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THE EFFECT OF SYNTACTIC CONSTRAINTS ON PARALLEL ACTIVATION OF WORDS IN THE BILINGUAL'S LANGUAGES

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Jason William Gullifer

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The thesis of Jason William Gullifer was reviewed and approved* by the following:

Judith F. Kroll
Distinguished Professor of Psychology, Linguistics, and Women's Studies
Director, Center for Language Science
Thesis Co-Advisor

Paola E. Dussias
Associate Professor of Spanish, Linguistics, and Psychology
Associate Director, Center for Language Science
Thesis Co-Advisor

Reginald Adams
Assistant Professor of Psychology and Neurology

Ping Li
Professor of Psychology, Linguistics, and Information Sciences and Technology
Director, University Park Graduate Program in Neuroscience

Janet Van Hell
Professor Psychology and Linguistics
Director, Linguistics Program

Melvin M. Mark
Professor of Psychology
Deptartment Head

*Signatures are on file in the Graduate School.

Abstract

Many recent studies demonstrate that bilingual word recognition is language nonselective in nature. Bilinguals activate information about words in each language in parallel when reading or listening to a word in one language alone (e.g., Dijkstra, 2005; Marian & Spivey, 2003), even if the word is embedded in a sentence context (e.g., Duyck, Van Assche, Drieghe, & Hartsuiker, 2007; Libben & Titone, 2009; Schwartz & Kroll, 2006; Van Hell & de Groot, 2008). Two factors have been identified that effectively eliminate the cross-language effect within sentence context: a highly biased semantic constraint (e.g., Schwartz & Kroll, 2006) and when words differ in grammatical class across both languages (e.g., Baten, Hofman, & Loeys, 2010).

One contextual factor that has been ignored is the presence of language-specific syntactic constraints. In the current study, highly proficient Spanish-English bilinguals read sentences in each language across separate blocks. Half of the Spanish sentences contained syntax that was structurally specific to Spanish in two ways: (a) the indirect object of a ditransitive verb was realized pleonastically with the proclitic le and its corresponding noun phrase, and (b) the grammatical subject of the object relative clause was not expressed overtly (e.g., Las monjas (a)le llevaron las mantas que (b)(pro) habían bordado a la directora del orfanato. [The nuns took the quilts that they had embroidered to the director of the orphanage.]) The English translations were controls in that the initial phrase of the sentence was not syntactically specific to either language. Bilinguals read sentences presented word-by-word and named a target word aloud. Critical target words were language-ambiguous cognates (e.g., bus in English and Spanish), which were matched to a set of unambiguous control words (e.g., hairspray-laca).

The results indicated that language-specific syntactic constraints did not reliably modulate the cognate effect for all bilinguals. This suggests that the bilinguals activated both languages even in sentences with syntactic structure specific to only one language. However, a subset of the bilinguals, those who were dominant in Spanish, did appear to make use of the syntactic constraints to switch off the unintended language. However, there was not sufficient power to find an effect statistically. The current study shows that it may be premature to conclude that language-specific syntactic constraints do not modulate nonselectivity. The implications for models of the bilingual lexicon are discussed.

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Chapter 1

Introduction

Anyone who has had exposure to a second language (L2), even if for a brief amount of time, has likely noticed that the L2 may share some of the same words and lexical features with the first language (L1). For instance, in both Dutch and English the word *hotel* refers to an establishment that provides lodging for guests. The word *hotel* is a cognate in Dutch and English: a translation equivalent that shares similar lexical form in both languages (i.e., orthography and phonology). Words in two languages may also overlap in lexical form without sharing the same meaning; these are called false cognates or homographs. For example, the English translation of the Dutch word *room* is cream. An example with more sinister consequences is the German word for poison: *Gift*. While observations such as these may seem amusing when first learning a new language, it would seem absurd to assume that a proficient German-English bilingual would think of poison upon hearing the English word gift. However, this may not be far from the truth, as recent evidence suggests that bilinguals may not be able to function as the sum of two monolinguals (Grosjean, 1989).

While listening to spoken language, reading written text, or preparing words and sentences to be spoken, the bilingual appears to have both languages active momentarily before the intended language is selected (e.g., Dijkstra, 2005; Kroll & Sumutka, 2005; Marian & Spivey, 2003). Research initially suggested that the dominant L1 was more likely to intrude when bilinguals were performing a task in their weaker L2 (e.g., Dijkstra, Grainger, & Van Heuven, 1999; Dijkstra, Van Jaarsveld, & Ten Brinke, 1998). More recent findings demonstrate that bilinguals' experience with an L2 or even L3 can also influence their performance when completing a task in the more dominant L1 (e.g., van Hell & Dijkstra, 2002). This parallel activation of the two languages has been referred to as *language nonselectivity* and it manifests itself as a cross-language interaction when bilinguals encounter words that are ambiguous across the two languages (e.g., *hotel* or *room* when read by a bilingual who speaks Dutch and English). The observed interactions

are not categorical but can be modulated by the relative degree of cross-language overlap (e.g., Schwartz, Kroll, & Diaz, 2007).

Despite evidence for nonselectivity, under ordinary circumstances bilinguals must eventually select one language to read, hear, or speak. Most of the early studies that have found evidence for language nonselectivity were conducted outside of any meaningful context; participants were required to make decisions about or name single words aloud. Without additional context, lexical ambiguity is at its peak. Thus, parallel activation may be a byproduct of the way in which word recognition experiments are performed rather than a feature of ordinary bilingual language processing. A set of recent studies has asked whether the evidence for language nonselectivity can also be observed within sentence context (Baten et al., 2010; Chambers & Cooke, 2009; Duyck et al., 2007; Libben & Titone, 2009; Schwartz & Kroll, 2006; Van Assche, Duyck, Hartsuiker, & Diependaele, 2009, 2010; Van Hell & de Groot, 2008). Using a range of experimental methods, these studies have converged upon the conclusion that sentence context in and of itself is not sufficient to constrain lexical access to one language. This is true when bilinguals listen to spoken words in the L2 (e.g., Chambers & Cooke, 2009) or read the L2 (Baten et al., 2010; Duyck et al., 2007; Libben & Titone, 2009; Schwartz & Kroll, 2006; Van Assche et al., 2010; Van Hell & de Groot, 2008). Parallel activation of the alternative language has also been observed when bilinguals read words in L1 sentence contexts (Van Assche et al., 2009). If sentence context itself cannot constrain language selection, then other factors must be doing so.

In typical language use, a sentence contains words grouped together in order to express a meaning. Two important and distinct aspects of this characterization are the meaning of the sentence (the semantics) and the rules that govern the ordering of words in the sentence (the syntax). Both the semantics and the syntax can impose restrictions or constraints on upcoming words in a sentence. For example, the sentence *John kept his gym clothes in the locker* imposes a semantic restriction; the semantic context of the sentence (established by gym clothes) makes the word locker more predictable. This sentence is said to have a high semantic constraint. In such highly constrained contexts, monolingual readers experience facilitated processing of the target word *locker* (e.g., Schwanenflugel & LaCount, 1988; Stanovich & West, 1983). For bilinguals, semantic constraints may play a role in assisting with the selection of the intended language. When bilinguals read sentences with a high semantic constraint, they tend to access language-ambiguous words as if they were words in only the language of the sentence (e.g., Libben & Titone, 2009; Schwartz & Kroll, 2006; Van Hell & de Groot, 2008). That is, word recognition appears to be language-selective when ambiguous words appear in sentences that are semantically constrained.

The majority of evidence supports the notion that semantics are completely or partially shared across the bilingual's languages (e.g., Costa, Miozzo, & Caramazza, 1999; Fox, 1996; Kroll & Sholl, 1992; Kroll, 1993; Potter, So, & Eckardt, 1984; Schwanenflugel & Rey, 1986; Smith, 1991; Snodgrass, 1984). Thus, there is no reason a priori that semantics itself should provide a solid language cue that would facilitate language selection. Furthermore, not every sentence is highly semantically constrained, so there must be other ways for bilinguals to arrive at the language of

the sentence.

The semantics are not the only source of restrictions on upcoming words; the syntactic structure of the sentence also provides constraints. Importantly, the ways in which sentences achieve syntactic coherence differs markedly across languages (compared to semantics which are largely shared). In extreme cases, the word ordering of sentences differs across languages. To illustrate, whereas English uses a Subject-Verb-Object (e.g., *The child sees the house*) word ordering, Fijian uses a Verb-Object-Subject ordering (e.g., *Sees the house the child*). In these cases, the interpretation of the sentences does not differ between English and Fijian, but the syntax does. The case of Fijian and English is an extreme example, and more minor differences also occur across languages. For example, Spanish sentences can include special pronouns (called proclitics) and they must drop the subject of an object relative clause. These two features are exemplified in (1) by *le* and *[pro]* respectively.

(1) Las monjas **le** llevaron las mantas que [**pro**] habían bordado a la directora del orfanato.
The nuns [ ] took the quilts that **they** had embroidered to the director of the orphanage.

In contrast, English does not use proclitics nor does it allow for the dropping of the subject in a relative clause. These syntactic differences may provide salient cues to language and allow bilinguals to selectively access words in sentence context.

The purpose of the current investigation is to further explore the mechanisms that allow bilinguals to control selection of the intended language by having participants read words either within or outside of a sentence context. In preparation for the upcoming experiments, I first review the bilingual word recognition literature, beginning with a sample of the out of context research and the dominant word recognition model which explains the findings. Then I turn to a comprehensive review of the more recent in context research.

1.1 Out of context word recognition

Evidence for nonselectivity is seen reliably when participants are asked to read, hear, or produce single words in one of the two languages. Many of these studies exploit the presence of ambiguities in the written form and pronunciation of words in the bilingual's two languages to demonstrate that bilinguals, but not monolinguals, are sensitive to the properties of the language not in use. Although evidence for nonselectivity has been found using a wide array of stimuli (e.g., cognates, homographs, and words with many cross-language neighbors), the *cognate effect*, that cognates are typically recognized fast than noncognate controls, has been the most robust (e.g., Dijkstra et al., 1998). Influence from the unintended language is seen regardless of whether the L2 or the L1 is in use (Dijkstra et al., 1998; Grainger & Dijkstra, 1992; Dijkstra et al., 1999; van Hell & Dijkstra, 2002). Furthermore, both phonological and orthographical representations remain active (e.g., Marian & Spivey, 2003; Jared & Kroll, 2001) regardless of script differences between the two languages (e.g., Gollan, Forster, & Frost, 1997)

If a bilingual can selectively access one of her two languages, then words that are language-ambiguous should be recognized no differently than words that are language non-ambiguous. For this reason, language-ambiguous words have been the focus of many studies investigating lexical access in bilingual speakers. Two types of language-ambiguous words, cognates and homographs, are of particular interest to psycholinguists because they are the words that are the most ambiguous between languages. Sharing nearly complete overlap between two languages (similar orthography, phonology, and meaning), a cognate is the prime example of a language-ambiguous word. Homographs are also highly language-ambiguous, except that they do not share meaning. Therefore, it is reasonable to predict that cognates may allow for greater parallel activation of the two languages.

Dijkstra, Van Jaarsveld, and Ten Brinke showed that cognates robustly allow for measurement of parallel activation of languages compared to homographs. In three separate experiments, they asked Dutch-English participants to make lexical decisions to single words. In the first two experiments, participants were told to make a "yes" decision for English, their L2. The stimuli consisted of cognates, homographs, and English noncognate words. These stimuli were supplemented with a set of Dutch words in the second experiment. The Dutch words required a "no" response. In the third experiment, participants were told to respond "yes" to both Dutch and English words. In all three experiments, Dijkstra et al. found a facilitatory cognate effect. However, the nature of the homograph effect depended on the composition of the other stimuli and instructions of the task.

The evidence for parallel activation of the stronger L1 when using the weaker L2 may not be surprising. In fact, it seems obvious that a more dominant system would impede on a less dominant one. However, parallel activation is not simply a function of language dominance or proficiency. Tasks where bilinguals use only the more dominant L1 have yielded a striking and counterintuitive result: knowledge of a second language influences how bilinguals use their first language. van Hell and Dijkstra (2002) asked highly proficient Dutch-English-French trilinguals to participate in a Dutch lexical decision task. The participants were recruited in the Dutch language and were given no knowledge that either French or English were in any way involved in the study. The LDT contained Dutch words in each of the following categories: cognates between Dutch and French but not English (e.g., Dutch: meuble [French: meuble; English: piece of furniture]), cognates between Dutch and English but not French (e.g., Dutch: bakker [English: baker; French: boulanger]), and noncognate controls (Dutch: fiets [French: vlo; English: bike]). The stimuli also contained a set of Dutch pseudo-words. Pseudo-words, like the nonwords above, follow the phonotactic regularities of a language but have no meaning (e.g., raponse in Dutch or wug in English). The results of the study showed that participants were reliably faster to judge Dutch-English and Dutch-French cognates as words than noncognate controls. The participants believed that this task was conducted only in Dutch and had no reason to suspect that English or French was in any way involved. Yet, they could not prevent the activation of their L2 and L3 when they are reading the cognate words. This result demonstrates that the bilingual language processing system functions in a nonselective manner even when recognizing words in the stronger

L1.

Thus far, we have seen evidence for parallel activation when bilinguals process language-ambiguous words in either their L1 or L2. A question that now arises is how deep this parallel activation runs. In the two studies above, bilinguals were performing LDTs that involved reading words. Thus, we have learned that the orthography of both languages is active. Although cognates are said to overlap in both orthography and phonology, there can actually be subtle differences between them across languages. For example, while base, a cognate, is written identically in English and Spanish, the pronunciations are noticeably different. Thus it's reasonable to suspect that the phonology of the cognates plays a role in their recognition as well.

