when a learner begins to establish form-meaning connections between pictures and words at study, they are benefitting from multiple different processing facilitation effects at test.

First, if they must retrieve a word's meaning from its word form, they benefit from two processing facilitation effects: (1) seeing the word form at study facilitates retrieval of the word's meaning, and (2) seeing the picture at study also facilitates retrieval of the word's meaning. Second, if they must retrieve a word form from its meaning (or picture/concept), they also benefit from two processing facilitation effects: (1) seeing the word form at study facilitates retrieval of the word form, and (2) seeing the picture at study also facilitates retrieval of the word form. Overall, however, because the magnitude of priming is lowest in the picture-word condition, participants should be more likely to retrieve the meaning of a word than its form.

It appears, then, that seeing a word with its referent picture at study leads to two processing facilitation effects at test. Of course, this dual-processing effect would only be beneficial if it can be shown that the two processing facilitations are additive. In fact, Paivio's (1971) dual-coding theory has done just that, by showing that the dual processing facilitations from pictures and words are indeed additive.

According to the dual-coding hypothesis, the mind processes pictorial and verbal information in two different channels. Each processing channel has a limit on the amount of information it can process at one time. However, because the channels are separate, the information processed in each channel can be added. For example, one can only remember x number of items in the verbal channel, and y number of items in the pictorial channel; these numbers are limited by short-term memory. However, if one processes an item in both the verbal and pictorial channels, one can remember x plus y items. This specific phenomenon is known as the additivity hypothesis (Paivio 1975).

In demonstrating this effect, Paivio (1975) presented participants with a long list of items involving pictures and words, and subsequently asked them to recall as many items as possible. There were three conditions within the counterbalanced lists that are important here. Some pictures were repeated in the list (PP), some words were repeated (WW), and some words were repeated as pictures (WP), or vice versa (PW). Paivio found that items presented as either WP or PW were better recalled than items presented as WW or PP.

Paivio's results can be explained with reference to the control conditions. Besides the three conditions noted above, some items were presented only once: words (W) or pictures (P)—and not repeated. Words or pictures that were presented only once were used as the baseline recall rate. One might assume, then, that if those words or pictures were presented twice, the recall rate would be double the baseline rate. In fact, that is not the case. The repetition in the WW or PP condition had only a small additive effect on recall; it did not double performance on recall. Conversely, in the PW and WP conditions, the repetition in the different channels had a fully additive effect on memory,

doubling recall. Therefore, there is a cognitive advantage for processing items both pictorially and verbally.

Chapter Summary

In sum, Chapter 2 has so far reviewed four areas of research. Firstly, it discussed the advantage of studying with pictures over translations in novel word learning and noted the lack of research in this area. Secondly, it examined how perceptual features of words are processed: specifically, how perceptual (and consequently, conceptual) facilitation can be maximized from study to test. Thirdly, it outlined how conceptual features are processed: specifically, how words or pictures facilitate subsequent processing of both words and pictures. Finally, it showed how the benefits of conceptual processing are additive if information is presented both verbally and pictorially. In terms of L2 vocabulary learning, all these findings are relevant to the present study. Because of the processing facilitations and advantages described above, in the present study novel words will be presented to learners both pictorially and verbally, so that learners may benefit from them.

The Present Study

The present study builds on previous psycholinguistic studies of form and meaning processing (some of which are reviewed above) in order to investigate the processing of word form and word meaning by novice L2 learners. The present study has two goals.

The first goal is to investigate the effectiveness of a common L2 vocabulary learning strategy—using pictures to teach new L2 words. In doing so, the present study attempts

to simulate a common learning technique. Learners do not always go through multiple tasks and tests when they want to learn a new L2 word. They often have access to a picture and its referent word in the L2 and attempt to memorize the word and its meaning by looking at both. And then they briefly test themselves by looking at only the word form and trying to mentally produce the image (or meaning), and then looking at only the picture and trying to mentally produce the word form. Consequently, the present study attempts to simulate this typical procedure in an experimental setting and test its effectiveness for the learning of word form and word meaning. Therefore, the second goal of the present study is to measure how well learners are able to retain knowledge of word form, and retain knowledge of word meaning. The focus on the learning of both aspects of word knowledge separately (word form and word meaning) is a critical feature that sets this study apart from much previous work. The present study is guided by the following research questions.

1. When adult Spanish beginners attempt to learn a set of novel Spanish words presented as words along with their referent pictures in a brief learning task, how closely will Spanish beginners approach Spanish-English bilinguals in terms of performance on a task that measures knowledge of word form?
2. Similarly, how closely will the Spanish beginners approach Spanish-English bilinguals in terms of performance on a task that measures knowledge of word meaning?

In order to address these research questions, a two-stage design (consisting of a study phase and a test phase) is used. All items are presented in the visual modality, and all words are novel words in the participants' L2. The participants are native English

speakers who are true beginners of Spanish, and high-proficiency Spanish-English bilinguals who are similarly fluent in both Spanish and English.

The study phase involves three tasks. In the first task, target words are presented along with their referent pictures for participants to learn. In the second and third tasks, the goal is to reinforce participants' learning of the novel words. Therefore, in the second task participants' attention is drawn to conceptual processing by first presenting a word, then having participants mentally predict the picture (silently, in their minds), and then presenting the referent picture above its word. In the third task, participants' attention is drawn to perceptual processing by first presenting a picture, then having participants mentally predict the word (silently, in their minds), and then presenting the referent word below its picture.

There are two test tasks in the test phase: one measure draws on knowledge of word form (perceptual), the other (conceptual) measure draws on knowledge of word meaning (i.e., the development of a form-meaning connection). The perceptual measure is a reaction-timed recognition task where participants are presented with the set of target words from the study task (OLD) along with a set of distracter words (NEW). Participants are required to decide (as quickly as possible) if the items presented are OLD or NEW. This is a perceptual measure as it requires only that participants remember the form from the study task: an understanding of the word is not necessary. If participants retain information about the form of the words they learned in the study phase, they should do two things. Their response latencies and accuracies should approach those of highly proficient Spanish speakers. Moreover, they should show a significant priming effect, responding faster to OLD words than to NEW ones.

The conceptual measure is a reaction-timed translation task based on Altarriba and Mathis (1997) where participants are presented with a set of translation trials. Each trial involves a stimulus Spanish word, followed by a target English word. Participants are required to decide—as quickly as possible--if the English word is a correct translation of the stimulus Spanish word. The English word could be one of three types: (1) a correct translation; (2) a semantically associated translation; or (3) an incorrect translation. This task provides a conceptual measure as it requires that participants understand the meaning of the Spanish word in order to make a correct judgment about the English word. Once again, if participants retain information about the meaning of the words they learned in the study phase, they should do two things. First, their response latencies and accuracies to the correct English translations should approach those of Spanish-English bilinguals. And second, they should respond significantly more slowly to incorrect but semantically associated translations than to incorrect translations, as the semantically associated items should produce an interference effect. The interference effect is a sign that participants have made form-meaning connections (i.e., connections between the L2 word and its concept), as opposed to only L1-L2 lexical connections (see Altarriba & Mathis, 1997; Kroll & Stewart, 1994). The mechanism underlying this interference effect shall be further expounded in Chapter 5 (Discussion).

To the author's knowledge, no study has investigated the effectiveness of presenting pictures with their referent words in a decontextualized study phase involving true beginners of an L2. Furthermore, no study has focused on the acquisition of a word's form and meaning separately in the same study. Therefore, the current study is an attempt to address these two shortcomings in the L2 vocabulary acquisition literature.

CHAPTER 3

METHODOLOGY

Chapter Overview

In this chapter, a description of the participants, materials, and procedures is outlined for the present study. First, the participants will be discussed in terms of selection criteria, language backgrounds and language proficiencies. Second, the materials used in the present study will be outlined. Third, the experimental procedure used in the present study will be described. And finally, the methods of data analyses will be given and dependent variables will be described.

Participants

Selection of Participants

Thirty-seven participants took part in the present study in return for a small monetary compensation ($10). The participants' mean age was 28.6 years. (One participant's dataset was excluded because this participant failed to meet the selection criteria described below. Specifically, after the experiment was finished, it was discovered that this participant had had some familiarity with Spanish prior to the study. Therefore, the following sections, and the remaining chapters, will be based on the data from the remaining 36 participants.) All participants (21 females and 15 males) were recruited from the Concordia University Sir George Williams campus in downtown Montreal. The participants were recruited in two ways: through posters advertising the study, and the

researcher asking participants and acquaintances if they knew any people that fit the selection criteria for the study.

Two groups of participants were recruited: a group of native English true beginners of Spanish, and a group of Spanish-English bilinguals. Only those participants who answered the pre-screening questions satisfactorily qualified for the present study.

The experimental group included native English speakers (i.e., English speakers whose first language learned was English, and whose dominant language was English for their entire lives). In order to qualify for the study, the native English speakers had to answer two sets of pre-screening questions (for a total of five questions), one set about their parents and one set about themselves.

In terms of their English, the participants in the experimental group had to answer 'yes' to the following two questions: (1) Are you, and have you always been, a native English speaker throughout your life? and (2) Are one or both of your parents native English speakers whose dominant language has been English throughout most their lives? In terms of their Spanish, participants had to answer 'no' to the following three questions: (1) Have you ever taken Spanish lessons? (2) Have you ever been to a country where Spanish is a primary language? and (3) Do you know any simple, common, every day Spanish words? Therefore, in order to qualify for the present study, the native English participants had to have become fluent in English before any other language, had to have had English as their dominant language for their entire lives, could not have ever had any Spanish lessons, could not have ever been to a country where Spanish is the primary language, and not could not have known simple Spanish words. These measures were taken to ensure that the participants' were true Anglophones and that their level of

Spanish proficiency was as close to being true beginner as possible. (However, as will be discussed below, a post-experimental questionnaire revealed that some participants did in fact have some prior knowledge of some Spanish words used in this study, although very few words were known.) Herein, the experimental group of English true beginners shall be referred to as either *Spanish beginners*, or simply *beginners*.

The control group consisted of Spanish-English bilinguals. These participants had to self-report to be similarly fluent in Spanish and English. The bilingual participants had to answer 'yes' to the following two pre-screening questions: (1) Are you equally, or almost equally, proficient and comfortable in Spanish and English? and (2) Would you enjoy living in a country that only speaks *English/Spanish* (i.e., their non-dominant language) for the rest of your life if the right circumstances presented themselves? These measures were taken to ensure that the bilingual participants were similarly fluent in Spanish and English. Therefore, in order to qualify for the present study, the Spanish-English bilinguals had to report to be similarly fluent in Spanish and English (see self-ratings below), and had to report to be able to enjoy living in a country that spoke their non-dominant language (which was true not just through self-reports, but *behaviourally* for 17 out of 18 participants as, at the time of the study, they were living not in Spanish countries, but in Montreal English communities). Herein, the control group of Spanish-English bilinguals shall be referred to as either *Spanish-English bilinguals*, or simply *bilinguals*.

Participants' Geographical Language Backgrounds

A language background questionnaire was completed by all participants (Appendix A; for the Spanish-English bilinguals, the page entitled "Language" was completed twice,

once for Spanish and once for English). The questionnaire was created by Marian, Blumenfeld, and Kaushanskaya (2007). Marian et al. compared the results of participants' self-evaluations on this questionnaire to objective language measures and found a significant correlation. Therefore, for the purposes of this study, this questionnaire was taken to accurately represent the language history of the participants, and adequately represent the participants' proficiencies. All questionnaire data was entered by the researcher into specialized word processing documents provided by Marian et al. This was done by reading the question to the participants (who read along), and entering their answers.