Schwartz et al. (2007) looked at the role of phonology in more detail. In this study, instead of the LDT, participants were asked complete a word naming task. Words appear one at a time on a computer screen and they are asked to name the word aloud; the reaction time (RT) to the onset of articulation is measured. The word naming task is similar to the LDT in that it measures recognition of the word; however, in addition, the naming task requires participants to select a single word and access its phonology. Schwartz and Kroll embedded Spanish cognates and their English translations into two language blocks. Each cognate was matched to a noncognates control word. The cognates varied orthogonally in the degree of phonological (P) and orthographic (O) overlap (+O+P: *piano-piano*, +O-P: *base-base*, -O+P: *tren-train*, -O-P: *marca-mark*). A group of English-Spanish bilinguals were asked to name words in each of the language blocks. The critical result observed was that cognates that overlapped in orthography but not phonology were named more slowly than cognates with converging phonology and orthography (+O-P > +O+P). This difference was observed when participants were naming word in both their L1 and L2. These data suggest that bilinguals activate phonological representations of word in the unintended language via orthographic codes (see also Jared & Kroll, 2001). Furthermore, these data provide evidence that cross-language interactions can be modulated by the degree of overlap between the two languages.

The evidence for language non selectivity is not restricted to visual stimuli. Bilinguals activate the phonology of the unintended language when they hear either of their languages (e.g., Marian & Spivey, 2003). Furthermore, this parallel activation of phonology and orthography occurs regardless of script differences between the bilingual's two languages (e.g., Gollan et al., 1997). Overall, bilinguals seem fundamentally open to cross-language similarity. Yet, there must be a control mechanism that allows them to eventually select a language since bilinguals can successfully speak or listen to one language alone.

1.2 BIA+ Model of word recognition

Dijkstra and van Heuven (2002) proposed the BIA+ model to account for cross-language interactions during bilingual word recognition (see also Dijkstra et al. (1998) for an earlier version of the BIA+ model). The BIA+ model, adapted from the Interactive Activation Model (McClelland & Rumelhart, 1981), was designed to account for data from reading experiments conducted with

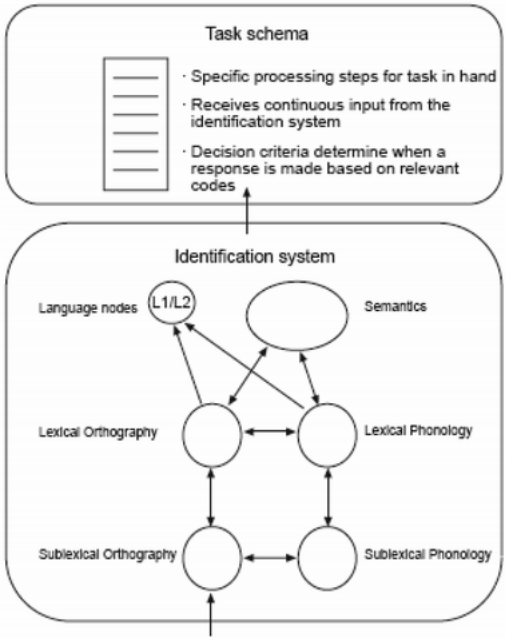

Figure 1.1. The BIA+ model of word recognition (reprinted from Dijkstra & van Heuven, 2002)

bilingual participants. The model, shown in Figure 1.2, is divided into two separate levels: the task schema and the word identification system. The word identification system is responsible for handling only linguistic input while the task schema handles the demands of non-linguistic contexts.

The word identification system deals with linguistic input to the model. The BIA+ posits an integrated lexicon (i.e., the words of each language are integrated into one dictionary) and shared semantics across the two languages. The word identification system is highly interactive. Upon reading a word, nodes for phonological and orthographic representations at the lexical and sublexical levels become active. Activation then spreads within and between the lexical and sublexical levels causing potential candidates to become more highly activated than other words. The higher levels of the model (i.e., the semantics level and language nodes) receive activation from the lower levels. In the semantic level, concepts receiving enough activation spread this activation back down to the lower levels further reinforcing the activation of potential lexical candidates. The language nodes are responsible for identification of the language being read. A crucial assumption made by the model is that the higher level nodes may only receive bottom-up activation. Furthermore, the language nodes may not send activation back down to the lower levels. Thus, prior knowledge of the intended language will not increase activation to nodes at lower levels. That is, the language nodes cannot function as a language filter. Instead, the nodes must be sufficiently activated through experience with a linguistic input.

While the word identification system handles linguistic input, the task schema deals with non-linguistic contexts. The task schema is responsible for accomplishing the task at hand (e.g.,

lexical decision, naming, etc.) and determining when a response should be made. In order to help with this decision, this level of the model receives constant input from the word identification system. A critical assumption of the BIA+ model is that the task schema (and, thus, non-linguistic context) does not infiltrate the word recognition system. Evidence for this was shown by Dijkstra, De Bruijn, Schriefers, and Ten Brinke (2000) who demonstrated that the presence of stimuli and not expectations derived from instructions affected bilingual performance in an LDT.

Given the assumptions of the BIA+ model it is easy to see how cross-language overlap will affect the recognition of words. Cognates, because of their close overlap in orthography, phonology, and meaning, will receive activation in both languages more quickly compared to words without similar overlap. Thus lexical decision or naming will be facilitated. On the other hand, when homographs are the input, the cross-language overlap with orthography and phonology may initially speed activation but the discrepancy in meaning will cause the system to have trouble identifying the language of the word thus slowing lexical decision or naming performance. Overall, the BIA+ predicts that a parallel access account with respect to language occurs in a bottom-up fashion. This parallel activity is not easily constrained by non-linguistic contexts.

The question now is how linguistic contexts influence word recognition. Because the BIA+ model was designed to account for word recognition outside of sentence contexts, it makes no explicit predictions regarding linguistic contexts. However, as we shall see in the following section, there are specific linguistic contexts that may allow bilinguals to recognize words in a language-selective manner.

1.3 In context word recognition

The previous studies reviewed thus far have been conducted asking participants to recognize single words. However, reading rarely involves the recognition of single words without any relation to one another. Instead, words are part of sentences which themselves are part of paragraphs. Likewise in speech, words are components of sentences in a discourse. Each level contributes a new layer of context. Because language use typically occurs in a rich context, out of context experiments provide an artificial environment for reading. For bilinguals, the ambiguity of language membership for each word may also be heightened. This may allow for parallel activation of both languages that would not otherwise exist in an environment with context. More recent research has sought to explore the role of sentence context on bilingual word recognition, investigating whether both language are still activated in parallel when a sentence is in one language alone. Only a handful of studies have examined this question, and the results have been interpreted in a variety of ways.

The fundamental question addressed by this most recent set of studies is whether evidence for nonselectivity can be seen in sentence context. Thus far, every study examining this question has come to the same conclusion: parallel activation does persist even when there is meaningful, unilingual context. This result is amazingly counterintuitive; an English word surrounded by

other words that are unambiguously English activates words in another language. It would seem that language nonselectivity is a fundamental property of the bilingual word recognition system and is does not arise as the result of experimental contexts.

While the results of all studies converge on the fact that word recognition in sentence context is nonselective, there is disagreement on the issue of whether certain types of linguistic contexts can provide bilinguals a cue to the language of the sentence and work to lessen or even eliminate parallel activation of the unintended language. A set of studies has shown that semantic constraints can, at least sometimes, allow the system to function in a selective manner. The present study attempts to address this debate by examining another type of context that could work similarly to semantic constraints.

1.3.1 Evidence for nonselectivity in sentence context

There is strong evidence that bilingual word recognition in sentence context is nonselective in nature. This is seen across a variety of methodologies, for example in word naming (e.g., Schwartz & Kroll, 2006); in lexical decision and translation (e.g., Baten et al., 2010; Van Hell & de Groot, 2008); in eye-tracking measures of reading (e.g., Duyck et al., 2007; Libben & Titone, 2009; Van Assche et al., 2009, 2010); and during auditory word recognition (Chambers & Cooke, 2009). The unintended language is activated regardless of whether the less dominant L2 is in use (e.g., Baten et al., 2010; Chambers & Cooke, 2009; Duyck et al., 2007; Libben & Titone, 2009; Schwartz & Kroll, 2006; Van Assche et al., 2010) or the more dominant L1 is use (e.g., Van Assche et al., 2009; Schwartz & Kroll, 2006). The degree of parallel activation is shown to be a function of the amount of cross-language overlap, suggesting parallel activation is not unique to cognates. Language nonselectivity seems to be a fundamental property of bilingual word recognition system. This finding is quite counterintuitive. It means that despite being aware that a sentence is entirely written in one language, a bilingual will activate both languages. The fact that a sentence has coherent semantics and syntax cannot eliminate activation of the unintended language. However, there is evidence that if a sentence is very strongly biased towards a single interpretation, parallel activity can be modulated.

Researchers have used a variety of methodologies to study language nonselectivity. Each method can provide a unique perspective on the phenomenon, particularly in what contexts and over what time-course it occurs. Importantly, research shows that regardless of the method used, bilingual word recognition is nonselective in nature. This cross-method comparison is important because it provides support that parallel activation is not task dependent.

Initial evidence for parallel activation of two languages in sentence context came from behavioral tasks such as word-naming, lexical decision and translation (e.g., Baten et al., 2010; Schwartz & Kroll, 2006; Van Hell & de Groot, 2008). Parallel activation has also been demonstrated in auditory word recognition, suggesting that the phenomenon is not specific to written word recognition (Chambers & Cooke, 2009). While the results of these tasks show the existence of parallel activation, they cannot speak to how early in processing the lexical candidates become

activated. Are words in the two languages activated from the very beginning of processing, or do they only become activated during a later stage? The answer to this question comes from evidence from eye-tracking studies. They confirm that both languages are activated in parallel from the earliest stages of processing (e.g., Duyck et al., 2007; Libben & Titone, 2009; Van Assche et al., 2009, 2010).

Schwartz and Kroll (2006) were among the first to investigate bilingual word recognition in sentence context. They asked bilinguals to read sentences in both languages across separate blocks. The sentences were presented word-by-word at a rapid pace, a method known as rapid serial visual presentation (RSVP). Target cognates and control words were marked in red and remained on the display until the participant spoke the name of the word. The time to begin speaking the word was recorded by a voice trigger. Schwartz and Kroll found that cognates were named faster than their matched controls in both the L1 and the L2. Cognate facilitation suggests that a sentence context is not enough to modulate language nonselectivity; bilinguals activated the lexical representations in both languages while reading in their native and second languages.

These results have also been corroborated by using a different set of behavioral tasks. Van Hell and de Groot (2008) asked bilinguals to make lexical decisions or to name the translations of target words (cognates or controls) that were embedded in sentences. Again, reaction times to translate or to perform a lexical decision were faster for cognates than for controls, suggesting that bilinguals activated both languages despite target words being embedded in a single language context. Evidence for cross-language activation during lexical decision was corroborated by Baten et al. (2010). While parallel activation in a translation task may not be so surprising (the task demands that both languages are in use and likely to be activated by the participants) a lexical decision task does have this requirement. Participants in an LDT are likely unaware that knowledge of a second language is important for the experiment. These replications suggest that the parallel activation as witnessed by Schwartz and Kroll (2006) cannot be attributed to properties of the task or the materials. Instead, nonselectivity seems to be a feature of the bilingual word recognition system.

The finding of nonselectivity is not limited to the written word. Chambers and Cooke (2009) show evidence for parallel activation during auditory word recognition. During auditory presentation of sentences, French-English bilinguals viewed scenes containing 4 objects as their eyes were monitored, a methodology called the Visual World Paradigm (VWP). The visual displays included the target object mentioned in the sentence along with other objects that were unrelated to the sentence. Critical displays contained one object that was a homophone to the target object. For example, a participants might hear "Marie va décrire la **poule** / [Marie will describe the **chicken**]" while viewing a scene that contained a chicken and a pool (the homophone). Chambers and Cooke found that participants were more likely to fixate on distractor homophones (e.g., pool) compared to unrelated objects, suggesting that they were activating English while listening to French sentences auditorily.

Something that the behavioral studies and the VWP do not tell us is what the nature of

the time-course of activation is. How early do participants begin considering options in both languages? If the word recognition system is truly nonselective, then parallel activation should occur immediately. The use of eye-tracking while participants read sentences is well suited to address this question.

Eye-tracking allows participants to read sentences naturalistically, as one might read a sentence in a newspaper. Participants are free to read at their own pace, and are able to regress back to earlier parts of the sentence in case something is misunderstood. While reading, the eye-movement patterns of the participants are monitored. The eye-movement record allows for a detailed analysis of the time-course of lexical activation. Early reading measures, such as first fixation duration, provide information about initial lexical access, while later reading measures provide information about semantic integration. Duyck et al. (2007), Libben and Titone (2009), Van Assche et al. (2009), and Van Assche et al. (2010) exploit this sensitivity of eye-tracking to show that words are activated in both languages in parallel from the earliest stages of recognition, and that coactivation remains indefinitely. In each of these studies, bilinguals read sentences that contained language-ambiguous words (cognates or homographs) and nonambiguous controls. The studies found that cognate words were fixated on for a shorter amount of time compared to control words while homographs were fixated on for a longer amount of time. Crucially, these effect were present from the earliest measures of reading (e.g., first fixation duration, which is taken to reflect initial lexical access) through later measures that reflect semantic integration. These eye-tracking studies show that during all points of word recognition, bilinguals have both languages activated in parallel.

The results of eye-tracking experiments investigating written and auditory word recognition converge with data from behavioral studies to show that the finding of parallel activation is not dependent on the methodology being used. Next, we will see that, for the most part, the languages pairs that are used in these experiments and whether the languages are spoken as the L1 or L2 do not affect the overall result of nonselectivity in sentence context.

An important consideration in assessing nonselectivity in sentence context is the direction of the coactivation. It is generally assumed that the L1 influences the L2 because the L2 is often the weaker language. However, evidence that the weaker L2 can influence the stronger L1 provides a compelling case for the ubiquity of nonselectivity. A second consideration is whether the results can be replicated across a variety of language pairs, ensuring that nonselectivity is a feature of bilingual word recognition in general, not just recognition by a specific type of bilingual. Again, the number of in context studies is small, so more replication is necessary, but the preliminary set suggests that the finding of nonselectivity is invariant to the languages spoken by the bilingual.

The majority of evidence for nonselectivity in sentence context has been found for bilinguals reading in their L2. Baten et al. (2010), Duyck et al. (2007), Van Assche et al. (2010), Libben and Titone (2009), and Schwartz and Kroll (2006) all tested bilinguals in English as their L2. Chambers and Cooke (2009) recruited bilinguals that use French as their L2. All researchers find evidence for nonselectivity in sentence context. Because, it is often assumed that the L1 has an effect on the L2, parallel activation of the L1 while reading in the L2 may not be surprising.

Yet, research has shown that bilinguals experience coactivation of the L2 even while reading in the stronger L1, though the number of studies is much more limited. In addition to presenting sentences in the L2, Schwartz and Kroll (2006) also asked their participants to read sentences in a block of their L1 (Spanish). Likewise, Van Assche et al. (2009) eye-tracked participants reading in their native language, Dutch. Both of these studies find cognate effects—evidence for language nonselectivity. These results provide striking evidence that even in L1 reading, a more practiced skill compared to L2 reading, bilinguals activate both languages in parallel.

Considerably less research has systematically investigated the role of the specific languages in the degree of parallel activation within context. The languages pairs tested thus far have been Dutch and English (Baten et al., 2010; Duyck et al., 2007; Van Assche et al., 2009, 2010), Spanish and English (Schwartz & Kroll, 2006), and French and English (Chambers & Cooke, 2009; Libben & Titone, 2009). In the studies that have examined processing in the L2, the L2 has most often been English (Baten et al., 2010; Duyck et al., 2007; Libben & Titone, 2009; Van Assche et al., 2010), though Chambers and Cooke studied French as the L2. Because English and French are from different language families (Germanic and Romance) and because results of out of context studies have been replicated across a variety of different language pairs, concerns about confounds due to the language pairs should be ameliorated. Only, two studies have examined processing in the L1, one study investigates processing in Dutch (Van Assche et al., 2009) and another in English (Schwartz & Kroll, 2006). Both Dutch and English are Germanic languages, which technically could confound the result because of language similarity. However, again results from out of context tasks suggest that the specific languages should not play a very large role; parallel activation should occur regardless of the languages.

A critique of the research supporting nonselectivity is that a majority of the evidence comes from cognates, which arguably have a special representation in the lexicon. Thus the argument can be made that evidence for parallel activation of two languages is really evidence for a special representation of cognates. If this is true, then it sheds doubt on the usefulness of the cognate effect as a measure of cross-language parallel activation. The cognate effect may result from a special representation. This potential confound can be addressed by investigating the role of cross-language overlap in word recognition. If the cognate effect is driven by special representation, then word recognition times should not differ as a function of the degree of overlap because all cognates are special. In contrast, if the cognate effect is really a marker of parallel activation, then we should see graded effects that are dependent on the amount of cross-language overlap.

A subset of the studies discussed above show evidence that the size of the cognate effect depends on the degree of cross-language overlap. Cross-language overlap can be operationalized in terms of orthographic overlap and phonological overlap. For example, *hotel* and *ship* are both cognates with Dutch. *Hotel*, however, has complete orthographic overlap with Dutch whereas *ship* is written as *schip* in Dutch, containing a slight difference in orthography. Similarly, words that are written the same across languages often differ in their pronunciation (phonological overlap) or in their meaning (i.e., homographs). The typical finding has been that words with less cross-language overlap tend to elicit slower reaction times while words with greater overlap

are recognized faster. This justifies the use cognate effect as a marker of parallel activation.

Duyck et al. (2007) conducted a discrete analysis using their eye-tracking data to show that cross-language overlap affects the presence of the cognate effect. In their materials, they included cognates and noncognate words, and the cognate items were further split into identical cognates (e.g., hotel) and nonidentical cognates (e.g., *ship-schip*). Duyck et al. found that identical cognates were fixated on for a shorter amount of time compared to matched noncognate control words. However, this difference was not significant for nonidentical cognates. This finding provides preliminary evidence for the idea that not all cognates are processed equally. Cognates with complete orthographic overlap elicit a greater cognate effect, while the nonidentical cognates elicit a smaller effect. This small effect was apparently not detectable by Duyck et al.'s analysis.

While the results of Duyck et al. (2007) suggest that orthographic overlap influences the time to identify a word, a discrete difference between identical and nonidentical cognates does not defeat the theory that cognates have a special representation. One could argue that while identical cognates are specially represented, nonidentical cognates are not cognates are not, explaining why Duyck et al. (2007) not see facilitation for nonidentical cognates. A more fine grained analysis can adjudicate whether cognates are somehow special.

Van Assche et al. (2009) and Van Assche et al. (2010) found continuous effects of cross-lingual overlap on reading times in the L1 and in the L2. Where Duyck et al. (2007) categorized cognates into discrete groups (identical and nonidentical), Van Assche et al. (2009) calculated the orthographic overlap of each target word and its translation according to the method by Van Orden (1987). This method provides a numerical measure of overlap between two words by taking into account such factors as number of letters, number of paired adjacent letters, whether the words share the same first or last letter, etc. This measure of overlap was then entered as a predictor into linear mixed-effects regression models for each of the eye-tracking measures of interest (first fixation duration, gaze-duration, and regression-path duration). While overall model fits were not included in the results, the authors found a significant effect of orthographic overlap on reading times. The time to read a word was inversely proportional to the degree of overlap; as overlap decreased reading times increased. This shows that readers utilized this lexical information during word recognition.

Van Assche et al. (2010) further show that the degree of phonological overlap influences bilingual word recognition and can be used as another continuous measure of cognate status. They measured the degree of phonological overlap by asking a group of participants, independent from their main experiments, to rate how similarly a word and its translation sounded. These ratings were aggregated to determine degree of overlap. When phonological similarity was entered into the regression model, the authors found an inversely proportional relation to reaction times, similar to that of orthographic overlap.

The results of Duyck et al. (2007), Van Assche et al. (2009), and Van Assche et al. (2010) illustrate that the degree of cross-lingual overlap influences how bilinguals recognize words in sentence context and that this effect is continuous. As words across two language increase in the

degree of overlap, the speed at which they are recognized increases. This finding is important because it shows that cognate status per se is not what influences recognition. Recognition is influenced by the degree of overlap between a word and its translation equivalent. Therefore it is correct to assume that the cognate effect is a measure of parallel activation of the bilingual's two languages not as proof of a special representation of cognates.

Taken together, the results of the in context studies presented here all show that language nonselectivity cannot be overcome by a sentence context alone. Words become activated in both languages according to their degree of overlap across languages despite the coherence created by the semantics, syntax, and language of a sentence. The parallel activation is so pervasive that it persists while bilinguals read sentences in their stronger native language, not only during L2 reading.

Yet it would seem that at some point, a bilingual should be able to "choose" a language. After all, bilinguals can successfully make lexical decisions in a sentence context, nor do they have a problem assembling the meaning of a sentence. Given the pervasiveness of nonselectivity in sentence context, a second goal of in context word recognition research has been to explore whether there are any linguistic factors that might allow bilinguals to make a language selection.

1.3.2 The role of semantic constraints

While all studies converge on the finding that word recognition is nonselective within a sentence context, they diverge on whether recognition may become selective under certain conditions, namely following a highly constrained semantic context. A subset of the studies examined above illustrates that patterns of word recognition following a highly biased context are consistent with the predictions made by a language-selective access account. In highly constrained contexts, cognate facilitation is eliminated (the *semantic constraint effect*; e.g., Chambers & Cooke, 2009; Libben & Titone, 2009; Schwartz & Kroll, 2006; Van Hell & de Groot, 2008). However, there is disagreement in the literature as to whether the locus of the effect actually stems from language-selectivity, or whether it is the result of another factor, such as a confounding of the methods or a floor effect caused by the speeded processing due to semantic constraints. Furthermore, one study has failed to find the semantic constraint effect (e.g., Van Assche et al., 2010). Despite the criticisms of semantic constraints, the effect seems to be reliable. Yet, semantic constraints cannot be the only way that a bilingual comes to choose a language. After all, not every sentence is highly semantically constrained. Other factors that provide language-specific cues, such as the syntax, may induce language-selective access.

The semantic constraint effect has been replicated with a variety of methods including lexical decision and translation (Van Hell & de Groot, 2008), eye-tracking during reading, and with the Visual World Paradigm (Chambers & Cooke, 2009; Libben & Titone, 2009). The eye-tracking record shows that when semantic constraints have an effect, it occurs during later stages in processing (Libben & Titone, 2009). Because the effect of semantic constraints can be seen with a variety of methods, from behavioral to eye-tracking, the effect is likely not due to the method-

ology. However, the debate about whether speeded processing creates a floor effect is still open. The current study will approach the question of whether word recognition can become selective by investigating whether another sentential factor, language-specific syntactic constraints, can eliminate or reduce parallel activation.

Schwartz and Kroll (2006) demonstrate that a sentence which is highly constrained in its interpretation appears to eliminate the cognate effect. Schwartz and Kroll varied the semantic constraint of their sentences such that half of the sentences contained a highly predictable semantic contexts (i.e., *high constraint*) while the other half did not (i.e., *low constraint*). Constraintedness was determined by an offline sentence completion task. The target word of each sentence was removed along with any material following the target. A set of participants who did not complete the main experiment asked to complete each sentence. If the participants were highly likely to complete a sentence with the actual target word, the sentence was rated as high constraint. If a variety of words followed a sentence, it was rated as low constraint.

Schwartz and Kroll (2006) found cognate facilitation only in the low constraint sentences. In sentences with a high semantic constraint, the authors found that all target words were named faster. This signifies that the biased context helped participants to access the upcoming target word. Importantly, the authors failed to find a cognate effect for target words following a high semantic constraint. The cognate facilitation effect in low constraint sentences signifies that a sentence context alone is not enough to constrain word recognition to one language. However, additional semantic cues may provide lexical restrictions to language, resulting in a modulation the cognate effect.

The finding of apparent selective access in high constraint sentences has been criticized on two grounds. First, the elimination of the cognate effect may be the result of the method that Schwartz and Kroll used to investigate word recognition (i.e., word naming). Second, the elimination of the cognate effect in high constraint sentences may be the result of the facilitation that occurs following a biased semantic context. That is, because high constraint sentences speed lexical access, word recognition in these sentences may reach a floor and cognate facilitation may no longer be witnessed. Each critique warrants further explorations, and with the use of converging methodologies, they can begin to be addressed.

The semantic constraint effect cannot be due to the methods used by Schwartz and Kroll (2006). The effect has been replicated using other behavioral methods as well as with eye-tracking methods (e.g., Chambers & Cooke, 2009; Libben & Titone, 2009; Van Hell & de Groot, 2008). The eye-tracking record during reading suggests that the effect of semantic constraints occurs during later stages of word recognition, meaning that word recognition is initially nonselective. While converging methods confirm that semantic constraints eliminate the cognate effect, they cannot confirm that this modulation is due to language-selective access. The reduction in the cognate effect may be due to speeded access of semantic constraints creating a floor effect that over-shadows an effect of cross-language overlap.

Van Hell and de Groot (2008) show that semantic constraints modulate the cognate effect during word recognition while bilinguals read sentences and were asked to make either a lexical

decision or to translate the target words. When targets followed a high semantic constraint (which again facilitated reaction times to identify targets), the difference between cognates and controls was reduced, and in lexical decision the difference was eliminated. A similar finding occurred during auditory word recognition. Chambers and Cooke (2009) found that following sentences containing a high semantic constraint, fixations toward homograph distractor pictures were greatly decreased when compared to fixations in low constraint sentences.

Following highly semantically constrained sentences, the degree to which both languages were activated was greatly decreased in line with the findings of Schwartz and Kroll. Because the constraint effect was replicated with a different set of behavioral methods, it signifies that the findings of Schwartz and Kroll did not depend on the word naming method they used.

Behavioral tasks, such as lexical decision, translation, and word naming, rely on the response made by a participant to a stimulus. Responses tell us about the later stages of word recognition—the end result of the process. Information about the earliest stages of the process is potentially lost. Thus, it is conceivable that in high constraint sentences, word recognition proceeds in an initially nonselective manner and then becomes selective downstream. If this theory were true, behavioral methods such as those used by Schwartz and Kroll (2006) and Van Hell and de Groot (2008) might fail to capture evidence for this initial nonselectivity. While the Visual World Paradigm used by Chambers and Cooke (2009) provides a good temporal measure of the word candidates participants are considering, the analysis they conducted was not fine-grained enough discern whether the semantic constraint effect began initially or later on. Analyses of fixations during sentence reading are sensitive enough to adjudicate between early and late processing differences.

Libben and Titone (2009) provide striking data that suggest word recognition in high constraint sentences proceeds in an initially nonselective manner but becomes selective over time as the meaning of the sentence is integrated. They show that in high constraint sentences cross-language facilitation and inhibition were only present in early measures of reading (e.g., first-fixation duration). Later measures (e.g., regression path) showed no significant differences between language-ambiguous stimuli and control words. This result highlights the fact that the word recognition system is profoundly nonselective at early stages of processing, but that semantic constraints can allow the system to become selective over time. It also further shows that the semantic constraint effect is not unique to behavioral methods, such as word naming.

Findings from a variety of methods provide evidence that semantic constraints can eliminate activation from the unintended language. This finding is not method-specific, though there are differences in how methods illustrate details about the time-course of processing. While the semantic constraint effect is not due to the methodology used, locus of the effect is still in question; the elimination of the cognate effect may be due to the fact that semantic biases increase word recognition speed. This speed increase may create a floor effect that diminishes the detectability of the cross-language activity.

Semantic constraints reliably increase the rate at which upcoming words are recognized, and we have seen that semantic constraints decrease or eliminate effects that are known to measure

parallel activation (e.g., cognate effect and homograph inhibition). However, the locus of this modulation is in question. It could stem from two possible sources: language-selective access cause by increased lexical cues due to the constraint, or, more trivially, a loss of analytical power due to the decrease in reaction times due to the semantic constraint. Much of the prior research cannot address this question, except for, possibly, the results of Van Hell and De Groot.

The idea behind the floor effect theory is that participants become so fast at predicting an upcoming word, the cognate effect can no longer be measured. Cross-language activation is still present, however the effect size is so small it cannot be measured. This theory can be tested by examining a situation in which there is a semantic constraint but no floor effect. In such a situation, the theory would predict that a cognate effect would be present, and the magnitude of the effect should be no different than in a low constraint sentence. A difference in the sizes of the cognate effects would indicate that the semantic constraint is in some way affecting the degree of parallel activation.