The Spanish beginners consisted of native English speakers with a fairly uniform geographical background. The native English speakers (10 females, 8 males; mean age: 29.9; range: 15.9-47.1 years) were all residents of Montreal at the time of testing. Fourteen participants were born and raised in Canada. The 4 remaining participants were born in English speaking countries other than Canada: one participant was born in Bermuda and moved to Canada at the age of 17; another participant was born in England and moved to Canada at the age of 13; another was born in the U.S. and moved to Canada at the age of 20; and another was born in South Africa and moved to Canada at the age of 21. When asked about traveling or living in non-English speaking countries for extended periods of time, only one participant (different from the 4 immediately above) lived in a non-English speaking country (France) for 1 year at the age of 24.

The Spanish-English bilinguals consisted of Spanish-English speakers who were mostly immigrants and visiting students to Canada from Central and South America. The bilinguals (11 females, 7 males; mean age: 27.4; range: 22.3-41.3 years) were all

residents of Montreal at the time of testing. Seventeen participants were born and raised in Spanish-speaking countries: 8 were born in Mexico, 4 were born in Columbia, 2 were born in Venezuela, 1 was born in Nicaragua, 1 was born in Panama, and 1 was born in El Salvador. The remaining participant was born and raised in Canada. At the time of testing, the Spanish-English bilinguals had lived in Spanish-speaking countries for an average of 21.4 years (range: 2.5-37 years; range without the participant who was born in Canada: 10-37 years). The bilinguals lived in English-speaking countries for an average of 7.4 years (range: 0.7-19 years).

Participants' Exposural Language Backgrounds

In the Spanish beginner group, all participants answered the selection criteria questions (above) in a satisfactory manner for inclusion in the present study as native speakers. In terms of their questionnaire responses, all participants described themselves as being native English speakers since birth, and as having English as their dominant language throughout their lives. One participant, however, was exposed to an extra language at birth, although never became fluent in it. This participant was born in Canada of Korean parents and spent the first two years of life in a Korean and English environment. But his dominant language became English, and has remained so until the present study.

When Spanish beginners were asked how much they were currently exposed to the English language (compared to other languages) in terms of a weekly percentage, the average exposure rate was 69.7% (range: 30%-100%). Such rates are reasonable given the bilingual (French and English) and multicultural nature of the city of Montreal. Moreover, all participants described both of their parents as being native English

speakers whose dominant language had been English throughout most of their lives. In the case of the participant with Korean-Canadian parents (above), he indicated that since his Korean parents have resided in Canada for a majority of their lives, English has been their dominant language for the majority of their lives.

In terms of the Spanish beginners' Spanish background, all participants indicated that they had never taken any Spanish courses. Furthermore, they also indicated that they had never been to a Spanish-speaking country. And finally, all participants described themselves as knowing no (or almost no) Spanish words. It should be noted, however, that many indicated that they knew the word 'sí' (Spanish word for 'yes'), Corona (the Mexican beer), and 'cerveza' (Spanish word for 'beer', although most participants said that they were not certain about what it meant). Also, some participants indicated that they knew the word 'casa' from the popular Montreal restaurant 'Casa del Popolo' but were not sure what it meant. In addition, some participants indicated that they believed that they knew no Spanish words but could not be one hundred percent certain that they had not encountered a few words throughout their lifetime. All experimental participants indicated that they were currently--and had been throughout their lives—exposed to the Spanish language at a weekly rate of 0% of the time (compared to other languages).

In the Spanish-English bilingual group, all participants answered the selection criteria questions (above) in a satisfactory manner for inclusion in the present study as Spanish-English bilinguals. That is, all participants said that they were equally, or almost equally, proficient and comfortable in both English and Spanish. Furthermore, they indicated that they would feel comfortable living in a country where only their non-dominant language (i.e., English or Spanish) was used for the rest of their lives.

In terms of the Spanish-English bilinguals' Spanish background, 16 participants described themselves as being native Spanish speakers since birth whose dominant language had been Spanish for most of their lives. One participant described himself as being a native Spanish speaker since birth, but had come to be equally dominant in Spanish and English. Another participant was a native English speaker since birth whose dominant language had been English all of her life. This participant indicated that she began learning Spanish at the age of 15, and became fluent by the age of 22. She then met her future husband (a native Spanish speaker from Panama), and had used Spanish extensively inside and outside the home until the age of 28 at the time of the present study, almost becoming unable to choose a dominant language. When asked how much the bilinguals were exposed to Spanish in terms of a weekly percentage (compared to other languages), the average exposure rate was 24.3% of the time (range: 1%-60%). These values are reasonable given that the Spanish speakers reside in the bilingual (French and English) and multicultural city of Montreal.

In terms of the Spanish-English bilinguals' English background, all participants were currently exposed to English inside and outside the home. With the exception of the participant who was raised in Canada, all (17) Spanish-English bilinguals were non-dominant in English. When asked how much they were currently exposed to English in terms of a weekly percentage (compared to other languages), the average exposure rate was 53.3% of the time (range: 15%-90%). Once again, with the exception of the participant who was raised in Canada and who was dominant in English from birth, the remaining 17 participants indicated that they began to learn English at the mean age of 8.1 years (range: 4-18), and became fluent in English by the mean age of 13.8 years

(range: 5-22). It was also indicated that the bilinguals had resided in a country where English was a primary language for a mean of 7.7 years (range: 0.7-19), and had been in a school or work environment where English had been the primary language for a mean of 6.2 years (range: 0.7-19).

Participants' Language Proficiency Self-Evaluations

In order to determine the participants' language proficiencies, participants were asked to rate their language proficiencies in three areas: speaking, understanding spoken speech, and reading. Each rating was on a proficiency scale between 0 ("none"; i.e., no knowledge of the language) to 10 ("perfect"; i.e., can use the language perfectly).

In terms of the Spanish beginner group's self-rated English proficiencies, the mean rating for speaking was 10 (*SD*: 0), the mean rating for understanding spoken speech was 10 (*SD*: 0), and the mean rating for reading was 10 (*SD*: 0). In terms of the beginner group's self-rated Spanish proficiencies, the mean rating for speaking was 0 (*SD*: 0), the mean rating for understanding spoken speech was 0 (*SD*: 0), and the mean rating for reading was 0 (*SD*: 0). These results are not surprising given the pre-screening questions which were designed to screen for native English speakers with no knowledge of Spanish.

In terms of the Spanish-English bilingual group's self-rated Spanish proficiencies, the mean rating for speaking was 9.9 (*SD*: 0.4; range: 9-10), the mean rating for understanding spoken speech was 9.9 (*SD*: 0.2; range: 9-10), and the mean rating for reading was 9.9 (*SD*: 0.2; range: 9-10). In terms of the bilingual group's self-rated English proficiencies, the mean rating for speaking was 8.5 (*SD*: 1.0; range: 7-10), the mean rating for understanding spoken speech was 9.1 (*SD*: 1.0; range: 7-10), and the

mean rating for reading was 9.1 (*SD*: 0.9; range: 7-10). These results suggest that the Spanish-English participants were highly proficient bilinguals, although more dominant in Spanish than English. A summary of participant background and proficiency variables appears in Table 1.

Table 1

Background and Language Proficiency Characteristics of Participants in the Two Groups

Measure	Group			
	Beginners (n = 18)		Bilinguals (n = 18)	
	M	*SD*	*M*	*SD*
Chronological age[a]	29.9	9.8	27.4	4.7
Current English exposure[b]	69.7	15.9	53.3	22.6
Current Spanish exposure[b]	0.0	0.0	24.3	17.9
English Proficiency				
English speaking[c]	10.0	0.0	8.5	1.0
English understanding of spoken speech[d]	10.0	0.0	9.1	1.0
English reading[e]	10.0	0.0	9.1	0.9
Spanish Proficiency				
Spanish speaking[c]	0.0	0.0	9.9	0.5
Spanish understanding of spoken speech[d]	0.0	0.0	9.9	0.2
Spanish reading[e]	0.0	0.0	9.9	0.2

[a]In years. [b]Measured as a percentage of current weekly life in relation to other languages (includes speaking, listening, reading and writing). [c]Measured on a 10-point scale (0="My ability to speak is *none*", 10="My ability to speak is *perfect*"). [d]Measured on a 10-point scale (0="My ability to understand spoken language is *none*", 10="My ability to understand spoken language is *perfect*"). [e] Measured on a 10-point scale (0="My ability to read is *none*", 10="My ability to read is *perfect*").

Apparatus

All participants were tested in the Concordia University Sage Laboratory, located in Concordia's Hall building on the Sir George Williams campus. The measures were

performed on a PC computer, using E-Prime (Schneider, Eschman, & Zuccolotto, 2002). E-Prime psychological presentation software allows researchers to create priming tasks in which presentation and reaction times of target items can be carefully controlled, measured and recorded. During the task, participants used two well-identified keyboard keys for all input. Therefore, only the computer screen and keyboard were used for the experiment (the questionnaire data were entered on a separate PC).

Materials

Word Selection

The materials used in the present study included one set of pictures and five sets of words. In terms of study task materials (and each test task), there was a set of 26 Spanish target words (Appendix B), and a set of 26 Spanish target pictures (Appendix C). For the episodic recognition task (perceptual processing), there was a set of 26 Spanish distracter words (Appendix D). For the translation test task (conceptual processing), there was a set of 26 English translations (of the Spanish target words), a set of 26 English incorrect distracter words, and a set of 26 English incorrect distracter words which were semantically associated to the Spanish target words (Appendix E). In the following paragraphs, each set is discussed individually.

For the purpose of clarification, it should be noted at this point that three studies have been used in choosing the target materials for the present study. Snodgrass and Vanderwaart (1980) originally produced a set of line drawings which they standardized in English for picture naming, picture familiarity, and picture complexity. Sanfeliu and Fernandez (2004) used those same line-drawings and standardized them in Spanish for

picture naming, picture familiarity, and picture complexity. Rossion and Pourtois (2004) added color to those same line drawings and standardized them for picture familiarity and picture complexity. Thus, the present study used the colored picture data from Rossion and Pourtois, the Spanish line-drawing names (words) from Sanfeliu and Fernandez, and the English line-drawing names (words) from Snodgrass and Vanderwaart.

Firstly, the target material included a set of 26 Spanish words of two or three syllables in length chosen by the author to represent common concrete nouns that beginner learners would typically learn (e.g., *pero* = dog, *dedo* = thumb, *cama* = bed). The words were chosen to satisfy four criteria. For the first criterion, the words had to be represented among a set of standardized pictures from Sanfeliu and Fernandez (2004). The second criterion was that the words could not be cognates of English or French words (i.e., words with similar spelling; although the present study was performed with native English speakers, many participants [n = 17] had some knowledge of French). The third criterion was that the words had to be similar in letter length (M = 5.3; SD = 1.1; range: 4-7) so that shorter or longer words were not rendered more salient than the average. And the fourth criterion was that the frequencies of the Spanish words had to be within a narrow range ($\log_{10}$ frequency M = 1.2; SD = 0.3; range: 0.7-1.8; based on Juilland & Chang-Rodriguez, 1964) so that, once again, more frequent or infrequent words were not rendered more salient than the average.

Secondly, the set of 26 Spanish target word pictures were used (also in the study task). The pictures were taken from Rossion and Pourtois (2004). The picture familiarity ratings were based on a scale of 1 to 5 (1 = *a very unfamiliar object*, 5 = *a very familiar object*), and had a range of 2.4-3.9 (M = 4.0; SD = 1.1). The picture complexity ratings were also

based on a scale of 1 to 5 (1 = *drawing very simple*, 5 = *drawing very complex*), and had a range of 1.2-3.9 (M = 2.5; SD = 0.8).

Thirdly, a set of 26 Spanish distracter words was used (in the episodic recognition task, in addition to the Spanish target words). The Spanish distracters were selected by three native Spanish speakers (not participants) to represent common Spanish concrete nouns that were not used as target words in the present study (e.g., *milk, doll, dress*), and were matched to the Spanish target words for mean frequency and letter length. In terms of frequency ($\log_{10}$), the Spanish distracters had a mean of 1.2 (SD = 0.3; range: 0.7-1.8) compared to the Spanish targets mean of 1.2 (SD = 0.3; range: 0.7-1.9). In terms of letter length, the Spanish distracters had a mean of 5.4 (SD = 0.9), compared to the Spanish targets mean of 5.3 (SD = 1.1).

Finally, three sets of English words were used (in the translation task, in addition to the Spanish target words). The three sets of English words used in the translation task were matched for overall word frequency and letter length. A set of 26 English correct translations (of the Spanish target words) was taken from Snodgrass and Vanderwaart (1980), and had a word frequency ($\log_{10}$) mean of 1.5 (SD = 0.4; Kucera & Francis, 1967) and letter length mean of 4.5 (SD = 1.2). Next, a set of 26 English semantically associated translations to the Spanish target words was selected by the researcher; these words were chosen from several published word association norms (Battig & Montague, 1969; Hunt & Hodge, 1971; Postman & Keppel, 1970), and had a word frequency ($\log_{10}$) of 1.7 (SD = 0.6) and letter length mean of 4.5 (SD = 1.2). And finally, a set of 26 English incorrect translations (unrelated to Spanish target words) was created by the researcher to represent

common concrete nouns (e.g., *eye, house, knife*), which had a word frequency (log_{10}) mean of 1.7 (*SD* = 0.5) and letter length mean of 4.5 (*SD* = 0.8).

Procedure

General Outline

The testing was performed individually in a small room (approximately 3 x 2 m) that had only one light switch, which ensured a consistent environment and background lighting across all participants. Each testing session lasted approximately 60 minutes. Participants were seated in front of a laptop computer and all instructions were given in English.

The entire experiment consisted of the following order of events: the signing of ethics forms, the completion of the scientific integrity form, the performance of the study task, the completion of a background questionnaire (distracter task), and the performance of the two test tasks (episodic recognition task, and translation task).

Before the study phase, participants were read an ethics form stating their rights as participants; they then signed the form if they desired to participate (no participant declined). Next, participants completed a scientific integrity form (see Appendix F). A scientific integrity form was utilized in the present study because of a concern about participant motivation during the study phase. In genuine learning situations, learners would exhibit a natural curiosity when attempting to learn new words; therefore, it was important to attempt to re-create this genuine curiosity in the lab. The study phase (as described below in more detail) had participants attempting to learn new words passively in a somewhat inauthentic laboratory setting; that is, they were instructed to look at the

computer screen and attempt to learn the new words without, for example, writing anything, performing any task, or hitting any keys on the keyboard. It was thought, therefore, that some participants might simply not try to learn the new words, only passively looking at the computer screen without much attention or mental effort. No doubt, instructing participants to perform mental activities did not guarantee that they would do so. Nor could the compensation for the experiment ($10) because participants knew they would be paid for their participation, not for the amount of effort they exercised. Therefore, a scientific integrity form was created based on psychological principles of persuasion (see below) which was meant to increase participant attention and effort during the study phase.

The primary principle on which it was based was the psychological principle of commitment and consistency, which states that once people have committed to something, they are more likely to feel an internal desire to be consistent with that commitment (Cialdini, 2001). The integrity form had participants commit themselves to being honest, effortful, and in favor of participating in research that would positively affect students of second languages. It was thought that completing this form would engage participants' internal desire to be consistent with what they committed to. Within this line of reasoning, the form employed two other proven psychological tactics to improve its effectiveness.

After signing their name, participants copied a short text about scientific integrity in their own handwriting. This was done based on a series of arguments by Cialdini (2001). Cialdini showed that people are more likely to act in a consistent manner after they made

a commitment in their own handwriting, compared to a commitment in the form of a verbal agreement.

Furthermore, the form was filled with integrity words similar to what would be found in an honour code. Mazar, Amir and Ariely (2007) found that by priming participants with ethical messages, the participants were more likely to act honestly in a subsequent task designed to measure honesty. Because of this, the integrity form of the present study was designed to simulate an ethical honour code by using words such as *honestly, integrity, active,* and *positive*, to affectively prime an ethical message before the study phase.

Thus, it was believed that having participants sign and fill out a scientific integrity form would increase their levels of attention and effort in the study task to a degree that would ideally approximate the curiosity of language learners in language classrooms. (Interesting future research could assess this claim by comparing two groups of participants when passive tasks are used during study phases: one group that signs integrity forms, and the other that does not.)

Study Phase

Participants were asked to sit in front of the computer to begin the three part study phase. Before the first study task began, the experimenter gave the following directions:

> "Throughout this part you do not need to touch any buttons; just focus as much as you can on learning the new words in Spanish. You will see 26 pictures above their referent Spanish words: these are the 26 target items. It is your job to learn each word and what it means to the best of your ability."

The researcher then left the room. In this first part of the study phase, the 26 target words were presented below their referent pictures. Each target word with picture was presented for 7 seconds, automatically, one after another (i.e., participants did not press any key) in a list randomized for each participant. After the first study part was concluded, the researcher re-entered the room to explain the second part:

> "In this second part, you will see the same 26 words with the same referent pictures, but in a different order. However, this time the word will be presented and then the picture will be added. It is your job to predict the picture in your mind before it appears on the screen."

The researcher then left the room. In this second part of the study phase, instead of each target word appearing with its picture for 7 seconds, the target word first appeared for 3 seconds, during which time participants had to mentally predict the correct picture, then the picture was added to the target word for an additional 4 seconds (for a total of 7 seconds). Once again, the task proceeded automatically (i.e., participants did not press any key), and the list was randomized for each participant. After the second study part was concluded, the researcher re-entered the room to explain the third part:

> "In this third part, you will see the same 26 words with the same referent pictures again in a different order. However, this time, the picture will be presented first, and then the word will be added. It is your job to predict the word in your mind before it appears on the screen."

The researcher then left the room. This third part was the same as the second part, but the word and picture were presented in the opposite order. First the picture was presented for 3 seconds, during which the participant had to mentally predict the correct word, then the

word was added to the picture for an additional 4 seconds (for a total of 7 seconds). Once again, the task proceeded automatically (i.e., participants did not press any key), and the list was randomized for each participant.

The purpose of the 2nd and 3rd presentations (featuring the same pictures and words presented in different random orders) was to provide the participant with more opportunity to process and learn the target items. One reason for asking participants to mentally predict pictures from words, and words from pictures, was to add a learning focus to both the conceptual aspect of a word (predict picture) and the perceptual aspect of a word (predict word). A second reason was to attempt to simulate natural learning conditions. In the author's experience, when students are in a classroom (and they probably behave similarly at home) with a picture dictionary (or a workbook with pictures and words), it is common for them to do a few things. They often look at the picture and its referent word to initially learn the word. Then, as a quick and simple learning strategy, they refer back to the word and try to remember the picture, or conversely, they refer back to the picture and try to remember the word. Therefore, the study task in the present experiment was designed to approximate a common quick and easy learning strategy used by beginners (anecdotal evidence also suggests that learners of many other subjects and levels use this strategy in their studies).

Distracter Task – Language Background Questionnaire

Once the study phase was completed, participants were asked to answer a series of questions in the language background questionnaire (described above). The questionnaire was administered after the study phase in order to clear participants' short-term memory

before the test tasks. It took approximately 15 minutes, on average, for participants to complete the questionnaire.

Test Phase

Episodic Recognition Task

After the language background questionnaire was completed, participants moved on to the first test task. The first (perceptual) test task, known as episodic recognition, had participants react to words according to whether or not they saw them in the study phase. In other words, if a word appeared on the screen that was seen in the study phase (OLD), participants pressed the "m" key (*yes*) on the keyboard. Contrarily, if a word appeared that was not seen in the study phase (NEW), participants pressed the "c" key (*no*). Each key was clearly labeled with large, different colored stickers.

Thus, the episodic recognition task proceeded as follows. Words appeared on the screen, one by one, for a period of 1500 ms or until the participant pressed a button, whichever was shorter. If participants did not respond within 1500 ms, they received a warning screen for 500 ms which displayed the message, *Too slow. Respond faster!* A blank screen appeared between each trial for 500ms. No feedback was given after each answer, or at the end of the task. All participants were instructed to use their index fingers to respond, and to keep their fingers lightly touching the keys during testing.

The episodic recognition task had a practice session before the test session. The practice was comprised of 2 Spanish target words (*clavo* [nail] and *dedo* [thumb]) and 2 Spanish distracter words (*horno* [furnace], *cuna* [cradle]), arranged alternately, in a fixed order for all participants. Once the practice session was completed, participants had the opportunity to ask the researcher questions. No participant reported any difficulties

understanding and performing the task. The episodic recognition test task then began and was comprised of 24 target and 24 distracter words, arranged randomly for each participant, for a total of 48 items. The task's duration (not including the practice session or instructions) was approximately 70 seconds. By including the language background questionnaire and the practice session, there was, on average approximately 18 minutes between the end of the study phase and the beginning of the episodic recognition task.

Translation Task

Once the first (perceptual) test (episodic recognition) was completed, participants immediately moved on to the second (conceptual) test: the translation task. In this task, participants responded to words according to whether or not the two words presented in series were correct translations. In other words, participants had to decide if an English word was the correct translation of the Spanish word that preceded it. If they believed that the English word was the correct translation, they pressed the "m" key (*yes*) on the keyboard. Contrarily, if they believed that the English word was not the correct translation, they pressed the "c" key (*no*). Thus, the first word in the sequence shall be called the *Spanish word*, while the second shall be called the *English target.*

The translation task proceeded as follows (based on the task used by Altarriba & Mathis, 1997). A Spanish word appeared for 500 ms, and was immediately followed by an English target for up to 1500 ms. The English target remained on the screen for 1500 ms or until the participant pressed a key, whichever was shorter. If participants did not respond within 1500 ms, they received a warning screen for 500 ms which displayed the message, *Too slow. Respond faster!* Feedback was given after each a response. Correct responses were followed by a screen for 500 ms with the word *Correct!*, while incorrect

responses were followed by a screen for 500 ms with the word *Error!*. A blank screen appeared between each trial for 500 ms. The test items within each task were randomized for each participant. All participants were instructed to use their index fingers to respond, and to keep their fingers lightly touching the keys during testing. The translation task had a practice task before the test task.

The translation practice task was comprised of 2 sessions. Each session used the same two Spanish targets, but different English responses. Two short sessions were administered for three reasons: first, to allow participants sufficient practice and familiarity with the task, it was deemed that 4 trials were necessary; second, there was a need to maximize the number of target test words at 24--the same as the episodic recognition task--so only 2 target words could be used in the practice session; and third, using the same words twice within the same session (which never occurs in the test task) might have changed participant expectations of the test task; therefore this was not done. In other words, compared to the episodic recognition practice task (which used 2 target words and 2 distracters), the translation practice task needed a Spanish word for each trial, and since only 2 were available, they had to be repeated, but in two different practice sessions so as not to give the impression that some Spanish target words would be repeated in the same session. The same 2 Spanish target words (*clavo* and *dedo*) that were used in the episodic recognition task practice session were used in the translation task practice session as well. Participants had the opportunity to ask the researcher questions about the translation task after each of the first and second practice sessions. No participant reported any difficulties understanding and performing the task.

The English translations were one of three categories: a correct translation (e.g., *cama* [bed] – *bed*), a semantically associated translation (e.g., *cama* [bed] - *sleep*), or an incorrect translation (e.g., *cama* [bed] - *wagon*). Therefore, in the translation task there were 24 Spanish words (from the study session), 8 English correct translations, 8 English semantically associated translations, and 8 English incorrect translations. The English words were counterbalanced across participants by creating 6 different lists, which made 6 conditions. Participants were randomly assigned to one of the 6 conditions. The presentation order of the Spanish-English word pairs was randomized for each participant, within each condition. The duration of the translation task was approximately 60 seconds. There was, on average, approximately 22 minutes between the end of the study phase and the beginning of the translation task.