The translation task of Van Hell and de Groot (2008) provides the situation outlined above. In their experiments, participants translated target words that were embedded in high and low constraint sentences. Translation is a more difficult task for participants compared to lexical decision or word naming. Hence, reaction times are slower (though no statistical analyses were conducted to test this). Because reaction times were no longer at floor, role of semantic constraints can be investigated. Van Hell and De Groot found cognate effects in both high and low constraint sentences during translation. However, counter to the predictions made by the floor effect theory, the cognate effect was smaller in the high constraint condition, indicating that although participants coactivated both languages during the translation, this coactivation was less when the context was biased towards a single interpretation. This modulation is likely due to a decrease in parallel activation and not a floor effect because reaction times in the task were slower overall.

Not all studies have managed to find evidence for the semantic constraint modulation of the cognate effect. Though, failure to find an effect is not evidence that no effect exists, especially in the presence of other positive evidence. It may be that semantic constraints do not always allow for words to be selectively accessed from the lexicon.

Van Assche et al. (2010) failed to find evidence that semantic constraints modulate the cognate effect, despite the inclusion of sentences that were rated as being very high constraint compared to previous studies. Instead, their Dutch-English bilinguals read cognate words significantly faster than noncognate words in both low and high constraint sentences; the magnitude did not change. According to Van Assche et al. "this contrasts with Libben and Titone (2009) who found cognate facilitation only in early comprehension measures... Instead, our results suggest that the influence of such factors on the language-selectivity of lexical access is rather limited..." This result also contrasts with Schwartz and Kroll, Van Hell and De Groot, and Chambers and Cooke. As we know from statistics, lack of a significant effect is not evidence that there is no effect. Instead there are likely many factors which the authors did not consider that likely result in the lack of the effect.

The main reason that Van Assche et al. (2010) failed to find an effect was likely due to the sizes of their cognate effects. For some of the measures, the effects were less than 10ms. These effects are so small that the number of participants they recruited is much higher than in previous studies (e.g., 60 participants). A sub-10 ms effect, in addition to potentially not being a meaningful difference, leaves less room to find a detectable interaction when the effect is expected to decrease.

In this study, the more proficient language and dominant language (i.e., Dutch) of the environment was inactive, so cognate effects should have been rather large (e.g., Jared & Kroll, 2001; Marian & Spivey, 2003; van Hell & Dijkstra, 2002). Why were the effects so small? Van Assche et al. (2010) chose to use exclusively nonidentical cognates as a tool to measure of parallel activation. As we saw earlier, nonidentical cognates tend to elicit less parallel activation (and perhaps none at all) because of their lack in cross-language overlap. Furthermore, in Duyck et al. (2007) the group failed to find any cognate effects on nonidentical cognates as a group. In this light, it is not surprising that Van Assche et al. struggled to find a cognate effect and failed to finsd evidence for an interaction.

While failure to find the semantic constraint modulation does not prove that the effect does not exist, the findings of Van Assche et al. (2010) do suggest that decreasing parallel activation is not always as easy as including a high semantic constraint. Furthermore, not every sentence contains a semantic constraint, thus there may be several other factors that allow bilinguals to come to a language decision.

1.4 The present investigation

Most researchers assume that the semantics is shared across language. Therefore there is no reason a priori that the meaning of a sentence should provide strong language cues. On the other hand, it is well known that syntax differs across languages. If any linguistic construct should provide language cues, then it should be the syntax. The goal of the present investigation is to explore whether language-specific syntactic constraints allow for language-selective access. While nobody has examined this question, there is evidence from an out of context task and an in context task that hints that aspects of the syntax may be important during word recognition.

Sunderman and Kroll (2006) showed that grammatical class differences (a morphosyntactic property) can reduce lexical form interference from the other language. Relatively proficient English-Spanish speakers made translation recognition judgments about word pairs in Spanish and English (i.e., "Are these two words translations of one another?"). Critical word pairs required a "no" response, and a subset of critical items were related in lexical form (e.g., *mano-man*). When the two words belonged to the same grammatical class (e.g., noun-noun), Sunderman and Kroll found lexical interference compared to control items (e.g., *casa-man*). However, when the two words differed in their grammatical classes (e.g., noun-verb), the lexical interference was dramatically reduced, suggesting that the degree of lexical interference depended on grammatical class overlap.

A similar result was found by Baten et al. (2010) for bilingual participants reading in sentence context. Participants performed an English lexical decision for target words embedded in sentences. Homographs elicited a facilitation effect when the homograph and its translation shared grammatical class, suggesting that both languages were activated. However, when the grammatical class differed across the two languages the facilitation effect was eliminated, consistent with language-selective access. The results of Sunderman and Kroll (2006) and Baten et al. (2010) hint that syntax may play a role in modulating influence from the unintended language.

The present investigation explores the role of syntax in allowing for language-selective activation by asking Spanish-English bilinguals to read sentences that are language-specific to Spanish in their syntax. We operationalize Spanish-specific syntactic constraints as the inclusion of proclitics and the dropping of the subject of an object relative clause before the target word of the sentence is reached. Spanish-specific syntax is exemplified in (2) (target word: *directora*, a cognate).

(2) Las monjas **le** llevaron las mantas que [**pro**] habían bordado a la directora del orfanato.
The nuns [ ] took the quilts that **they** had embroidered to the director of the orphanage.

If the presence of Spanish-specific syntactic constructions in a sentence allow the reader or listener *zoom in* to the target language (e.g., Elston-Güttler, Gunter, & Kotz, 2005), then word recognition should proceed in a language-selective selective manner. That is, cognates embedded in sentences with language-specific syntax (and with a low semantic bias) should be accessed as if they are a word only in the language of that sentence (i.e., a noncognate word). However, following language-general syntax, word recognition should proceed in a nonselective manner, in line with previous studies. Monolingual control experiments will confirm that any cognate or syntactic specificity effects are due to the experimental manipulations and not to idiosyncratic properties of the stimuli.

The experiments in the current investigation are laid out as follows. Experiment 1 implements a word naming task to replicate the cognate facilitation effect outside of sentence context. Experiment 2 uses the Rapid Serial Visual Presentation task to present cognate and noncognate control words in sentence contexts that contain language-general (low syntactic constraint) and language-specific syntactic constraints (high syntactic constraint). A block of Spanish sentences will contain both low and high syntactic constraints while a block of English sentences contain only low syntactic constraints. Experiments 3 and 4 are English and Spanish monolingual control experiments.

Chapter 2

General directions and methodologies

There were two main goals to this study. The first goal was to further confirm that a sentence context is not enough by itself to constrain word recognition to one language. The second goal of the study was to assess whether the use of language-specific syntactic constraints in sentence contexts is sufficient to allow for language-selective word recognition. To investigate these issues, participants performed a Rapid Serial Visual Presentation (RSVP) experiment (Chapter 4) in which they read sentences presented word-by-word and named target words aloud. The target words were embedded in sentence contexts that contained syntax specific to Spanish or contained language-general syntax. Control studies ensured that any effects are due to the intended manipulations and not to idiosyncratic properties of the stimuli. A variety of cognitive tasks and language-proficiency tasks were implemented to insure that our groups of participants were matched for language experience and cognitive performance. These measures were also used to explore the ways in which individual differences influence processing. The current chapter provides an overview of the participants recruited and the experimental procedures used in each part of study.

2.1 Participants

Four groups of participants were recruited for this investigation. Bilinguals who were native speakers of English and acquired Spanish as a second language (English-Spanish bilinguals) were recruited for the out-of context naming study in Chapter 3. Native speakers of Spanish who learned English as a second language (Spanish-English bilinguals) participated in the RSVP experiment in Chapter 4. Two monolingual control groups were recruited for the in context control experiment: a group of English monolinguals and a group of Spanish monolinguals. The Spanish monolinguals were recruited from the University of Granada in Spain, while all other

groups were recruited from the Pennsylvania State University in the United States.

The learners of Spanish studying at Penn State University were recruited for the out of context task in Chapter 3 in order to ensure that our cognates were sensitive to parallel activation of two languages. Because the size of the cognate effect is typically larger for participants using their second language, a failure to find effect in the second language would indicate that effects would not likely be found for participants reading in their native language.

Native speakers of Spanish were necessary for the main experiment in Chapter 4 because our critical manipulation depends on speakers' knowledge of and ability to process complex syntactic structures in Spanish. Hence, a high proficiency in Spanish was required. While high proficiency L2 speakers certainly exist, some researchers argue that L2 speakers do not have access to certain syntactic structures in the L2 (e.g., Clahsen & Felser, 2006). While I remain agnostic towards this claim, the choice of native Spanish speakers ensures that they will be able to process the structures that the critical manipulation depends on.

In order to ensure that any effects found were due to the intended manipulations, two groups of monolinguals were recruited to participate in each of the language blocks. A group of Spanish monolinguals recruited from the University of Granada, Spain read the Spanish portion of the in context study. A group of English monolinguals from Penn State were recruited to read the English portion of the materials. Because monolinguals only know one language, they should not demonstrate any effects due to cognate status.

2.2 Word naming tasks

The word naming tasks were used to assess the degree of cross-language activation. Participants were presented with cognate and control words, and the time it took them to begin naming was recorded. The latencies for cognates and noncognates were compared to measure parallel activation. Two types of word naming tasks were used in the present set of experiments: out of context word naming, and word naming in sentence context. Before detailing each of these tasks, I review how the target words were selected.

2.2.1 Selection of target words

A set of 64 cognates between English and Spanish were selected. Each of the cognates was matched to a Spanish noncognate control word, yielding a total of 128 target words. The targets were matched for word frequency (e.g., Alameda & Cuetos, 1995), length, number of syllables, number of phonemes, first phoneme, and animacy. Cognates and controls were not always perfectly matched for every measure, but importance was placed on frequency and length. Neither length nor frequency differed significantly between Spanish cognate and noncognate words (both $t(126) < 1$). These target words were then translated into English. The English cognate and control materials are reproduced in tables Table A.3 and Table A.4. Again, neither length nor frequency differed significantly between the cognate and control words. The cognate materials

and control stimuli are reproduced in Appendix A.

2.2.2 Out of context word naming

A Spanish out of context word naming task was administered to second language learners of Spanish in order to assess the degree to which the target cognates were sensitive in eliciting parallel activation of English and Spanish (i.e., experiment in Chapter 3). At the beginning of each trial, a fixation point was displayed until the participant pressed a key. The fixation point was followed by a Spanish target word. Upon the display of each word, participants were told to name the target into a voice trigger microphone as quickly and as accurately as possible. Their naming session was recorded to access naming accuracy following the task. Participants saw each of the 64 cognates and 64 controls for a total of 128 items. They also saw 12 practice items at the beginning of the experiment. The items were pseudo-randomized prior to each session with the constraint that the participants should never see more than three cognates or noncognates in a row.

Word naming was chosen because prior studies show that it is a sufficiently sensitive task for detecting parallel activation of two languages (e.g., Schwartz et al., 2007). Furthermore, overt naming, in comparison to a lexical decision task, ensures that participants activate the target word in the language of the task because they are required to speak in that language. In contrast, for a lexical decision task, one could argue that for any given cognate, a participant can respond "yes" upon identifying the cognate as a word in either language (especially if no false cognates are present to deter this behavior).

2.2.3 In context: RSVP task

The in context Rapid Serial Visual Presentation (RSVP) task allowed for the assessment of parallel activation while participants read sentences. In this instantiation of the RSVP task, participants were presented with a fixation cross at the beginning of each trial. After the participant pressed a key, a sentence was displayed word-by word at a fixed pace. When the target word, marked in red, appeared it remained on the screen until the participant spoke the word into the voice trigger microphone. At this point, the remainder of the sentence was displayed, word-by-word. One quarter of the sentences contained yes–no comprehension sentences. RTs to name the target word and measures of accuracy for both naming and comprehension questions were recorded. Thus, the dependent measures for the RSVP task are the same as the measures in the out of context word naming task.

The Spanish target words (64 cognates and 64 controls), originally chosen for the out of context task, were embedded into sentence contexts of high and low syntactic constraint (all sentences were low semantic constraint) yielding a total of 256 Spanish sentences. These Spanish sentences were translated into English in a manner such that all sentences were low syntactic constraint, though their specificity coding was preserved from the Spanish materials to provide a control comparison. The Spanish and English versions of the materials were counterbalanced

into two versions with each language comprising a separate block.

The Spanish version of the materials allowed for the comparison of cognate status, syntactic constraint, and the interaction between the two. The English version of the materials provided the comparison of cognate status. The syntactic constraint manipulation in the English translations served as a control for the Spanish constraint manipulation. Because all sentences were translated into English to be low syntactic constraint, no differences in the size of the cognate effect should be observed across constraint conditions, ensuring that any modulation due to syntactic constraint can really be attributed to the syntax and not to extraneous properties of the words or sentences.

There were three versions of the RSVP experiment in Chapter 4 intended for three groups of bilinguals: Spanish-English bilinguals, English monolinguals, and Spanish monolinguals. The bilinguals read sentences in both languages across two separate blocks. The Spanish and English monolingual speakers read sentences in Spanish and English respectively. The justification for including each group of participants is provided above in Section 2.1.

The materials were counterbalanced in such a way that a single participant never saw the translation of any sentence (or the same sentence) across blocks. For example, if a bilingual participant saw a cognate and its matched control in the low syntactic constraint condition in English, when they read the Spanish sentences the target and control would appear in a high constraint sentence. They would receive the opposite conditions with a different pair of target words. This method of counterbalancing does mean that each participant saw every cognate and control twice across blocks (once in each language for bilinguals; twice in the same language for monolinguals). 48 filler sentences were added to each language block. The blocks were pseudorandomized before each session such that no condition (cognate high constraint, cognate low constraint, etc.) was ever repeated more than three times in a row.

The RSVP task has been used successfully to demonstrate evidence for parallel activation in sentence context (e.g., Schwartz & Kroll, 2006). While it is less naturalistic than the eye-tracking methodology, it accurately taps into the word-recognition process while at the same time providing a less complex dataset for analysis. Also, previous studies show that RSVP can yield results similar to eye-tracking (Altarriba, Kroll, Sholl, & Rayner, 1996). Furthermore, the dependent measure for RSVP is the same as the one used in the out of context norming experiment (i.e., time to begin naming the target), allowing for comparison between the in context and out of context results.