Word Knowledge Check

Once the test phase was completed, participants were given a word knowledge check (see Appendix G). The word knowledge check was a list of all Spanish target words. Participants were instructed to place a mark beside each Spanish target word (from the study phase) that they had known or seen before the present study. If a participant marked that she knew what a word meant before the present study, that word was discarded from the analysis. Moreover, if a participant marked that she had previously seen a word (even if she did not know what it meant), that word was discarded from the analysis. Thus, if a participant knew the form or the meaning of a word before the present study, that word was discarded from the analysis reported in Chapter 4 (Results). The mean number of target words known by participants prior to performing the present study is 1.6 (*SD* = 1.5).

Design

Research Design

A mixed factorial design was used in this study. The between-participant variable was group (Spanish beginners, Spanish-English bilinguals), whereas the within-participant variable was condition: word type (old, new) in the episodic recognition task, and translation type (correct, semantically associated, incorrect) in the translation task. The order of the test tasks (episodic recognition, translation) was not counterbalanced between participants because of the nature of the tasks. The episodic recognition task measured knowledge of word form only, giving no extra input as to the meaning of the target words. On the other hand, the translation task measured knowledge of word meaning, but also reinforced knowledge of word form simply by presenting the words to participants. Therefore, if some participants had performed the translation task first, they would have had the added advantage of seeing the word form one extra time before they performed the episodic recognition task. Contrarily, by performing the episodic recognition task first, participants did not have the extra advantage of seeing the meaning of the target words before they performed the translation task.

Dependent Variables

For both test tasks, there were two primary dependent variables: response latency and response accuracy. In the episodic recognition task, the response latency was defined as the length of time (in milliseconds) between the onset of the stimulus word and the participant key response. The response accuracy in this task was defined as the number of stimulus words which were correctly identified as having been seen in the study phase. In the translation task, response latency was defined as the length of time (in milliseconds)

between the onset of the English word (i.e., correct translation, semantically associated translation, or incorrect translation) and the participant key response. The response accuracy in this task was defined as the number of stimulus pairs which were correctly identified as Spanish-English translations.

Data Analysis

Measurement

All presentations of stimuli and measurements of dependent variables (response latency and accuracy) were done by the *E-Prime* program, which has the ability to simultaneously present stimuli and record responses to those stimuli.

Data Tabulation

The data were tabulated separately for each participant within each group (Spanish beginners, Spanish-English bilinguals), for each test (episodic recognition, translation), and for each condition (old and new words in episodic recognition; correct, semantically associated, and incorrect translations in translation). Within each test cell, the data were tabulated separately for response latency (to correct responses only) and response accuracy. By tabulating the data in this manner, it was possible to compare the response latencies and accuracies (in each condition) between language groups. In other words, the Spanish beginners (who learned new Spanish words) could be compared to the Spanish-English bilinguals (who already knew the Spanish words) in terms of response latency and accuracy on both the perceptual (episodic recognition) and conceptual (translation) tasks.

As noted above, target words that were indicated as being known by participants before the present study were not included in the final analyses (M = 1.6; SD = 1.5). Furthermore, in both test tasks (episodic recognition and translation), response times under 200 ms or above 1500 ms were treated as outliers and not included in the final analysis (Altarriba & Mathis, 1997). In terms of the episodic recognition task, the average number of response outliers was 1.4 (SD = 1.9) for the beginners, and 1.8 (SD = 1.9) for the bilinguals. In terms of the translation task, the average number of response outliers was 0.3 (SD = 0.8) for the beginners, and 0.1 (SD = 0.3) for the bilinguals.

In addition, in both test tasks (episodic recognition and translation), response times that exceeded 2.5 standard deviations above or below the mean for each participant were replaced by the value at 2.5 standard deviations above or below the participants' mean (Altarriba & Mathis, 1997). In terms of the episodic recognition task, the average number of responses that were replaced in this manner was 1.0 (SD = 0.8) for the beginners, and 1.3 (SD = 0.7) for the bilinguals. In terms of the translation task, the average number of responses that were replaced was 0.6 (SD = 0.6) for the beginners, and 0.6 (SD = 0.5) for the bilinguals.

Statistical Analyses

Response latency and response accuracy scores based upon subject tabulation of the data were submitted to a series of analyses of variance (ANOVAs) and/or t-tests. In all ANOVAs and t-tests, alpha (α) was set at .05. Significant main effects and interactions were explored using Bonferroni tests when necessary (t-tests with α adjusted for number of pairwise comparisons, Dunn, 1961).

CHAPTER 4

RESULTS

Main Objectives and Hypotheses

The overall objective of the present study was to determine the effectiveness of using pictures to teach L2 words to true beginners. Therefore, the overall research question was the following: When Spanish beginners attempt to learn a set of novel Spanish words presented as words along with their referent pictures in a brief learning task, how closely will the beginners approach bilinguals in terms of performance on measures of word knowledge? Two measures of word knowledge were administered: one which measured knowledge of word form, and the other which measured knowledge of word meaning.

Word Form

Thus, one specific objective was to determine participants' knowledge of word form. To do this, an episodic recognition task was administered first. In this task, participants were presented with, and responded to, a series of words from one of two sets: words from the study phase (OLD), and distracter words (NEW). The goals of this task were to examine (1) how closely the beginners would approach Spanish-English bilinguals in terms of performance (reaction time and accuracy) on a task that measures knowledge of word form and (2) to what extent each group would exhibit a priming effect for previously viewed words (i.e., a significant difference in processing speed between OLD words and NEW words). In the episodic recognition task, the knowledge of word form was operationalized in two ways. Response latency was recorded as a measure of processing speed (i.e., how fast participants were able to recognize word forms), and

response accuracy was recorded as a measure of accuracy (i.e., how accurately participants were able recognize word forms).

Word Meaning

Another specific objective was to determine participants' knowledge of word meaning. To do this, a translation task was also administered. In this task, participants were presented with, and responded to, a series of trials each involving two items: a Spanish word (all from the study phase) followed by an English word (the correct translation, a semantically associated translation, or an incorrect translation). The goals here were to examine (1) how closely the beginners would approach Spanish-English bilinguals in terms of performance (reaction time and accuracy) on a task that measures knowledge of word meaning and (2) to what extent each group (especially the Spanish beginners) would show an interference effect from the semantically similar words in the translation task (i.e., exhibit significantly slower responses to the translations that are semantically similar to the target words, compared to incorrect translations). In the translation task, word knowledge was also operationalized in two ways. Response latency was recorded as a measure of processing speed (i.e., how fast participants were able to recognize trials that had correct or incorrect Spanish-English translations), and response accuracy was recorded as a measure of word knowledge (i.e., how accurately participants identified word meanings that had been in the study phase).

Learning of Word Form

Response Latency

For the episodic recognition task, which measured knowledge of word form, the response latency data of the Spanish beginners (n = 18) and Spanish-English bilinguals (n = 18) were submitted to a two-way analysis of variance (ANOVA). The between-subjects variable was group (beginner, bilingual), and the within-subjects variable was condition (OLD, NEW). The mean response latencies are listed in Table 2.

Table 2

Response Latencies for the Beginner and Bilingual Groups

	Beginner		Bilingual	
Word type	*M*	*SD*	*M*	*SD*
New[a]	820.8	114.6	836.1	88.1
Old[b]	795.3	93.8	790.1	88.5
Priming	25.5		46.1	

Note. Response latency data are in milliseconds. [a]Correct responses to distracter (i.e., "new") words. [b]Correct responses to target (i.e., "old") words.

The ANOVA yielded a significant main effect for condition, $F(1, 34) = 11.26, p = .002$, but no significant main effect for group, $F(1, 34) = .03, p = .87$, and no significant group x condition interaction, $F(1, 34) = .93, p = .34$. This suggests that the beginners were as fast as the bilinguals at processing both the OLD and the NEW words, and that overall both groups processed OLD words faster than NEW words. Therefore, it appears that after learning a set of novel Spanish words presented as words along with their referent pictures in a brief learning task, at least in terms of processing speed, beginners perform as well as bilinguals on a task that measures knowledge of word form.

Furthermore, both groups exhibited a priming effect as both groups processed OLD words faster than NEW words (see Table 1).

Response Accuracy

For the episodic recognition task, which measured knowledge of word form, the response accuracy data of the beginner group (n = 18) and bilingual group (n = 18) were submitted to a two-way ANOVA. The between-subjects variable was group (beginner, bilingual) and the within-subjects variable was condition (OLD, NEW). The mean response accuracies are listed in Table 3.

Table 3

Response Accuracies (out of 24) for the Beginner and Bilingual Groups

	Beginner		Bilingual	
Word type	*M*	*SD*	*M*	*SD*
New[a]	21.8	2.0	22.3	1.5
Old[b]	20.5	2.5	22.9	0.8

[a]Correct responses to distracter (i.e., "new") words. [b]Correct responses to target (i.e., "old") words.

The ANOVA yielded a significant main effect for group, $F(1, 34) = 11.42, p = .002$, and a significant group x condition interaction, $F(1, 34) = 5.15, p = .03$, but no significant main effect for condition, $F(1, 34) = .64, p = .43$. The significant interaction was explored further using tests of simple main effects (Bonferroni corrected $\alpha = .0125$). These tests revealed a significant difference between the beginners and bilinguals for OLD words, $t(34) = 3.94, p < .0001$, but not for NEW words, $t(34) = .93, p = .36$. These results suggest that the beginners were not as accurate as the bilinguals in responding to

OLD words, but were as accurate as the bilinguals in responding to NEW words. In addition, these tests showed no significant differences within each of the two groups in their processing of OLD versus NEW words: $t(17) = 1.63, p = .12$, for the beginners, and $t(17) = 2.47, p = .05$, for the bilinguals. These results suggest that both the beginners and the bilinguals were equally as accurate at responding to OLD and NEW words.

Summary

In sum, in terms of knowledge of word form, the response latency and response accuracy data suggest two broad conclusions. First, it can be said that when adult Spanish beginners attempt to learn a set of novel Spanish words presented as words along with their referent pictures in a brief learning task, and then perform a task that measures knowledge of word form, the beginners process target words as quickly as Spanish-English bilinguals. However, the beginners are not as accurate as the bilinguals at identifying target words (although the beginner accuracy rate is still very high). Second, both the beginners and the bilinguals exhibit a priming effect, responding faster to previously learned words than to new words.

Learning of Word Meaning

Response Latency

For the translation task, which measured knowledge of word meaning, the response latency data of the Spanish beginners ($n = 18$) and the Spanish-English bilinguals ($n = 18$) were submitted to a two-way repeated-measures ANOVA. The between-subjects variable was group (beginner, bilingual), and the within-subjects variable was condition

(correct translation, semantically associated translation, incorrect translation). The mean response latencies are listed in Table 4.

Table 4

Response Latencies in the Beginner and Bilingual Groups

	Beginner		Bilingual	
Translation type	*M*	*SD*	*M*	*SD*
Correct	734.4	173.6	632.1	98.5
Sem. Associated	844.2	162.6	767.1	117.0
Incorrect	790.2	169.8	694.6	114.5

Note: Response times are in milliseconds.

The ANOVA revealed a significant main effect for group, $F(1, 34) = 4.16, p = .049$, a significant main effect for condition, $F(2, 68) = 19.79, p < .0001$, but no significant group x condition interaction, $F(2, 68) = .473, p = .63$. The significant main effect of group indicates that overall the bilinguals responded faster than the beginners in all conditions. To explore the significant main effect of condition further, three follow-up pairwise comparisons were carried out separately for each participant group (Bonferroni corrected $\alpha = .008$).

For the beginners, there were significant differences between correct translations and semantically associated translations, $t(17) = 6.08, p < .0001$, between correct translations and incorrect translations, $t(17) = 3.19, p = .005$, and between semantically associated translations and incorrect translations, $t(17) = 4.85, p < .0001$. Taken together, these results suggest that the beginners responded fastest to correct translations, followed by incorrect translations, and slowest to semantically similar associates.

For the bilinguals, there were also significant differences between correct translations and semantically associated translations, $t(17) = 5.11, p < .0001$, between correct translations and incorrect translations, $t(17) = 3.11, p = .006$, and between semantically associated translations and incorrect translations, $t(17) = 3.32, p = .004$. Taken together, these results suggest that the bilinguals also responded fastest to correct translations, followed by incorrect translations, and slowest to semantically associated translations.

Response Accuracy

For the translation task, which measured knowledge of word meaning, the response accuracy data of the Spanish beginner group ($n = 18$) and Spanish-English bilingual group ($n = 18$) were submitted to a two-way repeated measures ANOVA. The between-subjects variable was group (beginner, bilingual), and the within-subjects variable was condition (correct translation, semantically associated translation, incorrect translation). The mean response accuracies are listed in Table 5.

Table 5

Response Accuracies (out of 8) for the Beginner and Bilingual Groups

	Beginner		Bilingual	
Translation type	*M*	*SD*	*M*	*SD*
Correct	6.9	1.2	7.7	0.5
Sem. Associated	6.2	1.3	7.2	0.7
Incorrect	7.4	0.9	7.8	0.6

Note: Response accuracies are for correct responses.

The ANOVA revealed a significant main effect for group, $F(1, 34) = 11.08, p = .002$, a significant main effect for condition, $F(2, 68) = 11.76, p < .0001$, but no significant group x condition interaction, $F(2, 68) = 1.11, p = .34$. The significant main effect for

group indicates that overall the beginners were not as accurate as the bilinguals. To explore the significant main effect of condition further, three follow-up pairwise comparisons were carried out separately for each participant group (Bonferroni corrected $\alpha = .008$).

For the beginners, pairwise comparisons revealed a significant difference between semantically associated translations and incorrect translations, $t(17) = 5.78, p < .0001$, but not between correct translations and semantically associated translations, $t(17) = 1.83, p = .09$, or between correct translations and incorrect translations $t(17) = 1.33, p = .2$. Thus, these results suggest only one difference between conditions: the beginners were more accurate in response to incorrect translations than to semantically associated translations.

For the bilinguals, pairwise comparisons revealed a significant difference between correct translations and semantically associated translations, $t(17) = 3.0, p = .008$, but not between correct translations and incorrect translations, $t(17) = .62, p = .54$, or semantically associated translations and incorrect translations, $t(17) = 2.65, p = .02$. Thus, the bilinguals were more accurate in response to correct translations than to semantically associated translations.

Summary

In sum, in terms of knowledge of word meaning, the response latency and response accuracy data suggest two broad conclusions. First, when adult Spanish beginners attempt to learn a set of novel Spanish words presented as words along with their referent pictures in a brief learning task, and then perform a task that measures knowledge of word meaning, the beginners do not process target words as fast as the bilinguals. Moreover, the beginners are not as accurate as bilinguals at identifying correct translation

pairs (although the beginner accuracy rate was still high). Second, in terms of the presence of a semantic interference effect, results have shown that both the beginners and the bilinguals exhibit this effect (i.e., slower response times to semantically similar pairs, compared to incorrect translation pairs). The fact that the beginners showed this interference effect suggests that they had learned enough about the meaning of the target words to be distracted by semantically associated, yet incorrect, L1 translations of these words.

Chapter Summary

To summarize, this chapter has shown several findings. These findings came from the results of two test tasks (episodic recognition, translation) that measured word knowledge retained from a study task that presented participants with a set of novel Spanish words along with their referent pictures. In terms of knowledge of word form (episodic recognition), the beginners processed words as quickly as the bilinguals, but not as accurately (although the beginners' accuracy was still high). Furthermore, both the beginners and the bilinguals exhibited a priming effect (i.e., faster response to previously seen words than to new words). In terms of knowledge of word meaning (translation), the beginners did not process words as quickly or accurately as the bilinguals (although the beginners' accuracy was still high). More importantly, however, both the beginners and the bilinguals exhibited a semantic interference effect (i.e., slower response times to semantically associated translations, compared to incorrect translations), suggesting that the beginners learned something about the meanings of new L2 words to the extent that a

semantically associated L1 translation produced a statistically significant interference effect.

CHAPTER 5

DISCUSSION

The first overall goal of the present study was to determine the effectiveness of using pictures to learn novel L2 vocabulary. To achieve this goal, beginner-level learners of Spanish and Spanish-English bilingual controls were presented novel L2 words in a study phase, and were tested on their knowledge of these novel words in a test phase. The second overall goal of the present study was to measure two separate aspects of word knowledge (word form and word meaning). To achieve this goal, an episodic recognition task was administered to measure participants' knowledge of word form, and a translation task was administered to measure participants' knowledge of word meaning. Both word knowledge tests were chosen because, besides providing a measure of accuracy (i.e., correct responses to previously learned words), they both measured processing speed (i.e., how fast participants recognize and respond to previously learned words).

Processing of Word Form

In order to determine the effectiveness of using pictures to learn novel L2 words, one objective of the present study was to measure participants' knowledge of word form. For this objective, two research questions were posed. Firstly, how closely would the beginners approach Spanish-English bilinguals in terms of performance on a task that measures knowledge of word form? And secondly, to what extent would each group

exhibit a priming effect for previously seen words (i.e., significantly faster processing of previously seen words compared to new words)?

To answer these questions, an episodic recognition task was administered which asked participants to identify words as being from the study phase (OLD) or not (NEW). Participants had to recognize previously learned words. Knowledge of word form was operationalized in terms of response latency (i.e., processing speed) and response accuracy.

Beginners' Processing of Word Form

In terms of response latency on the episodic recognition task, no significant difference was found between the beginners and the bilinguals. This result suggests that after only 21 seconds of study time per target word, the Spanish true beginners were able to process novel word forms just as quickly as highly proficient Spanish-English bilinguals. In fact, 17 out of 18 bilingual participants indicated that Spanish was their native, and dominant, language and throughout most or all of their lives. Consequently, an even stronger argument could be made. Namely, as far as response latency is concerned, it appears that after only minimal exposure beginners are capable of recognizing newly learned word forms in a native-like manner. This result is of particular interest given that the language learners had no previous knowledge of the L2 (Spanish).

In terms of response accuracy, the beginners were significantly less accurate than the bilinguals on target word forms. However, a closer inspection of the actual response accuracy rates (beginners: $M = 20.5$; bilinguals: $M = 22.9$) puts this finding into perspective. Although significantly different, these means clearly show that the beginners are approaching the bilinguals in response accuracy. Given the qualification that the

bilinguals had encountered these common nouns innumerable times throughout their lives, and that the beginners spent only 21 seconds learning each word, a mean accuracy score of 20.5 out of a possible 24 word forms is noteworthy. Thus, to answer the first research question, the response latency and accuracy data show that after only a brief learning session, the beginners were able to process novel word forms as quickly, and almost as accurately, as the bilinguals.

An important question to ask, then, is how the beginners were able to recognize the previously seen words so quickly. Several possible explanations can be put forward. Firstly, the processing demands of the study task may have favored formal encoding. As was shown by Kolers (1975) in the written modality, L1 participants produced more word forms at test when their focus was on word forms at study than when their focus was on word meaning at study. This finding was confirmed with L2 participants by Trofimovich and Gatbonton (2006) in the auditory modality. The authors found that low-intermediate L2 learners with low pronunciation accuracy benefited from repetition of phonological form (Experiment 1), but that this benefit was only present when a focus on meaning at study was avoided. In other words, a focus on meaning at study removed the perceptual processing benefits. Thus, learners in the present study may have focused more of their processing resources on the forms of words at study, which resulted in largely formal encoding.

Unfortunately, this explanation is difficult to support in the present study because of the results of the translation task. The beginners must have allocated a significant amount of their processing resources to the meanings of words as they were almost as accurate in the translation task as the bilinguals (beginners: $M = 6.9$; bilinguals: $M = 7.7$, out of a

possible 8). Consequently, it is difficult to support the argument that the study task favored formal processing to the detriment of conceptual processing.

A second possible explanation for the beginners' native-like processing speed of novel word forms may lie in the effectiveness of the procedure for learning novel L2 word forms. That is, perhaps presenting pictures with their referent words in a repeated fashion is a powerful learning technique. Indeed, as mentioned above (Chapter 2), Kopstein and Roshall (1954) found that novel word forms were better recalled (written) at test when they were presented with their pictures at study, rather than with their L1 translations. Similarly, Wimer and Lambert (1959) found that nonsense word forms were better recalled at test when they were presented with their physical objects at study, rather than words. As with the present study, both of these studies involved short learning phases with participants who had no knowledge of the L2. Although these two studies included recall of target words (production) as a test task (while the present study involved recognition), the two studies are pertinent to the present discussion because they elicited knowledge of word form, and they both reveal the effectiveness of using pictures in novel word learning.

In fact, as Laufer et al. (2004) showed, being able to produce a word form is a more advanced form of word knowledge than being able to recognize a word form. Consequently, it may be the case that the use of pictures to learn novel L2 word forms is such a powerful learning technique that differences between beginner and bilingual processing speeds would only begin to emerge in a task that measured the more advanced level of *production* of word form. More research is needed to assess this possibility.

A third possible explanation for the beginners' native-like recognition latency may be due to an episodic recognition task effect. In an experiment involving L1 speakers, Duchek and Neely (1989) showed that in an episodic recognition task, low-frequency words were responded to significantly faster than high-frequency words. They attribute this finding to the fact that, in a study phase, low-frequency words are more salient within a list. Thus, the salient words are more quickly recognized in the episodic recognition task.

This frequency effect can therefore help to explain the present study's results. In the case of the beginners, the target words learned in the study phase were of extremely low frequency; that is, the beginners had not perceived these words innumerable times before the present study. In fact, they only experienced these words on three occasions, all during the study phase in the current experiment, making the target words extremely salient in the episodic recognition task. In comparison, in the case of the bilinguals, the target words were of high frequency; that is, the bilinguals had perceived these words innumerable times before the present study. Consequently, the words used here as targets may have been rendered by the study task as being slightly more salient for the beginners than for the bilinguals.

A fourth possible explanation may be that the combination of an effective study task (i.e., using pictures and mentally predicting both the word form and the concept), and an episodic recognition task effect (i.e., faster recognition for low-frequency words) resulted in the beginners processing novel words as quickly as the bilinguals. The two factors may have produced a combined effect. But although this explanation seems to be the most plausible, only further research could determine if this is indeed the case.

Priming

The second research question about knowledge of word form asked whether the beginners and bilinguals would exhibit a word priming effect; that is, whether they would process OLD words significantly faster than NEW words. Results in fact revealed that both the beginners and the bilinguals exhibited a priming effect (although the magnitude of priming was larger for the bilingual group). This finding is in line with previous research with L2 speakers.

Trofimovich (2005), for example, had intermediate Spanish speakers listen to a set of previously known (i.e., known before the study task) Spanish words at study. In the test task, participants were presented with a list of words that included OLD words and NEW words and had to orally name each word as it appeared. A priming effect was observed as voice onset to OLD words was significantly faster than voice onset to NEW words. One key difference with the present study, however, was that the words were previously known.

Another example of word form priming comes from, Kirsner, Smith, Lockhart, King, and Jain (1984), who showed that English L2 learners of French with 10 years of L2 experience exhibited visual word-priming effects. The authors used a lexical decision task (respond to items as words or nonwords) and found that repeated L2 words were responded to faster than unrepeated L2 words. Once again, the key difference with the present study is that the target words were previously known.

Consequently, the priming results of the present study are in line with previous L2 research on perceptual processing. However, the present study's results also extend two areas of L2 perceptual priming research. First, results have shown a perceptual priming

effect with L2 target words that were not known prior to the experiment (i.e., target words were novel words learned in a study phase). This finding is in agreement with L1 studies showing that repeated novel nonwords and pseudowords are responded to faster than unrepeated novel nonwords and pseudowords, respectively (e.g., Stark & McClelland, 2000). And second, the present study's results show that a perceptual priming effect can be exhibited even when the study task involves conceptual processing. Interestingly, this finding may contradict the results of Trofimovich and Gatbonton (2006), who found that a focus on meaning at study eliminated perceptual priming.