2.3 Operation Span task

The Operation Span task (Turner & Engle, 1989) was included as a measure of working memory. In this task, participants judge whether sets of equations, presented one at a time, were correct or incorrect (e.g., 5 X 2 + 1 = 10). After each equation, they were given a word to memorize. At the end of a set, they were prompted to recall as many words as possible from the set. Participants saw a total of 15 sets of equations and words increasing in difficulty as they proceeded through the experiment. A participants operation span was calculated by the number of words correctly

recalled for trials on which their performance on the numerical problem was correct.

Because participants in the set of experiments differed in their language experience, participants were allowed to perform the task in whichever language they felt was most comfortable or dominant. Thus, there were two versions of the Simon task: English and Spanish. Each version contained the same equations, and the words were translated across languages.

The justification for including the Operation Span task was to balance the groups of participants in terms of their working memory. It can also be used to investigate the way in which working memory span influences processing, given that some of our manipulations may depend on working memory (e.g., ability to maintain a syntactic representation in memory over the course of a long sentence).

2.4 Simon task

The Simon task (Simon & Rudell, 1967) was included as a measure of inhibitory control. In this task, participants must inhibit one form of information (spatial location) in favor of another (color). They saw a series of boxes colored either red or blue. The boxes appeared in the left-, middle-, or right-hand side of the screen. There were a total of 126 trials across three blocks. In each block, participants saw seven iterations of each of the six individual conditions (red or blue by left, middle, or right) in a random order. They were instructed to quickly press a colored button (blue on the left, red on the right) corresponding to the color of the box on the screen. On the critical trials the required key press (left- or right-hand side) conflicted with the side that the box was on. By comparing the reaction times to respond to the conflicting cues from the reaction time to respond to congruent cues, one can obtain a measure of the ease to which participants could inhibit the irrelevant cue (position) and attend to the relevant cue (color).

The primary reason for including the Simon task was to control cognitive function across groups of speakers. However, previous studies have shown that bilingual groups can outperform monolingual groups on tasks of executive function.

2.5 Picture naming task

Participants performed a picture naming task as a means of assessing English proficiency. Participants saw a total of 72 line drawings, presented one at a time, that they were instructed to name aloud. The time to begin naming the picture as well as the accuracy of naming were used as the dependent measures. The pictures were drawn from a variety of semantic categories (tools, instruments, clothing, furniture, etc.) One third of the pictures had cognate names in English and Spanish.

The naming accuracy and reaction time to begin naming should reflect the proficiency a group of speakers has with English. More proficient English speakers should, on average, name faster and more accurately compared to less proficient speakers. Additionally, more proficient speakers of English may demonstrate less of a cognate effect during English naming. In this manner, the

English picture naming task can be used to compare naming performance of native speakers with the performance of L2 speakers.

2.6 Grammar tests

In order to assess language proficiency in both English and Spanish, bilinguals performed portions of two grammar tests: the Michigan English Language Institute College English Test (MELICET) and the Diplomas de Español como Lengua Extranjera (DELE). Each portion contained 50 questions. Each test covered grammatical aspects such as verb conjugation and preposition choice. All questions were multiple choice.

While the grammar tests will not provide a comparison of the relative proficiency of each language, they can be used to compare groups of speakers within languages, in a similar manner as the picture naming task will be used. Thus, more proficient speakers of either language should score more highly, on average, compared to speakers who are less proficient in that language.

2.7 Predictions

To review, there are four main experimental sessions for the current investigation: (1) out of context word naming with Spanish-English bilinguals (Chapter 3); (2) in context naming with Spanish-English bilinguals (Chapter 4); (3) in context naming with English monolinguals (Chapter 4); and (4) in context naming with Spanish monolinguals (Chapter 4). The predictions for each experiment are reviewed in the following paragraphs.

In order to provide a sense of the degree to which the target cognates that were chosen for the present investigation are able to activate two languages, native English speakers who are L2 learners of Spanish will name words in Spanish (Chapter 3). If the cognates are sufficiently able to activate both Spanish and English, then the group of Spanish learners should produce a reliable cognate effect. That is, cognates should be named significantly faster compared to the matched noncognate controls.

The presence of the cognate effect would replicate a finding from a long line of previous research that suggests that bilinguals activate both of their language in parallel while reading words in one language. If the cognate effect does not emerge, it would suggest that some property of the stimuli was not sufficiently controlled and interfered with the he measurement of parallel activation.

To investigate bilingual word recognition in context, native Spanish speakers who have learned English as a second language will participate in the main experiment of the investigation (Chapter 4: RSVP sentence reading with word naming). To review, in this task each participant will see two language blocks (English and Spanish). Within each language block they will name cognates and noncognates embedded in syntax nonspecific or syntax specific sentences (though the syntax specific condition in English is a control manipulation and is actually language-general). All sentences contain low semantic constraints to avoid confounding the possible effects

of the syntax with effects of semantic bias. Previous studies find cognate effects in low constraint sentences, suggesting that bilinguals activate both languages while reading unilingual sentences. Therefore, in our sentences that contain language-general syntax, the same results are predicted. A facilitatory cognate effect is expected in syntax nonspecific sentences of Spanish and in all English sentences (due to the dummy manipulation).

The predictions in the language-specific conditions are more open-ended. If language-specific syntax can cue bilinguals into the language of the sentence and allow them to access the meaning of cognates selectively, then the cognate effect should be reduced or eliminated following the syntactic constraint manipulation compared to sentences with language-general syntax. In this case, an interaction between cognate status and syntactic specificity is predicted. In contrast, if there is a limited role of context in influencing word recognition, there should be no difference in the size of the cognate effect between language-specific and language-general syntax conditions. In this case, only a main effect of cognate status for Spanish sentences is predicted.

In order to ensure that any effects found in the in context task are due to the intended manipulations, two control RSVP experiments will be conducted with monolingual speakers of English and Spanish. Because English monolinguals have no knowledge of Spanish to activate in parallel, no cognate effect is predicted. Furthermore, to the extent that there are no differences that affect word recognition between the language-specific and language-nonspecific sentences, there should be no main effect of the English syntax dummy manipulation. Spanish monolinguals will read the Spanish sentences from the main RSVP experiment. Similarly to the English monolinguals, the Spanish monolinguals have no knowledge of English and should thus exhibit no cognate effect of while naming Spanish words in context. If there are syntactic differences between the Spanish-specific syntax and the language-general syntactic conditions that influence word recognition, they should emerge for the Spanish monolinguals as well as for the Spanish-English bilinguals.

Chapter 3

Experiment 1: Bilinguals out of sentence context

The goal of this first experiment is to replicate previous studies showing that bilinguals access both languages nonselectively when words are presented in isolation. A successful replication will ensure that the stimuli are capable of eliciting parallel activation, so that they can later be used to investigate bilingual word recognition in sentence contexts (Chapter 4).

Previous studies find evidence for nonselectivity by showing that bilinguals, but not monolinguals, recognize cognates faster than matched control words. Cognate facilitation occurs as a result of the form and semantic overlap across the two languages. The logic of this experiment follows that of previous studies. Cognates and matched noncognate controls were selected, and bilinguals are asked to recognize and name the words presented isolation. Based on previous results, cognates in this experiment were predicted to be named faster than control words.

3.1 Participants

Sixteen participants from the Pennsylvania State University participated in this experiment for course credit. One participant was removed because their native language was not English. The remaining 15 participants were all native English speakers who were proficient L2 speakers of Spanish.

3.2 Materials

A set of 128 Spanish words were chosen for this experiment. These words consisted of 64 cognates (e.g., *cable*) and 64 noncognate controls (e.g., *chispa – spark*). The cognates and controls were matched for lexical properties such as length and frequency. The cognate words varied in the

degree of orthographic overlap such that some cognates were identical (e.g., *cable*) and others were nonidentical (e.g., *catedral* – *cathedral*). The full list of materials is listed in Appendix A.

3.3 Procedure

Upon arrival to the lab, participants were asked to read and complete an informed consent form. After signing the informed consent, participants were asked to fill out a language history questionnaire. Participants were then seated at a computer and began the set of experiments, starting with the out of context word naming task. After the naming task, they completed a set of tasks designed to measure individual differences (working memory and executive control) and proficiency. Following participation, participants were given $10 as compensation for their time.

In the word naming task, participants were instructed both verbally and through written instructions on how to proceed through the task. A fixation cross ("+") appeared before each word. Participants were told to press a button at each cross to bring up a Spanish word. They were told to name the word as quickly and accurately as possible as soon as it appeared. A voice-key trigger recorded the latency to begin naming, and the entire session was recorded so naming accuracy could be computed later. Ten practice trials preceded the experimental session to familiarize the participant with the task. During this time, the experimenter was present to answer any questions the participant might have. Following the practice section, the experimenter left the room.

Following the word naming task, participants completed the Operation Span task, the Simon task, and the picture naming task outlined above in Chapter 2. Participant were then thanked for their participation and paid for their tuime. The experimental session lasted approximately 45 minutes.

3.4 Results

Data from the word naming task were analyzed by comparing naming latencies for cognates to naming latencies for matched controls. An analysis for accuracy was conducted in the same manner. Before these results are reviewed, data about the language experience and individual differences (working memory and executive function) are reviewed for the participants.

3.4.1 Language history and individual difference data

Data from the language history questionnaire, English picture naming task, Operation Span task, and Simon task are shown in Table 3.1. The participants' ages ranged from 18 to 29 years with a mean age of 21.3. On average, they began studying Spanish at 9.1 years of age and had been studying for 11.8 years.

Self-reported language-proficiency ratings for reading, spelling, writing, speaking, and listening in each language are shown in Table 3.2. These ratings were averaged over together for

English-Spanish Bilinguals	
N	15
Age (years)	21.1 (2.6)
L2 Age of Onset (years)	9.1 (6.1)
L2 Length of Study (years)	11.8 (5.3)
Simon Score	43.4 (26.0)
Operation Span (Out of 60)	48.1 (7.1)
Picture Naming Accuracy	94% (0.06%)

Table 3.1. Language background data and individual difference measures for English-Spanish bilinguals out of context

Language Ratings (Out of 10)	Spanish (L2)	English (L1)
Reading	7.5 (1.1)	9.7 (0.5)
Spelling	7.8 (1.4)	9.6 (0.5)
Writing	7.3 (1.3)	9.6 (0.5)
Speaking	7.4 (1.8)	9.8 (0.4)
Listening	7.9 (1.4)	9.9 (0.25)
Average	7.7 (0.9)	9.7 (0.3)

Table 3.2. Self-assessed language ratings for English-Spanish bilinguals naming words out of context

each participant to give an overall language rating. A paired t-test revealed that this group of participants judged themselves as more proficient in English ($M = 9.7$) than in Spanish ($M = 7.7$; $t(14) = 9.68$, $p < 0.01$). Participants scored very highly ($M = 94\%$) on the English picture naming task.

3.4.2 Word naming

Before statistical analyses were conducted on the word naming data, latencies were trimmed of both absolute and relative outliers. Based on data scrubbing techniques of previous word naming studies, absolute cutoffs were set at 200 ms and 2000 ms. Trials outside of this range were removed from further analyses. Mean reaction times were calculated by participant by condition for correct trials. Trials with reaction times 2.5 *SD* above or below this mean were marked as relative outliers and were removed from subsequent analyses. The outlier removal procedure resulted in the removal of 7% of the data. Means and accuracies were then calculated by participant for cognate and control words.

A paired-samples t-test revealed that latencies for cognate words ($M = 615.8$) were significantly faster than latencies for noncognate words ($M = 647.3$; $t(14) = 4.14$, $p < 0.01$). In terms of accuracy, there was no evidence that cognate and noncognate accuracies differed (cognates: 97% correct, noncognates: 96% correct; $t(14) < 1$, $p > 0.5$). The data from the word-naming task are reported in Table 3.3.

	Latency (in ms)	Accuracy (% correct)
Cognates	615.8	0.97
Noncognates	647.3	0.96

Table 3.3. Naming latencies and percent correct for cognate and noncognate stimuli in Experiment 1.

3.5 Discussion

The goal of the first experiment was to replicate the decontextualized processing effects that support the theory of nonselective word recognition for bilingual speakers. Native English speakers that learned Spanish as a second language participated in the experiment. They named words that were cognates between Spanish and English and noncognates controls. Analysis of cognate words and noncognate words showed that the cognate words were named faster compared to the control words, suggesting that the bilingual participants were activating both languages. If the bilinguals had been activating only Spanish, then there would be no reason for the words containing cross-language overlap with English to be read faster.

One shortcoming of this experiment is that it lacked a monolingual control group. While great care was taken during the process of matching cognate words to controls, not everything can be perfectly controlled. Thus, it is possible that monolingual speakers could show the same "cognate effects" if the stimuli were not sufficiently controlled for lexical properties. From this experiment alone, there is no way to rule out this possibility and no way to ensure that the cognate effect is actually due to parallel activation. Data collection is being carried out with monolingual English speakers naming the English translations of the target words in order to provide this control comparison.

For the current investigation, I assume that the cognate effect demonstrated here is real. This assumption is supported by previous studies (reviewed in Section 1.1, all of which find cognate effects under similar circumstances (bilinguals recognizing L2 words). Furthermore, the in context control experiments in Chapter 4 show that monolingual speakers do not exhibit a cognate effect like the bilinguals do.

In sum, the stimuli chosen for the present investigation have been shown to be sufficiently able to elicit cognate effects. In the next chapter, these target words will be embedded in sentences to investigate the role of context and language-specific syntactic constraints on word recognition.

Chapter 4

Experiment 2: Bilinguals in sentence context

The first experiment demonstrated that the selected materials are sufficient to show that bilingual speakers activate words in both languages in parallel outside of sentence context. The goal of this experiment is to explore bilingual word recognition in sentence context. Specifically, it will replicate previous studies that find evidence for cross-language parallel activation in a sentence context, and it will investigate the extent to which language-specific syntax lessens coactivation.

For this experiment, sentence contexts were constructed around the target words used in the first experiment. All of the sentences were low semantic constraint, but they varied in whether they contained language-specific syntax or syntax that was language-general. If, like previous research suggests, bilinguals activate lexical candidates in both languages while reading a unilingual sentence, then bilingual participants should recognize cognates more quickly than noncognate controls. However, if language-specific syntax functions to reduce activation of the unintended language, the cognate effect should disappear or be reduced following language-specific material, resulting in an interaction between cognate status and syntactic specificity.