The presence of a perceptual priming effect at test may not be dependent upon the presence of conceptual processing at study. For example, the participants in Trofimovich and Gatbonton were asked to rate the pleasantness of target words. This processing manipulation was deemed to increase conceptual processing of target words. It may have been the case, then, that participants focused on conceptual aspects of target words *to the detriment* of perceptual aspects, which resulted in no priming effect. On the other hand, in the present study the participants were asked to learn new words by looking at the words and their pictures and to separately mentally predict the word form and its concept. Therefore, although the study task used in the present study involved a considerable amount of conceptual processing, it explicitly asked participants to process words both conceptually *and* perceptually. In other words, it appeared that the study task used in the present study emphasized *both* perceptual and conceptual processing, without emphasizing one kind of processing to the detriment of the other. Thus, it would seem that the mere presence of increased conceptual processing at study is not sufficient to eliminate perceptual priming at test. It appears that the perceptual priming effect is

eliminated when there is a lack of perceptual processing at study. Clearly, these claims need to be tested in further research, particularly in studies that directly compare both the production of word forms (as in Trofimovich and Gatbonton) and also their recognition (which was the case here).

Summary

In sum, after a study task that presented novel L2 words with pictures, the beginners were able to recognize word forms as quickly and almost as accurately as Spanish-English bilinguals. One plausible explanation for this finding may be a combination of two factors: that the study task included a procedure which allowed for effective encoding of word form, and that because of the salience of the novel words to the beginners (but not to the bilinguals), the beginners may have been able to respond faster in the episodic recognition task (see Duchek & Neely, 1989). Also, both the beginners and the bilinguals exhibited a priming effect. This finding is in line with previous L2 perceptual research and extends research in L2 perceptual processing in two ways. First, the present study found a perceptual priming effect for novel words (as opposed to previously known words). And second, it showed that the mere presence of conceptual processing at study might not be enough to eliminate priming.

Processing of Word Meaning

In order to determine the effectiveness of using pictures to learn new words, another objective of the present study was to measure participants' knowledge of word meaning. For this objective, two research questions were asked. The first research question asked how closely the beginners would approach Spanish-English bilinguals in terms of

performance on a task that measures knowledge of word meaning. And the second question asked to what extent each group (especially the Spanish beginners) would show an interference effect to the semantically similar words in the translation task (i.e., exhibit significantly slower responses to the semantically associated translations compared to the incorrect translations)?

To answer these questions, a translation task was administered; in this task, participants were asked to decide if English and Spanish word pairs were correct translations of each other. Knowledge of word meaning was operationalized in terms of response latency (i.e., processing speed) and response accuracy.

Beginners' Processing of Word Meaning

In terms of response latency in the translation task, a significant difference was found between the beginners and the bilinguals. Therefore, after 21 seconds of learning time per word, beginners were not able to process correct translation pairs as quickly as bilinguals. This is not a surprising result, given that the bilinguals had many years of exposure to both languages which helped them strengthen the links between the words and their concepts.

In terms of response accuracy, the bilinguals were shown to be more accurate than the beginners on the correct translation pairs. This is also not surprising, given that the beginners only just learned a set of 26 novel Spanish words. However, a closer inspection of each group's response accuracy for correct translation pairs (beginners: $M = 6.9$; bilinguals: $M = 7.7$ out of a possible 8) indicates that the beginners were approaching the bilinguals in accuracy.

Thus, to answer the first research question, the response latency and accuracy data show that after a brief learning session, the beginners were not able to process correct translation pairs as quickly or as accurately as the bilinguals; however, the beginners did *approach* the bilinguals in accuracy.

An important question to ask, then, is how the beginners were able to correctly identify almost 7 out of 8 correct translation pairs after only a brief study task. Several potential explanations can be put forward. The first explanation one could pose would be to say that the requirements of the study task favored conceptual encoding. This explanation, however, is not fully tenable because the beginners also encoded word form to the extent that they responded as quickly and almost as accurately as the bilinguals in the episodic recognition task. Therefore, the beginners' high accuracy must not have been due to a larger focus on meaning (to the detriment of form) in the study task.

The second explanation involves how pictures and words are processed. To explain how pictures and words interact in memory, Paivio (1971) proposed the dual-coding hypothesis. According to this hypothesis, the mind processes pictorial and verbal information separately, and each processing channel has a limit on the amount of information it can process at one time. However, because the channels are separate, the information processed in each channel can be added. For example, one can only remember x number of items in the verbal channel, and y number of items in the pictorial channel; these numbers are limited by short-term memory. However, if one processes items in both the verbal and pictorial channels, one can remember x plus y items. This specific phenomenon is known as the additivity hypothesis (Paivio, 1975).

Some specific evidence for the additivity hypothesis was presented in Chapter 2. To recapitulate, Paivio (1975) showed that repeating items as both pictures and words (i.e., using both the pictorial and the verbal channels) had an additive effect on participants' recall, doubling the recall rate in comparison to pictures and words presented alone. This finding is relevant to the study task used in the present study. The study task involved the presentation of pictures with their referent words. By presenting items in pictorial and verbal media, novel items were encoded in both the pictorial and verbal channels. Thus, the present results may be explained in light of this additivity effect for congruent items processed in different channels. In other words, presenting words along with pictures in the study phase helped create relatively strong memory traces for the target words and to encourage the creation of form-meaning links. But although the present results can be adequately interpreted in light of the additivity hypothesis, the present results do not necessarily lend support to this hypothesis, primarily because no comparison was made to novel items presented only as words along with their L1 translations. Therefore, it cannot be concluded that the strong beginner performance was necessarily due to dual-coding or the additivity effect per se. Because no strong conclusion in this area can be reached, it is worth exploring another line of reasoning that may explain how learners successfully encoded target words and their concepts in the study task.

Another potential explanation for how the beginners were able to so closely approach the bilinguals in translation task accuracy involves the role of mental imagery. In the study phase, the pictures with their referent words were not simply displayed together in each of the three blocks. In the first block, the pictures were simultaneously presented with their referent words. But in the second block, the word form was presented first, and

the participants had to *mentally imagine* the picture before it appeared; and in the third block, the picture was presented first, and the participants had to *mentally imagine* the word form before it appeared. So the study was not as simple as perceiving repeated instances of pictures with their referent words. The participants had to actively create mental images of the word forms and concepts. It is possible, then, that it was not the pictures themselves that led to the high translation task accuracy, but the act of mentally imagining word forms and pictures. For the present study, it is important to at least consider this possibility for two reasons. First, no other study has used a similar study task involving active mental imagery in novel L2 word learning, and second, no control condition (one that did not ask participants to actively create mental images) was used in the present study.

The L2 study that is relevant here is Pichette (2002), who sought to examine the role of mental imagery in L2 word learning. Pichette presented participants with a set of novel words on slides, one time for 6 seconds each, and instructed them to learn the words. However, Pichette did not compare a picture-target word and a translation-target word condition. Instead he chose to compare four conditions with differing numbers of items on each slide: translation-target (A, two items), translation-target-pronunciation (B, three items), translation-target-picture (C, three items), and translation-target-picture-pronunciation (D, four items). On a free recall test, results showed no difference between conditions with pictures and conditions without pictures. However, in performing this analysis, Pichette collapsed the two picture conditions (C, three items and D, four items) and the two non-picture conditions (A, two items and B, three items) together. By collapsing these conditions together into two large groups, the author created groups that

are difficult to compare because each condition had different input types and different input quantities.

Having a different number of items is relevant because it creates a difference in cognitive load (Sweller, 1988) between the two conditions. As Sweller aptly describes it, cognitive load theory stipulates that the more short-term memory is used during a learning experience, the less someone is able to learn. Therefore, it could be the case that the advantage that the pictures created was simply offset by the extra cognitive load involved in processing more items at one time (e.g., translation-target-picture-pronunciation vs. translation-target-pronunciation). For a similar interpretation of Pichette's findings, see Leutner, Leopold and Sumfleth (2009).

Nevertheless, Pichette's results highlight mental imagery as a potentially interesting mitigating factor in word learning. However, his results cannot be taken as evidence that mental imagery is as powerful as pictures in novel L2 vocabulary learning because of confounding study task conditions. Thus, future research needs to include conditions that are controlled in terms of input type and input quantity.

Semantic Interference Effect

The second research question related to the participants' performance on the translation task asked whether participants (especially the beginners) would exhibit a semantic interference effect (i.e., increased response latency to semantically associated translations compared to incorrect translations). Recall that in the translation task, participants saw pairs of Spanish and English words and had to decide if the pairs were correct translations. Each Spanish word presented was a target word from the study phase, while each English word was either a correct translation, a semantically associated

translation, or an incorrect translation. In fact, both the bilinguals and the beginners in the present study exhibited the semantic interference effect. This finding is in line with previous L2 research on the learning of word meaning.

The present study used the same translation task as Altarriba and Mathis (1997), who also found that both bilinguals and true L2 beginners identified semantically associated translation pairs significantly slower than incorrect translations pairs. This semantic interference effect can be explained as follows. When people learn new words, they develop links between the lexicon and the conceptual system. Such links include not only direct connections between a word (e.g., *cama*) and its semantic referent (*bed*) but also links between this word and similar, but not necessarily identical, concepts and meanings (e.g., sofa, chair, table). In native speakers (or bilinguals), the interference effect is evidence of connections between words and concepts because extra processing time is required to recognize that the semantically associated word is not the correct translation. In the case of the beginners, if they do not develop links between the novel L2 word and the conceptual system, then seeing a semantic associate would not result in extra processing time because there is no semantic connection that needs to be processed. Consequently, if the beginners show increased processing time—as they did in the present study—it is evidence that they develop at least some connections between words and the conceptual system (see Altarriba & Mathis, 1997, for theoretical justifications of this effect).

Thus, the presence of a semantic interference effect in the beginner group is further evidence—along with beginner response accuracies approaching those of bilinguals—for the effectiveness of using pictures in a study task as they serve to strengthen the links

between words and their concepts. Consequently, the semantic interference results of the present study are in line with previous L2 research on conceptual processing. However, the present study's results also extend one area of L2 conceptual processing research. Specifically, these results show that links can be developed between novel L2 words and their concepts in true beginners after a study task that is relatively brief.

Although similar results were obtained in the study by Altarriba and Mathis (1997) and in the present study, the study task used in the present study was seemingly more efficient. Altarriba and Mathis subjected their Spanish true beginner participants to an intense learning session involving three sections of three parts each. In each section, participants learned 12 target words by seeing them presented as translation equivalents on a screen, then performing a matching quiz and receiving feedback on the results, then performing a second quiz and receiving feedback on the results. After all three sections of three parts each were completed, an overall quiz was administered and the results discussed with the participants to insure maximum word knowledge. In fact, participants had to score 90% or better on the final overall quiz for their data to be considered in the final analysis, and Altarriba and Mathis reported that they had to exclude the data from at least 32 participants because they had failed to reach that criterion.

Consequently, Altarriba and Mathis' semantic interference effect reflects a long and intense study session. Comparatively, a similar outcome in the present study reflects a very brief study session of only 21 seconds per word, for a total study time of approximately 6 minutes (for 26 words). This finding is important in two ways. First, it is an important theoretical finding because it shows that production tasks are not necessary for beginner learners to be able to conceptually mediate newly learned words. And

second, it is an important finding for pedagogy because of its implications for more efficient learning inside and outside the classroom.

Summary

In sum, after a study task that presented novel L2 words with pictures, the beginners were not able to recognize word meanings as quickly as the bilinguals, but were able to approach the bilinguals in word accuracy. One plausible explanation for this finding may be that memory encoding is enhanced when congruent items are presented both verbally and pictorially (Paivio, 1975). Another possible explanation may be related to the effectiveness of mental imagery in the study task. However, further research is needed to compare different study conditions, especially those that involve and do not involve mental imagery. Also, both the beginners and the bilinguals exhibited a semantic interference effect. This finding is in line with previous L2 research on lexical-conceptual links with true beginners. This finding also extends this previous research as it shows that, in true beginners, words can be effectively linked to their concepts in a very brief learning task.

CHAPTER 6

IMPLICATIONS AND CONCLUSIONS

Chapter Overview

This chapter will begin by discussing the theoretical implications of the present study. Firstly, it will examine psycholinguistic implications for models of bilingual memory. Secondly, it will discuss pedagogical implications in terms of L2 vocabulary acquisition research. Pedagogical implications shall be in the areas of decontextualized word learning, picture use, and focus on form and meaning. Thirdly, limitations of the present study which lead to future research will be outlined. Finally, the chapter will conclude with closing remarks.

Implications and Applications

Psycholinguistic Implications

In terms of L2 psycholinguistic research, the present study's findings on form and meaning processing have implications in at least two areas. The first is in the area of how bilinguals organize the lexicosemantic system in their two languages. Originally, Weinreich (1953) proposed three models of bilingualism (*bilingualism* in this context refers to the use of a second language at any proficiency level; this meaning should be distinguished from the use of this term in the present study, which described speakers who were almost equally fluent in a native and a second language). Coordinate bilingualism refers to a lexicosemantic system in which bilinguals' L1 and L2 are each connected to their own separate language-dependent conceptual system. Compound

bilingualism refers to a lexicosemantic system in which bilinguals' L1 and L2 are both connected to a shared conceptual system. Subordinate bilingualism refers to a lexicosemantic system in which bilinguals' L2 is connected indirectly, through the L1, to the conceptual system. (In discussions of bilingual memory storage, the term *lexical memory* is used more frequently than the term *perceptual memory*. Thus, speakers store word forms in lexical memory and word meanings in conceptual memory.)

These original language storage models were later updated to reflect more recent research. For example, Kroll and Stewart (1994; see also Kroll & Sholl, 1992) proposed the Revised Hierarchical Model which incorporated aspects of compound and subordinate bilingualism. This model's principal claim is that lexical memory links between L2 and L1 words are initially stronger (i.e., lexical mediation) than links between L2 words and their concepts (i.e., concept mediation). Hence, as the speaker's exposure and/or proficiency in an L2 increases, so does the strength of the links between the L2 words and their concepts. The Revised Hierarchical Model therefore predicts that newly learned words will be lexically mediated at first and become progressively more conceptually mediated as a speaker's proficiency increases.

In terms of the present study, the fact that the true beginners exhibited a semantic interference effect provides evidence of concept mediation at the lowest level of proficiency. This effect demonstrates that links had indeed been formed between the novel L2 words and their concepts. Thus, these results do not support the predictions made by the Revised Hierarchical Model, which predicts no concept mediation at initial stages of L2 word learning (for a similar finding see Altarriba & Mathis, 1997). It would

seem, then, that any model of bilingual lexical organization will have to account for low proficiency beginners exhibiting concept mediation effects.

The results of the present study are also interesting in light of findings by Jiang and Forster (2001). These authors outline a model of bilingual language storage in which L1 words are stored in lexical memory *and* episodic memory, and L2 words are stored in episodic memory only. The episodic memory in which L2 words are stored, according to Jiang and Forster, is not like the traditional notion of episodic memory as memory for dates and autobiographical events (Tulving, 1972), but more like "*nonlexical memory*...[that] is not specialized for the storage of purely linguistic information" (p. 45). Evidence for this view comes from asymmetrical priming in lexical decision tasks (i.e., identify target as word or nonword) and episodic recognition (i.e., identify target word as previously seen or new). In a set of masked priming experiments (i.e., participants do not consciously see the prime), Jiang and Forster found that L2 translations did not prime L1 target words in lexical decision tasks, but did in episodic recognition. They also found that, in contrast, L1 words primed L2 translations in lexical decision but not in episodic recognition. Because of this asymmetry across the two tasks, the authors reasoned that L2 words were linked to L1 words in episodic memory, but not in lexical memory.

The results of the present study's episodic recognition task also point to a strong episodic component in novel L2 word processing. However, the results of the translation task do not fully support Jiang and Forster's model of L2 word memory. Specifically, the semantic interference effect exhibited by the beginners points to L2 words being conceptually mediated (which would imply a strong lexical component, using Jiang and Forster's terminology). There are several methodological differences between the two

studies that could explain this discrepancy in findings. Firstly, Jiang and Forster's participants were not learning new L2 words in a study task which encouraged a high degree of both perceptual and conceptual processing; they were told to look at and remember previously known L1 words. Secondly, the target words used by Jiang and Forster were abstract nouns whereas the target words in the present study were concrete nouns. Previous research has shown that concrete nouns are recognized and translated faster than abstract nouns (de Groot, 1992; Heredia, 1995). This is known as the *concreteness effect* and its presence may make the comparison between the two studies complicated. Lastly, the translation task in the present study may have imposed a different set of processing demands on participants than did the lexical decision and episodic recognition in Jiang and Forster. Consequently, the findings of both the present study and Jiang and Forster's experiments may not be easily comparable. Further research is needed that examines bilingual lexical storage by comparing a wider set of tasks.

Pedagogical Implications

In terms of L2 vocabulary acquisition research, the present study has pedagogical implications in three broad areas: decontextualized word learning, picture use, and focus on form and meaning. The discussion on decontextualization has two dimensions. The first dimension involves its importance for beginners. Recall from above that beginner learners face a "beginner's paradox" because they have not acquired enough words to understand basic texts (Coady, 1997). In fact, Nation (2006) claims that learners must understand 95-98% of words in a text to attain a level of adequate comprehension. To reach such a level of comprehensibility in most basic texts, Coady argues that learners

must acquire a minimum of 3000 word families. Thus, for beginners to begin to read texts, they must learn a number of words individually. Therefore, the present study attempted to address the needs of beginner learners by creating and testing a decontextualized study task and adding to the research in this area. Consequently, teachers should focus efforts on creating decontextualized L2 word learning activities for low proficiency learners who cannot learn novel written words from texts (for a further discussion of decontextualized methods of word learning, see Nation, 2000; Cobb, 1999; Schmitt, 2000).

The second dimension of the discussion on decontextualization involves its effectiveness. Results of the present study show that after only a brief study task (approximately 6 minutes), learners were able to retain large amounts of word knowledge, at least when tested immediately after the study task. This finding is in line with other studies that have found significant word knowledge gains after decontextualized study tasks (e.g., Laufer, 2003; Qian, 1996). Of course, Qian (1996) and Laufer (2003) differ from the present study in that they showed the superiority of decontextualized learning conditions over contextualized learning conditions. However, unlike Qian and Laufer, the present study compared L2 learners to native speakers and found that the L2 learners performed equally, or almost equally, well on important measures of word knowledge. Thus, it is the comparison to native speakers that sets the present study apart from previous research on the effectiveness of decontextualized L2 word learning. Teachers should therefore understand that decontextualized tasks (besides being necessary for beginners) can be effective for learning new words, and should actively incorporate such tasks into classroom activities.

Another broad area in which the present study has theoretical implications is in the use of pictures in L2 word learning. The present study's results support previous work on the use of pictures in learning tasks (e.g., Kopstein & Roshall, 1954), which show that pictures can be an effective learning tool. In fact, as discussed in Chapter 5, the present study obtained similar vocabulary gain results (on the same measure) as Altarriba and Mathis (1997), but the present study's picture learning task was shorter and simpler than Altarriba and Mathis' learning task. Moreover, the learning task in the present study did not involve practice production or corrective feedback on the target items, whereas Altarriba and Mathis' did. Consequently, although both studies involved decontextualized word learning that resulted in significant vocabulary gains, the present study's vocabulary learning tasks with pictures are potentially more efficient. Overall, then, in terms of picture use, the present study's finding on efficiency can be added to previous research on the superiority of learning words from pictures over translations (see Chun & Plass, 1996; Kopstein & Roshall, 1954) in novel L2 word learning. Although more research is needed to draw more specific comparisons, picture use in L2 vocabulary learning may be more efficient *and* more effective than other methods of learning (at least as concerns beginners learning concrete nouns at the level of recognition).

The present study also has implications for a third broad area of L2 vocabulary research, namely the notion of focus on form. Although this concept is normally used in discussions of L2 grammar acquisition (see Long, 1991), it has been emphasized by Nation (1990) as also being important to the overall vocabulary acquisition process. Although learners' attention is no doubt focused on formal and semantic aspects of words in most types of study tasks, learners may not be explicitly asked to separately study the

form and the meaning of a word. The present study had two out of three study sections that were designed to specifically focus learners' attention on the formal *or* the semantic aspects of words. Thus, it may be beneficial for L2 teachers to emphasize vocabulary tasks that focus on the formal and semantic aspects of words separately, whether explicitly or implicitly.

Summary

In sum, the present study has several psycholinguistic implications for L2 vocabulary research. First, in terms of how bilinguals store their two languages, the present study's results do not support the Revised Hierarchical Model (Kroll & Stewart, 1994). Secondly, in terms of L2 words being stored in episodic memory, results of the episodic recognition task support the involvement of episodic memory in L2 word learning (Jiang & Forster, 2001) whereas results from the translation task do not (they support concept mediation and the involvement of lexical memory in L2 word learning). However, differences in target word type (novel vs. previously known, concrete vs. abstract nouns), learning tasks, and test task processing demands may make comparisons between studies difficult.

Several implications for L2 vocabulary teaching were also discussed. Firstly, the present study tested true beginners to highlight the fact that beginner learners have not acquired enough words to read basic texts (or acquire new words from texts), and classroom activities must at times involve decontextualized learning, even within a communicative language teaching framework. In addition to highlighting the *necessity* for decontextualized L2 word learning in some classrooms, results supported previous research on the *effectiveness* of decontextualized word learning. Furthermore, pictures are an effective tool in L2 word learning; they may at times be *more efficient* than other

methods. Finally, the present study acknowledged the importance of a focus on form in L2 vocabulary acquisition by creating a study task that separately, and explicitly, focused learners' attention on the formal and semantic aspects of words, and suggests that this may be a beneficial endeavour for vocabulary learning in general.

Limitations and Directions for Future Research

The Study Phase

The present study has several limitations, which can be grouped into three categories. The first set of limitations involves the study phase. Pictures were used in the study phase as a method to teach novel vocabulary, but no comparison method was used. The power of the present study would have been increased had there been a condition which compared different methods of word learning (i.e., picture vs. L1 translation, or picture vs. L1 definition). Thus, because the present study did not use other study conditions as a comparison, it is difficult to compare the present results with those of previous L2 vocabulary acquisition studies.

In the second and third sections of the study phase, participants had to mentally predict pictures and words, respectively. It is therefore possible that this act of mental imagery contributed to word learning. However, in the present study, it was not possible to determine how much this mental imagery contributed to word learning. It would have been interesting to set up a learning condition which did not ask participants to mentally predict words. By doing so, it would have been possible to better understand the role of mental imagery compared to simple picture viewing.

Another limitation of the study phase was the type of pictures used: colored line drawings. The line drawings used were the black-and-white Snodgrass and Vanderwart (1980) pictures colored by Rossion and Pourtois (2004). However, real photos and black-and-white line drawings could have also been compared. As Hendersen and Ferraira (2004) argue quite convincingly, the type of visual representation used in tasks matters. They cite numerous eye-tracking studies (studies that track the movements of participants' eyes on a target surface) that show that eye movements differ between photographs, colored pictures, and black-and-white line drawings. The present study's use of colored line drawings was meant to best approximate the types of pictures commonly found in learner exercise books and picture dictionaries. However, learners are also faced with situations where novel words are learned from photographs (or real life situations) and line drawings on blackboards (or whiteboards). Therefore, comparison conditions involving photographs and black-and-white line drawings would surely have yielded interesting psycholinguistic, as well as practical classroom, findings.