Two monolingual control groups (English and Spanish) will ensure that any cognate effects are due to bilingualism and not to uncontrolled properties of the stimuli. Because monolinguals know only one language, they should exhibit no difference in recognition between cognate and noncognate words. Additionally, monolinguals can provide a window into whether there are differences between the way sentence containing specific syntax and sentences with language-general syntax cause the target words to be processed.

4.1 Participants

Three groups of participants were recruited for this experiment: Spanish-English bilinguals, English monolinguals, and Spanish monolinguals. Sixteen Spanish-English bilinguals were recruited

from the Pennsylvania State University. They were compensated $10 per hour for their participation. One bilingual participant was removed because of technical difficulties, leaving 15 remaining participants. Fourteen English monolinguals from the same university were recruited and were given course credit. Two monolinguals were removed due to low accuracy on comprehension questions, leaving 12 monolingual English speakers. Twelve Spanish monolinguals were recruited from the University of Granada and were given course credit for participation. Four of the Spanish monolinguals were removed from the analyses due to technical difficulties, leaving a total of eight Spanish monolingual participants.

4.2 Materials

This experiment included materials in Spanish and English. Bilinguals saw sentences in both languages while monolinguals saw only saw sentences in their language. The 128 Spanish target words (64 cognates and 64 matched noncognate controls) from Experiment 1 as well as their translations into English were used as targets in this experiment. This yielded a total set of 256 critical items across both languages. For each Spanish target word, two sentences were written. One sentence contained syntax that was specific to Spanish, and the other contained syntax that was language-general. Both sentences were low semantic constraint. The Spanish sentences were translated into English such that all English sentences contained syntax that could apply to either Spanish or English.

4.2.1 Bilingual materials

Spanish specific syntax was operationalized as the use of both a proclitic and *pro-drop* prior to the point at which the target word appeared. The proclitic is a special type of pronoun not present in English. The proclitic in these sentences redundantly coreferred to the target word. *Pro-drop* is the term for dropping the subject of a clause; in the case of these sentences, the subject of a relative clause was dropped. Like proclitics, *pro-drop* is not present in English. An illustration of a sentence with Spanish-specific syntax is presented in (1). The proclitic ("le") and *pro-drop* ("[pro]") are marked in bold, and the target word ("profesor" / "professor", a cognate) is italicized.

(1) Los estudiantes **le** contaron el cuento que **[pro]** leyeron el otro día al *profesor* de literatura inglesa.
The students recounted the story that they read the other day to the *professor* of English literature

Spanish-nonspecific syntax is exemplified in (2). Note that in this sentence, there is no *pro-drop* nor are there proclitics occurring before the target word.

(2) El taxista que estaba estacionado en la esquina de la panadera llevó al *profesor* a su casa.

The taxi driver who was parked at the corner of the bakery took the *professor* to her house.

The English version of the materials contained translations of each of the Spanish sentences. The translation was done in such a way that the grammatical structure was nonspecific to English or Spanish; they contained language-general syntax. This was done as a control manipulation to ensure that if there was an interaction between cognate status and syntactic specificity in Spanish that it was due to the syntax and not to arbitrary properties of the sentences. The translations are exemplified in (1) and (2), and the full set of stimuli can be found in Appendix B. Note that the general word order is the same across Spanish and English.

Overall, the materials contained three factors of interest: language (English or Spanish), syntactic specificity (nonspecific or specific), and cognate status (noncognate or cognate) for a total of eight conditions with 64 trials per condition for a total of 512 sentences. These materials were then counterbalanced into two lists within each language. Each list contained 32 trials per condition. In a given list, participants saw each cognate and its matched control in the same specificity condition (e.g., *cable* and *chispa* [spark] in specific). In the sister list for the other language, the participant would see the same cognate and noncognate but in the opposite specificity condition (e.g., *cable* and *spark* [chispa] in nonspecific). The order of the presentation of language blocks was counterbalanced across participants.

The method of counterbalancing in this experiment ensured that a given participant never saw the same sentence within or across languages. However, they did see each target word twice (once in each language). While repetition may cause some degree of priming, it was necessary to in order to have adequate power. It also allowed for a controlled comparison of cognate and matched noncognate controls within each condition.

In addition to the experimental stimuli, 12 practice and 48 filler sentences were included in each list. These sentences contained a mixture of cognate and noncognate target words and were not controlled for in terms of syntactic specificity.

4.2.2 Monolingual materials

The English and Spanish monolingual groups saw materials only in their respective languages. Because seeing translations of the same sentences was not an issue with the monolinguals, they could see both lists of materials. In other words they saw each item in each condition within their language. For example, an English monolingual in the first block would see *cable* and *spark* in the nonspecific condition. During the second block she would see *cable* and *spark* in the specific condition. For the monolingual speakers, rate of presentation was varied across two blocks (as opposed to language of presentation for the bilinguals). In one block, the participant would see a fast presentation, and on the second they would see a slower presentation. This order was counterbalanced across participants. This yielded a set of three factors of interest: presentation rate (fast or slow), syntactic specificity (nonspecific or specific), and cognate status (noncognate or cognate).

4.3 Procedure

This experiment was conducted across two visits to the lab. Each visit comprised of a different language or presentation rate. When participants arrived at the lab on the first day, they were asked to read and complete an informed consent form. After signing the informed consent, they were asked to fill out a language history questionnaire. Participants were then seated at a computer and began the set of experiments. They began with the first part of the in context word naming task. After the naming task, they completed a set of tasks designed to measure individual differences (working memory and executive control) and proficiency. Following participation, participants were compensated for their time.

Before leaving the lab, participants were invited back for the second visit. A second visit was completely voluntary. On the second visit to the lab, participants filled out another informed consent form. They then completed part two of the in context experiment. Following the naming experiment, participants completed the English and Spanish grammar tests. They were again paid for their participation.

Instructions for the in context word naming task were given verbally and were displayed on the computer screen prior to the start of the task. Participants were told that they would be reading sentences word-by-word and were to name the red target word aloud as quickly and accurately as possible. Before each sentence was presented, a fixation cross ("+") was displayed. In order to see the sentence, participants were told to press a key.

Each word of the sentence was presented at a fixed rate. For bilinguals, words were presented at 300 ms. Monolinguals received two presentation rates (150 ms or 300 ms). The entire session was recorded so accuracy could be coded, and a voice trigger was used to record naming latency. Overall, participants spent about two hours in the lab.

4.4 Results

Data from the RSVP task were analyzed by comparing cognate latencies to noncognate latencies within each syntactic constraint condition for each language. This procedure was also conducted on naming accuracy. The RSVP data were analyzed separately for each group: Spanish-English bilinguals, English monolinguals, and Spanish monolinguals. Before the results for the RSVP task are shown, the language history and individual difference data will be presented to allow for group comparisons.

4.4.1 Language history and individual difference data

Data regarding the participants' background and individual difference measures (Simon task and Operation Span) are shown in Table 4.1. A univariate ANOVA revealed that there were group differences in terms of age ($F(2,34) = 6.25$, $p < 0.01$). Pairwise comparisons corrected using the TukeyHSD method showed that participants in the bilingual group were older ($M = 24.1$) than participants in the two monolingual groups ($M_{English} = 19.6$ and $M_{Spanish} = 19$; bilingual vs.

English: $p < 0.05$; bilingual vs. Spanish: $p < 0.05$; English vs. Spanish: $p > 0.05$). The groups did not differ significantly in terms of their Operation Span score, though ANOVA did approach significance ($F(2,34) = 3.11$, $p = 0.057$). There were no differences between the three groups in terms of the Simon score ($F(2,34) < 1$).

	Bilinguals	Eng Monolinguals	Span Monolinguals
N	15	12	8
Age (years)	24.1 (5.2)	19.9 (3.8)	19 (1.9)
Simon Score	46.1 (17.0)	46.3 (27.4)	53.7 (14.4)
Operation Span (Out of 60)	42.6 (10.6)	46.3 (7.3)	36.6 (7.9)
Picture Naming Accuracy	87% (14%)	96% (2.1%)	NA

Table 4.1. Language background data and individual difference measures participants in Experiment 2

Average self-assessed language ratings are shown in Table 4.2. These ratings were analyzed across groups and within groups. Cross group comparisons provided a window into the differences between language proficiency for each group. Comparisons within groups allowed for the assessment of relative language dominance of each group.

A series of univariate ANOVAs were conducted for the across-group comparisons. Ratings within each language were used as the dependent variable and speaker group was the independent variable. Pairwise comparisons were conducted between each group using the TukeyHSD method. The three groups differed in terms of their English ratings ($F(2,34) = 49.86$, $p < 0.01$). Pairwise comparisons showed that the Spanish monolinguals rated themselves lower in English ($M = 4.4$) than the English monolinguals ($M = 9.7$; Spanish vs. English: $p < 0.01$). The Spanish monolinguals also rated themselves lower compared to the bilinguals ($M = 8.6$, $p < 0.01$). The difference in English ratings between the bilinguals and the English monolinguals was marginally significant (bilingual vs. English: $p = 0.058$).

Self assessed language ratings (out of 10)	English	Spanish
Spanish-English Bilinguals	8.6 (1.6)	9.7 (0.5)
English Monolinguals	9.7 (0.4)	3.1 (1.8)
Spanish Monolinguals	4.4 (1.4)	9.3 (0.6)

Table 4.2. Self-assessed language ratings for participants in Experiment 2

The speaker groups also differed in their self-assessed ratings of Spanish ($F(2,34) = 120.79$, $p < 0.01$). Pairwise comparisons revealed that both the bilinguals and the Spanish monolinguals rated themselves higher in Spanish compared to the English monolinguals ($M_{bilinguals} = 9.7$; $M_{English} = 3.1$; $M_{Spanish} = 9.4$; Bilinguals vs. Spanish: $p < 0.01$; Spanish vs. English: $p < 0.01$). The bilinguals did not differ from the Spanish monolinguals in their Spanish ratings ($p > 0.05$).

For within group comparisons, a t-test was conducted for each group comparing English to Spanish ratings. The English monolinguals rated themselves as significantly more proficient in English ($M = 9.7$) than in Spanish, or another L2, ($M = 3.1$; $t(13) = 13.90$, $p < 0.01$). The

Spanish monolinguals rated themselves as significantly more proficient in Spanish ($M = 9.4$) than in English, or another L2, ($M = 4.6$; $t(7) = 9.11$, $p < 0.01$). The Spanish-English bilinguals rated themselves as more proficient in Spanish ($M = 9.7$) than in English ($M = 8.6$; $t(14) = 3.79$, $p < 0.01$).

4.4.2 RSVP

Before the data from the RSVP experiment were analyzed, they were trimmed of outliers. Absolute cutoffs were set at 200 ms and 2000 ms, and trials outside of that range were removed from further analyses. Mean reaction times were calculated by participant by condition for trials on which the target word was named correctly. Trials with reaction times 2.5 *SD* above or below this mean were marked as relative outliers and were removed from subsequent analyses. This outlier procedure resulted in the removal of about 4% of the data. Means and accuracies were then calculated by participant for cognates and noncognates within each specificity condition for each language or timing condition. The results for each of the monolingual control studies are presented first. Following these results, data from the bilingual RSVP task are reviewed.

4.4.2.1 English monolinguals

The latency and accuracy data from the English monolinguals in sentence context were subjected to a 2x2x2 (timing x syntactic specificity x cognate status) repeated measures ANOVA. For the latency measure, the analysis revealed that there was a main effect of syntactic specificity ($F(1,11) = 16.22$, $p < 0.01$). Words were named more quickly in the specific condition compared to the nonspecific condition ($M_{nonspecific} = 613$ ms; $M_{specific} = 589$ms). No other main effects were significant (Fs < 1). No interactions were significant (timing X syntactic specificity $F(1,11) = 2.23$, $p > 0.05$; timing X cognate status: $F(1,11) < 1$; syntactic specificity X cognate status: $F(1,11) = 2.72$, $p > 0.05$; timing X syntactic specificity X cognate status: $F(1,11) < 1$). Mean reaction times are shown in Table 4.3.

Condition	Mean RT (in ms)	Std. Deviation	N
150ms Nonspecific Cognate	608.36	81.10	14
150ms Nonspecific Noncognate	619.81	82.93	14
150ms Specific Cognate	596.20	79.37	14
150ms Specific Noncognate	581.25	63.55	14
300ms Nonspecific Cognate	611.57	101.27	14
300ms Nonspecific Noncognate	612.88	100.09	14
300ms Specific Cognate	595.57	100.52	14
300ms Specific Noncognate	583.18	76.30	14

Table 4.3. Mean naming latencies (in ms) in context for English monolingual participants

The analysis on the accuracy measure showed that there were no significant effects of timing, specificity, or cognate status and no interactions between them (timing: $F(1,11) < 1$; specificity:

$F(1,11) < 1$; cognate status: $F(1,11) = 1.40$, $p > 0.05$; timing X specificity: $F(1,11) < 1$; timing X cognate status: $F(1,11) = 1.60$ $p > 0.05$; specificity X cognate status: $F(1,11) < 1$; timing X specificity X cognate status: $F(1,11) = 2$, $p > 0.05$).

Overall the results for the English monolinguals indicate that there may be some differences in terms of the English sentence structure between the specific and nonspecific condition that influences word recognition. Importantly, there were no significant effects of cognate status, suggesting that the cognates and noncognate controls were well matched lexically.

4.4.2.2 Spanish monolinguals

The accuracy and latency data from the Spanish monolinguals in sentence context were subjected to a 2x2x2 (timing x syntactic specificity x cognate status) repeated measures ANOVA. In the latency data, no main effects were significant (all Fs < 1). The interaction between timing and specificity approached significance ($F(1,7) = 3.20$, $p = 0.12$). No other interactions approached significance (Fs < 1). Mean reaction times are presented in Table 4.4.

Condition	Mean RT (in ms)	Std. Deviation	N
150ms Nonspecific Cognate	667.33	111.023	8
150ms Nonspecific Noncognate	672.38	86.390	8
150ms Specific Cognate	643.26	68.185	8
150ms Specific Noncognate	641.93	91.554	8
300ms Nonspecific Cognate	654.00	78.606	8
300ms Nonspecific Noncognate	649.88	91.322	8
300ms Specific Cognate	682.47	94.602	8
300ms Specific Noncognate	673.55	83.213	8

Table 4.4. Mean naming latencies (in ms) in context for Spanish monolingual participants

Because the interaction between timing and specificity would likely become significant if more participants were tested, simple effects analyses were conducted. For the fast presentation rate (150 ms), there was a marginal main effect of syntactic specificity ($F(1,7) = 5.30$, $p = 0.055$) with the reaction time for words named in the specific condition faster than in the nonspecific condition ($M_{nonspecific} = 670$ ms, $M_{specific} = 643$ ms). No other main effects or interactions were significant (Fs < 1). In the slower presentation block (300 ms), there were no significant main effects or interactions (Fs < 1).

The analysis on the accuracy measure revealed that there was a marginal main effect of timing and a marginal interaction between syntactic specificity and cognate status (timing: $F(1,7) = 5.362$, $p = 0.054$; specificity X cognate status: $F(1,7) = 5.119$, $p = 0.058$). No other main effects or interactions approached significance (specificity: $F(1,7) = 1.12$, $p > 0.05$; cognate status: $F(1,7) < 1$; timing X spec: $F(1,7) = 2.14$, $p > 0.05$; timing X cognate status: $F(1,7) = 2.59$, $p > 0.05$; timing X specificity X cognate status: $F(1,7) < 1$).

Though the interaction was not significant, a simple effects analysis was conducted in order to get a sense of the nature of the effect. The data were collapsed across timing, because it did

not interact with other factors, and an analysis of the effect of cognate status at each level of specificity was conducted. In the nonspecific condition, there was a marginal effect of cognate status ($F(1,7) = 4.20$, $p = 0.080$), with cognates having 1.8% higher accuracy than noncognate words. In the specific condition, there was no effect of cognate status ($F(1,7) = 1.84$, $p > 0.10$).

The results of the Spanish monolinguals show that the Spanish materials were well controlled. There were no significant effects of cognate status (though cognates may be named more accurately in the nonspecific condition). There was a hint of an effect of specificity, indicating that the Spanish monolinguals may process the sentences with Spanish specific syntax differentially compared to the nonspecific sentences.

4.4.2.3 Spanish-English bilinguals

A 2x2x2 repeated measures ANOVA was conducted on the latency and accuracy data from the Spanish-English bilinguals. The factors included in the model were language (English or Spanish), syntactic specificity (nonspecific or specific), and cognate status (cognate or noncognate). For the latency data (shown in Table 4.5), there was a significant main effect of cognate status ($F(1,14) = 20.22$, $p < 0.01$), indicating that cognates were named faster than noncognates ($M_{cognates} =$ 694 ms, $M_{noncognates} = 718$ ms). No other main effects were significant (Fs < 1). No interactions were significant (language X specificity: $F(1,14) < 1$; language X cognate status: $F(1,14) < 1$; specificity X cognate status: $F(1,14) = 1.35$, $p > .05$; language X specificity X cognate status: $F(1,14) = 1.22$, $p > .05$).

Condition	Mean RT (in ms)	Std..Deviation	N
English Nonspecific Cognate	705.31	180.844	15
English Nonspecific Noncognate	720.84	176.136	15
English Specific Cognate	689.61	157.824	15
English Specific Noncognate	729.08	196.690	15
Spanish Nonspecific Cognate	691.87	183.502	15
Spanish Nonspecific Noncognate	711.91	183.809	15
Spanish Specific Cognate	689.53	165.934	15
Spanish Specific Noncognate	713.33	190.399	15

Table 4.5. Mean naming latencies (in ms) for all Spanish-English bilingual participants

In the accuracy data, there was a marginal main effect of language ($F(1,14) = 3.76$, $p =$ 0.73), hinting that Spanish may be more accurate than English ($M_{Spanish} = 98\%$; $M_{English} =$ 96%). No other effects or interactions were significant (specificity: $F(1,14) < 1$; cognate status: $F(1,14) = 1.50$, $p > 0.05$; language X specificity: $F(1,14) = 2.52$, $p > 0.05$; language X cognate status: $F(1,14) < 1$; specificity X cognate status: $F(1,14) < 1$; language X specificity X cognate status: $F(1,14) < 1$).

In summary, the bilinguals showed a facilitatory cognate effect in the latency measures in both Spanish and English blocks. This cognate effect did not appear to interact with language of the task or specificity. Neither monolingual control group showed evidence of cognate effects

(though the Spanish monolinguals were marginally more accurate on cognate words). Both groups of monolinguals did show effects of the specificity manipulation. Monolingual English speakers were faster in the specific condition. Monolingual Spanish speakers were likely faster in the specific condition, but only under the faster timing manipulation. This difference was not significant, but the nonsignificance is likely due to a lack of power with only eight participants.

4.5 Discussion

The present experiment demonstrated that bilinguals, but not monolinguals, activated both languages in parallel while reading sentences in one language alone. This parallel activation was not constrained by the presence of language-specific syntax in all speakers. The monolingual participants did show evidence of differential processing in the language-specific syntax condition compared to the nonspecific condition.

Spanish-English bilinguals named cognates faster than noncognates when these words were embedded in sentence context. Facilitation was not observable for monolingual speakers reading the same sentences. Together these results indicate that the cognate facilitation for the bilinguals is not due to lexical factors. Instead, the effects are due to the presence of cross-language overlap in form and meaning for the cognates. These effects would only be present if bilinguals were activating both languages in parallel. The findings of this experiment converge with those of many previous studies (e.g., Baten et al., 2010; Chambers & Cooke, 2009; Duyck et al., 2007; Libben & Titone, 2009; Schwartz & Kroll, 2006; Van Assche et al., 2009, 2010; Van Hell & de Groot, 2008), all of which find that the presence of a sentence context alone is not sufficient to constrain word recognition to a single language.

In order to examine the role of language-specific syntax, a subset of the sentences included in this experiment incorporated two language-specific features: (1) proclitics, a special type of pronoun that refers to the target noun phrase and (2) pro-drop, the dropping of the subject of a clause, in this case an object-relative clause. Neither of these features are present in English syntax, making them unique to Spanish when only the two languages are considered. Pro-drop is an extremely salient cross-linguistic cue. Some languages have pro-drop and other do not, and attempting to pro-drop in a languages that does not do allow for it, causes a sentence to become ungrammatical (e.g., "John likes books. *Is reading one now"). In the case of the object relative clauses in these sentences, pro-drop is required, otherwise the sentence becomes ungrammatical. The proclitic is also not present in English. In the present materials, the proclitic always coreferred with the target cognate or noncognate, establishing tightly bound relationship with the target. One might predict that these two features would be a red flag as to the language of the sentence and that they may allow for language-selective access. However, this was not the case.

In the sentences containing language-specific syntax, the cognate effect persisted, and its magnitude was not changed. Hence, parallel activation of the two languages was not constrained by language-specific syntactic constraints. This finding is compatible with BIA+ model (Dijkstra

& van Heuven, 2002) and with researchers who posit a limited role for linguistic factors such as syntax or semantics in word recognition (e.g., Desmet & Duyck, 2007). Word recognition in the BIA+ model is a bottom-up process. Expectations of the language of the sentence do not influence word recognition in this model. If language-specific syntax in the present study were able to enhance expectations about the language of the task, then it did not come into play inside the word recognition system. Either the bilinguals were not sensitive to the manipulation, or they were sensitive but the manipulation had no effect. However, there is evidence from the monolingual participants that the syntax specific condition can influence word recognition. In the 150 ms timing condition, Spanish monolingual were facilitated in the specific syntax condition.

In sum, the results of this experiment confirm that bilingual word recognition is a fundamentally nonselective process. This finding falls in line with a the findings from a plethora of previous studies (e.g., Baten et al., 2010; Chambers & Cooke, 2009; Dijkstra et al., 1998; Dijkstra et al., 1999; Duyck et al., 2007; Grainger & Dijkstra, 1992; Gollan et al., 1997; Jared & Kroll, 2001; Libben & Titone, 2009; Marian & Spivey, 2003; Schwartz & Kroll, 2006; Schwartz et al., 2007; Van Assche et al., 2009, 2010; van Hell & Dijkstra, 2002; Van Hell & de Groot, 2008). It would seem that the elimination of parallel activation of the unintended language is not easy. Thus far, only two factors have been found that allow for selective access during word recognition in context: a highly biased semantic constraint (e.g., Libben & Titone, 2009; Chambers & Cooke, 2009; Schwartz & Kroll, 2006; Van Hell & de Groot, 2008), and non-overlapping word classes across languages (e.g., Baten et al., 2010; Sunderman & Kroll, 2006).

Chapter 5

General Discussion

The current study sought to examine bilingual word recognition in sentence context. The first goal was replicate previous studies that find support for nonselectivity in unilingual sentences. The second goal was to investigate whether syntactic constructions that are specific to only one of a bilingual's two language can reduce or eliminate the parallel activation. To accomplish these goals, two experiments were designed: an out of context naming experiment (Chapter 3) and an RSVP naming experiment in sentence context (Chapter 4). Overall, the results showed that bilinguals, but not monolinguals, activated both languages in parallel, as evidenced by the cognate effects, even in the presence of a sentence context. Parallel activation persisted even in sentences that were syntactically specific to one language. Interestingly, there was preliminary evidence that a sub-group of the participants appeared to exploit the presence of language-specific syntactic constraints to modulate nonselectivity. For the other participants, parallel activation persisted in the specific sentences. Because they are highly speculative, the results from these two groups are presented in this section All results will be interpreted under the framework of the BIA+ model (Dijkstra & van Heuven, 2002).

In Chapter 3, L2 learners of Spanish showed a facilitatory cognate effect for words named in Spanish. This result was interpreted as evidence for parallel activation of two languages. If the bilinguals were activating only Spanish without considering words in English, then the bilinguals should not have been facilitated due to the convergence of orthography, phonology, and semantics of the cognates across languages. Overall, the first experiment confirmed that the target words were sensitive to the detection of parallel activation. Hence, it was appropriate to use these words to investigate whether word recognition is also nonselective in L1 word recognition in sentence context.

In Chapter 4, native Spanish speakers who were proficient in English showed a facilitatory cognate effect in both languages. Neither Spanish monolingual speakers nor English monolinguals displayed cognate effects while naming words embedded in sentences. This shows that the naming latencies in English and in Spanish sentences were not influenced by unintended lexical

properties of the targets or sentential properties of the sentences. As of yet, no other study examining bilingual word recognition in sentence context has included a monolingual control in both languages. Thus, in the present investigation, we can be relatively certain that the cognate effects that occurred in sentence context (and in isolation) are due to parallel activation of two languages.

This is also the first investigation into the role of language-specific syntax for bilingual word recognition. In the current experiment, there was no evidence that language-specific syntax modulated magnitude of the cognate effect. If a sentence is constructed using syntactic constructions available only in one language, words in both languages are still activated. The finding that syntax does not influence parallel activation is compatible with BIA+ model (Dijkstra & van Heuven, 2002). Word recognition in the BIA+ model is a bottom-up, data driven process. Prior expectations about the language of a sentence do not influence word recognition in the BIA+ model. If language-specific syntax in the present study were able to enhance expectations about the language of the task, then it did not come into play inside the word recognition system. Otherwise, nonselectivity should have been influenced by the specific syntax. Instead, any expectations established by the language-specific syntax came into play likely at the level of the task schema. The task schema is modularized from the word recognition system, and it is not allowed to impede on word recognition.

Yet, previous studies have found that parallel activation can be overcome by a highly biased semantic constraint or when words differ in their lexical properties across languages (e.g., Baten et al., 2010; Schwartz & Kroll, 2006; Sunderman & Kroll, 2006). So it is possible for bilinguals to switch off the unintended language. There are at least three possible reasons why the bilinguals may not have shown a modulation of the cognate effect in the sentences with specific syntax. First, language-specific syntax may not function in the predicted manner of constraining nonselectivity. One alternative is that it does function in the predicted manner, but that the bilinguals were not influenced by the function of the syntax, either because the structures chosen were not powerful enough, or because the bilinguals were not sensitive. It is possible that because the bilinguals were all immersed in an English speaking environment, they became less sensitive to the specific syntax. Previous work demonstrates that bilinguals who are immersed in an L2 environment can experience changes in their parsing preferences (e.g., Dussias, 2003; Dussias & Sagarra, 2007). Yet another alternative is that the bilinguals are sensitive to language-specific syntactic constraints, but that the sentences were too long for participants to maintain the constraints in memory until they reached the target word. However, given that the monolinguals showed the main effect of syntactic specificity, the appearance of this effect is likely not due to working memory difference. An analysis of working memory scores and appearance of the specificity effect yielded no significant correlations.

In the current data set, there is a clue to this issue of immersion shifting syntactic processing. The Spanish monolinguals, who are all immersed in an L1 environment, process the specific syntax conditions faster, yet the bilingual speakers do not show this facilitation as a group. In order to investigate the alternative that the bilinguals are not sensitive to the language-specific

syntax, the data were reexamined. Some bilinguals processed the sentences with specific syntax like monolingual speakers, and some did not. Furthermore, those who did process like native speakers, tended to be Spanish dominant. When the data were analyzed by these two groups, the bilinguals who mirrored the Spanish monolinguals began to show our predicted interaction, though the sample size was too small to find significant effects.

Naming latencies for the bilinguals who processed the specific condition like native speakers are shown in Table 5.1. The naming latencies for the bilinguals who did not process like native speakers are shown in Table 5.2. Post-hoc repeated measures ANOVAs were conducted on each of these groups. Participants who were faster in the specific condition showed a marginal main effect of language ($F(1,7) = 4.50$, $p = 0.072$) with Spanish words being named faster than English words ($M_{Spanish} = 727$ ms, $M_{English} = 764$ ms). They also showed a significant main effect of syntactic specificity ($F(1,7) = 10.52$, $p < 0.05$); words in specific conditions were named faster than words in nonspecific conditions ($M_{specific} = 734$ ms; $M_{nonspecific} = 756$ ms). There was a marginal main effect of cognate status ($M_{cognate} = 736$ ms $M_{noncognate} = 756$ ms; $F(1,7) = 5.53$, $p = 0.051$). No two-way interactions were significant (language X specificity: $F(1,7) = 1.94$, $p = 0.20$; language X cognate status: $F(1,7) = 2.49$, $p = 0.159$; specificity X cognate status: $F(1,7) < 1$). The three way interaction between language, specificity, and cognate status approached significance ($F(1,7) = 3.41$, $p = 0.107$).