Another important limitation of the study phase is based on the physical orientation of the target words and their referent pictures. In the present study, the target words were located directly below their referent picture. But in many popular picture dictionaries this is not always the case. One of the most common series of picture dictionaries on the market in North America (based on Amazon.ca, Chapters.ca, and Google.ca searches) is the Oxford Picture Dictionary series. These dictionaries give each picture a number and list the words at the bottoms of the pages beside their numbers. This means that there is a physical distance between word and picture on each page. In essence, learners have to make the connection between a picture and its referent word located at the bottom of the

page in a list. In several studies of L1 learning, Mayer (2001) has shown that more spatial distance (what he calls the spatial contiguity principle) between written and pictorial information results in less overall learning (as measured by recall and transfer of knowledge tasks). Thus, a limitation of the present study was that it was not possible to compare the dimension of word-picture distance, which would have yielded conclusions relevant to popular picture dictionaries.

The last important limitation of the study phase is the controlled time given to study each word. Each word was studied a total of three times in three different sections. The study time for each word was strictly controlled at 7 seconds. This was done in order to provide an accurate assessment of word learning based on quantified data. But it may be the case that learners in a classroom might spend more or less time on novel words, and time spent may vary between words. This limitation could have been overcome by creating a condition in which all the target words and referent pictures would be shown to participants for a fixed total amount of time, so that participants could learn the words. In this situation, participants themselves would choose how much time to spend on each word. This would no doubt more appropriately mimic a natural classroom setting. Although various other complications could arise (i.e., spending too much time on some words to the detriment of others), this more naturalistic learning condition could be used as an interesting comparison to the more controlled methodology of the present study.

The Test Phase

The second major set of limitations involves the test phase. The test phase included a word recognition task and a translation recognition task. The reason for the use of these two tasks was the main thrust of the present experiment: to attempt to separately measure

knowledge of word form and word meaning at the level of recognition. However, one very common measure of vocabulary knowledge in L2 vocabulary research is recall at the level of production (e.g., Barcroft, 2002). Because participants did not produce any words, it is difficult to compare the results of the present study to a large body of L2 vocabulary research. It would have been interesting to add two other conditions: one in which participants would freely recall target words that were seen in the study phase (form measure), and one in which participants would produce English translations to Spanish target words (meaning measure).

In addition to having no production measure, there was no delayed post-test in the present study. There was approximately fifteen minutes between the end of the study phase and the beginning of the test phase (an intervening language background questionnaire was administered between the two phases). The vocabulary gains in the test phase were strong, but would this have been the case if the participants were tested a day, a week, or a month later? This author has been reluctant to use the word "acquisition" to describe the test phase results because this word may imply longer lasting word knowledge retention. Strong vocabulary gains on a delayed post-test could have lent credence to use of the word "acquisition" when describing the word knowledge gains attained in the present study.

Target Language and Participants

The last major set of limitations involves the selection of study objects and subjects. In terms of study objects, the Spanish language was taught to English true beginners. An important characteristic of this combination of languages is a similar orthography (a similar alphabet although some Spanish letters have accent marks). Therefore, the present

study's results are limited, most narrowly, to English speakers learning Spanish, and most broadly, to learners learning a language which has the same (or highly similar) orthography. Consequently, it cannot be predicted that learners would perform similarly if, for example, English speakers were learning Chinese symbols. Potentially, learners would be exposed to a larger cognitive load in learning new combinations of previously *unknown* orthographic characters (e.g., in the case of learning Chinese) than in learning new combinations of previously *known* characters (e.g., in the case of learning Spanish).

In terms of study subjects, the present study tested true beginners of Spanish who were native speakers of English. Consequently, it is difficult to generalize the findings to true Spanish beginners whose L1 is different. Would French L1 speakers perform differently? What is more, how would more distantly related L1s (i.e., Chinese, Slavic languages) affect performance? More research is necessary to examine other combinations of target L2s and L1s.

Summary

In conclusion, the limitations of the present study can be best explained with reference to the study phase, the test phase, the target language, and the participants, and are the basis for future research. In terms of the study phase, there were no comparison conditions (i.e., translation, definition), the pictures were not of different types (i.e., photographs, black-and-white line drawings), the picture-word distances were not manipulated (as they differ in popular picture dictionaries), and the study time may not have reflected natural conditions. In terms of the test phase, there was no production measure (which is common in L2 vocabulary research), and there was no delayed post-test (which makes it difficult to use the word *acquisition*). As pertains to the target

language and participants, no comparison was made between languages with widely differing orthographies, nor was a comparison made with participants who have different L1s. Future research should address these issues to create a more complete understanding of how L2 learners acquire the forms and meanings of novel words.

Closing Remarks

The present study has provided several theoretical and practical insights into L2 vocabulary acquisition. Perhaps more importantly, several interesting areas of future research can be undertaken to extend the present study's findings. By using psycholinguistic measures, researchers can increase our understanding of what goes on in the minds of L2 learners as they learn, and subsequently retrieve, novel L2 words. One promising area of study in which to use these measures will be with the use of pictures in L2 word learning. Interestingly, studying the effectiveness of pictures with psycholinguistic measures allows researchers to comment on both highly theoretical models of human cognition, and practical benefits in the real world of classroom teaching.

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Appendix A

Language Background Questionnaire

Northwestern Bilingualism & Psycholinguistics Research Laboratory
Please cite Marian, Blumenfeld, & Kaushanskaya (2007). The Language Experience and Proficiency Questionnaire (LEAP-Q): Assessing language profiles in bilinguals and multilinguals. *Journal of Speech Language and Hearing Research, 50* (4), 940-967.

Language Experience and Proficiency Questionnaire (LEAP-Q)

Last Name		First Name		Today's Date	
Age		Date of Birth		Male ☐	Female ☐

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

1	2	3	4	5

(2) Please list all the languages you know 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.
(Your percentages should add up to 100%):

List language here:					
List percentage here:					

(4) When choosing to read a text available in all your languages, in what percentage of cases would you choose to read it in each of your languages? Assume that the original was written in another language, which is unknown to you.
(Your percentages should add up to 100%):

List language here					
List percentage here:					

(5) When choosing a language to speak with a person who is equally fluent in all your languages, what percentage of time would you choose to speak each language? Please report percent of total time.
(Your percentages should add up to 100%):

List language here					
List percentage here:					

(6) Please name the cultures with which you identify. On a scale from zero to ten, please rate the extent to which you identify with each culture. (Examples of possible cultures include US-American, Chinese, Jewish-Orthodox, etc):

List cultures here					
	(click here for scale	(click here for scale	(click here for scale	(click here for scale	(click here for scale

(7) 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:

(8) 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.
_____ _____

(9) 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

This is my (please select from pull-down menu) language.

All questions below refer to your knowledge of .

(1) Age when you ...:

began acquiring :	*became fluem* in :	*began reading* in :	*became fluent reading* in :

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

	Years	Months
A country where is spoken		
A family where is spoken		
A school and/or working environment where is spoken		

(3) On a scale from zero to ten, please select your *level of proficiency* in speaking, understanding, and reading from the scroll-down menus:

Speaking	(click here for scale	Understanding spoken language	(click here for scale)	Reading	(click here for scale

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

Interacting with friends	(click here for pull-down scale)	Language tapes/self instruction	(click here for pull-down scale
Interacting with family	(click here for pull-down scale)	Watching TV	(click here for pull-down scale
Reading	(click here for pull-down scale)	Listening to the radio	(click here for pull-down scale

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

Interacting with friends	(click here for pull-down scale)	Listening to radio/music	(click here for pull-down scale
Interacting with family	(click here for pull-down scale)	Reading	(click here for pull-down scale
Watching TV	(click here for pull-down scale)	Language-lab/self-instruction	(click here for pull-down scale

(6) In your perception, how much of a foreign accent do you have in ?

(click here for pull-down scale)

(7) Please rate how frequently others identify you as a non-native speaker based on your accent in :

(click here for pull-down scale)

Appendix B

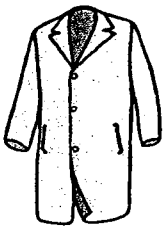
Spanish Target Words in Study Task

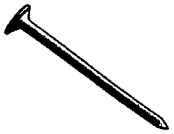
Spanish Target Words	[English Translations]*
coche	[car]
pájaro	[bird]
gato	[cat]
perro	[dog]
ventana	[window]
cama	[bed]
caballo	[horse]
reloj	[watch]
globo	[balloon]
campana	[bell]
vela	[candle]
silla	[chair]
gallina	[chicken]
llave	[key]
hoja	[leaf]
cocina	[stove]
corbata	[tie]
rueda	[wheel]
camisa	[shirt]
caja	[box]
puro	[cigar]
abrigo	[coat]
falda	[skirt]
lápiz	[pencil]
clavo	[nail]
dedo	[thumb]

* *Note*: For informational purposes only (not used in study task)

Appendix C

Target Pictures in Study Task


Appendix D

Spanish Distracters in Episodic Recognition Task

Spanish Target Words	Spanish Distracters	[English Translations of Spanish Distracters]*
coche	diario	[newspaper]
pájaro	granja	[farm]
gato	cajón	[drawer]
perro	nube	[cloud]
ventana	tejido	[tissue]
cama	vestido	[dress]
caballo	leche	[milk]
reloj	jabón	[soap]
globo	espejo	[mirror]
campana	barco	[boat]
vela	muñeca	[doll]
silla	sello	[stamp]
gallina	tienda	[tent]
llave	puente	[bridge]
hoja	espada	[sword]
cocina	pelo	[hair]
corbata	nariz	[nose]
rueda	pierna	[leg]
camisa	boca	[mouth]
caja	aguja	[needle]
puro	águila	[eagle]
abrigo	arroz	[rice]
falda	cuello	[collar]
lápiz	pelo	[dryer]
clavo	horno	[furnace]
dedo	cuna	[cradle]

**Note*: For informational purposes only (not used in episodic recognition task)

Appendix E

English Correct and Incorrect Translations in Translation Task

Spanish Target Words	Correct English Translations	Incorrect Semantically Associated Translations	Incorrect Translations
coche	car	truck	novel
pájaro	bird	fly	gin
gato	cat	mouse	glove
perro	dog	bark	fork
ventana	window	glass	heart
cama	bed	sleep	wagon
caballo	horse	cow	bag
reloj	watch	time	book
globo	balloon	party	woman
campana	bell	ring	corn
vela	candle	light	house
silla	chair	table	earth
gallina	chicken	soup	lamp
llave	key	lock	card
hoja	leaf	tree	desk
cocina	stove	cook	iron
corbata	tie	neck	file
rueda	wheel	round	knife
camisa	shirt	pants	elbow
caja	box	square	camera
puro	cigar	smoke	stick
abrigo	coat	hat	eye
falda	skirt	girl	face
lápiz	pencil	write	mouth
clavo	nail	hammer	monkey
dedo	thumb	tack	sock

Appendix F

Scientific Integrity Form

Scientific Integrity

Name:_____

Signature:_____

Please copy the following statement, in your own handwriting, in the space provided:

As a participant in this study, I agree to try my best. I also believe that scientific research of this kind requires researchers and participants to act honestly and with integrity. I agree to this because I know that the results of this type of study can help students and teachers, and I am happy to play an active role in research with positive goals.

_____

_____

_____

_____

_____

_____

Researcher's signature:_____

Appendix G

Word Knowledge Check

Participant Number:_____

The following words were presented with their pictures at the beginning of this study. If you already knew one or more of these words before this study, please indicate by selecting the appropriate box.

Study Word	I knew this word before this study, but I didn't know what it meant (Please write ***yes*** or ***no***).	I knew this word before this study, *and* I knew what it meant (Please write the **English translation**).
globo		
pájaro		
caballo		
campana		
ventana		
cama		
gato		
reloj		
coche		
perro		
vela		
silla		
gallina		

rueda		
hoja		
cocina		
puro		
llave		
camisa		
clavo		
corbata		
abrigo		
falda		
lápiz		
caja		
dedo		