Condition	Mean RT (ms)	Std. Deviation	N
English Nonspecific Cognate	767.36	203.977	8
English Nonspecific Noncognate	778.22	186.238	8
English Specific Cognate	734.07	167.588	8
English Specific Noncognate	777.03	220.379	8
Spanish Nonspecific Cognate	730.68	207.450	8
Spanish Nonspecific Noncognate	750.45	210.416	8
Spanish Specific Cognate	709.96	184.041	8
Spanish Specific Noncognate	717.57	205.934	8

Table 5.1. Mean naming latencies (in ms) in context for Spanish-English bilingual participants who processed Spanish-specific syntax like Spanish monolinguals

Follow-up tests were not conducted because the effects were not significant, but the pattern of the means seems to indicate that in the Spanish sentences, the bilinguals who named words faster in specific condition show a cognate effect in the non-specific condition, but the cognate effect is eliminated in the specific condition. For English, it appears as though there is a cognate effect across the board, and that the effect is larger in the specific sentences.

Participants who were not faster in the non-specific condition showed a significant main effect of specificity and of cognate status (specificity: $F(1,6) = 12.90$, $p < 0.05$; cognate status: $F = 20.23$, $p < 0.01$). Specific sentences were named slower than nonspecific sentences ($M_{specific} = 671$ ms; $M_{nonspecific} = 651$ ms) and cognates were named faster than noncognates ($M_{cognate} = 647$ ms; $M_{noncognate} = 676$ ms). The was no main effect of language ($F(1,6) < 1$). There was a significant interaction between specificity and cognate status. No other interactions were

Condition	Mean RT (in ms)	Std..Deviation	N
English Nonspecific Cognate	634.39	129.492	7
English Nonspecific Noncognate	655.25	150.049	7
English Specific Cognate	638.80	140.373	7
English Specific Noncognate	674.28	164.431	7
Spanish Nonspecific Cognate	647.51	155.107	7
Spanish Nonspecific Noncognate	667.85	151.437	7
Spanish Specific Cognate	666.18	153.419	7
Spanish Specific Noncognate	708.48	187.239	7

Table 5.2. Mean naming latencies (in ms) in context for Spanish-English bilingual participants who did not process Spanish-specific syntax like Spanish monolinguals

significant (language X specificity: $F(1,6) = 1.16$, $p > 0.05$; language X cognate status: $F(1,6) < 1$; language X specificity X cognate status: $F(1,6) < 1$).

To explore the interaction between specificity and cognate status for the bilinguals who were slower in the specific sentences, simple effects tests were performed on the data collapsed over language. The simple effects tests revealed that in the nonspecific condition, cognates were named faster than noncognates ($M_{cognate} = 641$ms; $M_{noncognate} = 661$ ms; $F(1,6) = 9.37$, $p < 0.05$). In the specific condition, cognates were also named faster than noncognates, but the magnitude of the effect was larger ($M_{cognate} = 652$ ms; $M_{noncognate} = 691$ ms; $F(1,6) = 21.98$, $p < 0.01$). Overall, it would appear that the manner in which bilinguals recognize words in the specific syntax condition influences whether the specific condition will modulate the cognate effect.

Currently, the BIA+ model has no explicit way to model syntactic effects on bilingual word recognition, though Dijkstra and van Heuven (2002) assert that syntactic effects may be able to influence word recognition in BIA+. In order to model the role of syntactic constraints, the nature of the constructions used in the current investigation must be explored. Experiment 2 included two types of syntactic constraint, the pro-clitic and pro-drop, and each one may function differently. The pro-clitic is a unique piece of the syntactic structure of Spanish and is closely linked to the verb and its object. It may provide the reader with predictions about upcoming material in the sentence. In other words, when a reader encounters a proclitic, they expect to encounter a verb that takes an indirect object. While pro-drop is also unique to Spanish, it does not allow the reader to make predictions about the number of objects that a verb takes. For example, both intransitive and transitive verbs can drop their subjects. Therefore, the presence of pro-drop may only provide the reader with additional expectations as to the language of the sentence. If the BIA+ model is correct in assuming that prior language expectations do not influence word recognition, then it would predict that only the pro-clitic should be able to reduce parallel activity of the unintended language. If syntactic constraints ultimately turn out to be useful for bilinguals during word recognition, future research can explore this question by teasing apart the independent contributions of proclitics and pro-drop.

One way for BIA+ to model the effect of the proclitic would be to assume that syntactic information is encoded lexically (e.g., Pickering, 1998). If syntactic information is present in the

lexicon, the appearance of a proclitic could preactivate any verbs that use a proclitic as well as potential objects of the verb. This not only generates the prediction that both the verb and object would be processed more quickly, but because clitics exist in Spanish but not English, Spanish words would become more highly activated, allowing the reader to selectively access Spanish words before English can be activated.

Another open question for the current investigation is what factors allow a bilingual to attend to the language-specific syntax. While no correlations were found for individual difference and language history measures, an informal analysis of the data suggests that the bilinguals who were processing the specific sentence like native speakers tended to be Spanish dominant. Those who were English dominant tended not process like the Spanish monolinguals. This cross-tabulation is interesting in light of research demonstrating that the parsing preferences of the native language are malleable when bilinguals are immersed in an L2 environment (Dussias, 2003; Dussias & Sagarra, 2007). Because the syntactic constructions used in this experiment were specific to Spanish, the bilinguals who have been living in an English dominant environment experience less exposure to the constructions compared to bilinguals, or monolinguals, who are not immersed. Hence, they may be less able to exploit the Spanish-specific syntax to switch off the unintended language. Data are currently being collected on speakers who have more use of Spanish on a daily basis in order to more rigorously test this hypothesis.

In conclusion, the results from the current experiments suggest that it may be premature to conclude that language-specific syntactic constraints have no influence on bilingual word recognition. More data need to be collected before a decision is made either way.

Appendix A

Out of context stimuli

A.1 Spanish cognates

Cognate	Frequency	First Phoneme	Syllables	Phonemes	Length	Animacy
bus	2	b	1	3	3	i
general	632	x	3	7	7	a
colegas	56	k	3	7	7	a
garaje	22	g	3	6	6	i
cable	16	k	2	5	5	i
proyecto	155	p	3	8	8	i
cámara	114	k	3	6	6	i
turistas	51	t	3	8	8	a
jirafa	2	x	3	6	6	a
reportero	3	r	4	9	9	a
plato	85	p	2	5	5	i
pirata	12	p	3	6	6	a
pipa	38	p	2	4	4	i
planta	89	p	2	6	6	a
profesora	15	p	4	9	9	a
estatua	36	E	3	7	7	i
cliente	40	k	2	7	7	a
cobra	37	k	2	5	5	a
cubo	26	k	2	4	4	i
organizador	4	O	5	11	11	a
violín	17	b	2	6	6	i
círculo	59	T	3	7	7	i
pistola	50	p	3	7	7	i

Cognate	Frequency	First Phoneme	Syllables	Phonemes	Length	Animacy
oficial	118	O	3	7	7	a
problemas	279	p	3	9	9	i
computadora	9	k	5	11	11	i
detective	12	d	4	9	9	a
atleta	8	A	3	6	6	a
compositor	4	k	4	10	10	a
coronel	6	k	3	7	7	a
paciente	52	p	3	8	8	a
hamburguesa	3	A	4	9	11	i
capitales	13	k	4	9	9	i
sopa	31	s	2	4	4	i
vendedor	21	b	3	8	8	a
decisión	140	d	4	8	8	i
rata	34	r	2	4	4	a
suéter	6	s	2	6	6	i
ingeniero	70	I	4	9	9	a
bebé	30	b	2	4	4	a
instituto	84	I	4	9	9	i
tanque	12	t	2	5	6	i
director	173	d	3	8	8	a
estrategia	54	E	4	10	10	i
café	210	k	2	4	4	i
catedral	58	k	3	8	8	i
teléfono	186	t	4	8	8	i
carpintero	12	k	4	10	10	a
brcoli	1	b	0	0	7	a
caramelos	15	k	4	9	9	i
familia	495	f	3	7	7	a
presidente	138	p	4	10	10	a
estudiante	37	E	4	10	10	a
recepcionista	3	r	5	11	13	a
sofá	67	s	2	4	4	i
bióloga	1	b	4	7	7	a
presentador	3	p	4	11	11	a
artista	102	A	3	7	7	a
cereal	1	T	3	6	6	i
dinamita	2	d	4	8	8	i
autoridades	37	A	0	0	11	a
miembros	140	m	0	0	8	a

Cognate	Frequency	First Phoneme	Syllables	Phonemes	Length	Animacy
antílope	1	A	4	8	8	a
canguro	2	k	3	7	7	a

Table A.1: List of Spanish cognate words

A.2 Spanish noncognate controls

Control	Frequency	First Phoneme	Syllables	Phonemes	Length	Animacy
laca	2	l	2	4	4	i
escritura	73	E	4	9	9	i
cuaderno	55	k	3	8	8	i
manejo	24	m	3	6	6	i
chispa	19	J	2	5	6	i
barrio	161	b	2	5	6	i
primavera	114	p	4	9	9	i
herida	52	E	3	5	6	i
bistec	2	b	2	6	6	i
pescadora	1	p	4	9	9	a
torre	85	t	2	4	5	i
folio	13	f	2	5	5	i
perro	38	p	2	4	5	a
hierro	89	j	2	4	6	i
lavado	13	l	3	6	6	i
espuma	36	E	3	6	6	i
postre	41	p	2	6	6	i
cinta	37	T	2	5	5	i
niñez	26	n	2	5	5	i
impresora	4	I	4	9	9	i
bragueta	18	b	3	7	8	i
castigo	59	k	3	7	7	i
corbata	51	k	3	7	7	i
despacho	118	d	3	7	8	i
alma	329	A	2	4	4	i
escalerilla	9	E	5	10	11	i
cabalgata	8	k	4	9	9	i
avestruz	8	A	3	8	8	a
congelador	4	k	4	10	10	i
báscula	7	b	3	7	7	i

Control	Frequency	First Phoneme	Syllables	Phonemes	Length	Animacy
agujero	53	A	4	7	7	i
hermanastro	3	E	4	10	11	a
mendigo	13	m	3	7	7	a
lomo	31	l	2	4	4	i
encuesta	21	E	3	8	8	i
fiesta	140	f	2	6	6	i
viajero	33	b	3	7	7	a
biombo	5	b	2	6	6	i
crecimiento	70	k	4	11	11	i
cueva	29	k	2	5	5	i
papa	84	p	2	4	4	i
harina	12	A	3	5	6	i
actuación	53	A	4	9	9	i
encargado	55	E	4	9	9	a
belleza	212	b	3	6	7	i
ascensor	55	A	3	8	8	i
caballo	187	k	3	6	7	a
calcetines	26	k	4	10	10	i
arbitro	2	A	0	0	7	a
cabellera	15	k	4	8	9	i
niños	497	-1	0	0	5	a
amiga	136	A	3	5	5	a
extranjeros	40	-1	0	0	11	a
guardabosques	1	g	4	12	13	a
muro	72	m	2	4	4	i
cabrito	1	k	3	7	7	a
bibliotecario	4	b	7	11	13	a
ciegos	73	T	2	5	5	a
duraznos	1	-1	0	0	8	a
ciruelas	3	T	3	8	8	a
huéspedes	37	-1	0	0	9	a
edificio	141	E	4	8	8	i
cachorro	1	k	3	6	7	a
duendes	1	-1	0	0	7	a

Table A.2: List of Spanish noncognate control words

A.3 English cognates

Cognate	Frequency	First Phoneme	Syllables	Phonemes	Length	Animacy
bus	34	b	1	3	3	i
general	497	dZ	2	6	7	a
colleagues	23	k	2	6	10	a
garage	21	g	2	5	6	i
cable	7	k	2	4	5	i
project	93	p	2	7	7	i
camera	36	k	2	5	6	i
tourists	12	t	2	7	8	a
giraffe	0	dZ	2	5	7	a
reporter	20	r	3	7	8	a
plate	22	p	1	4	5	i
pirate	4	p	2	5	6	a
pipe	20	p	1	3	4	i
plant	125	p	1	5	5	a
professor	57	p	3	7	9	a
statue	17	s	2	5	6	i
client	15	k	1	6	6	a
cobra	3	k	2	5	5	a
cube	1	k	1	4	4	i
organizer	3	O	4	8	9	a
violin	11	v	2	6	6	i
circle	60	s	2	4	6	i
pistol	27	p	2	5	6	i
official	75	@	3	5	8	a
problems	247	p	2	8	8	i
computer	13	k	3	8	8	i
detective	52	d	3	8	9	a
athlete	9	a	2	5	7	a
composer	31	k	3	7	8	a
colonel	37	k	2	4	7	a
patient	86	p	2	5	7	a
hamburger	6	h	3	7	9	i
capitals	4	k	3	7	8	i
soup	16	s	1	3	4	i
vendor	1	v	2	5	6	a
decision	119	d	3	6	8	i
rat	6	r	1	3	3	a
sweater	14	s	2	5	7	i

Cognate	Frequency	First Phoneme	Syllables	Phonemes	Length	Animacy
engineer	42	E	3	7	8	a
baby	62	b	2	4	4	a
institute	50	I	3	8	9	i
tank	12	t	1	4	4	i
director	101	d	3	7	8	a
strategy	22	s	3	8	8	i
coffee	78	k	2	4	6	i
cathedral	8	k	3	8	9	i
telephone	76	t	3	7	9	i
carpenter	6	k	3	8	9	a
broccoli	1	b	3	7	8	a
caramels	1	k	3	7	8	i
family	331	f	3	6	6	a
president	382	p	3	8	9	a
student	131	s	2	6	7	a
receptionist	5	r	4	10	12	a
sofa	6	s	2	4	4	i
biologist	2	b	4	9	9	a
presenter	1	p	3	8	9	a
artist	57	A	2	6	6	a
cereal	17	s	2	6	6	i
dynamite	5	d	3	7	8	i
authorities	39	@	4	8	11	a
members	325	m	2	6	7	a
antelope	7	a	3	6	8	a
kangaroo	0	k	3	7	8	a

Table A.3: List of English cognate words

A.4 English noncognate controls

Control	Frequency	First Phoneme	Syllables	Phonemes	Length	Animacy
hairspray	0	h	2	7	9	i
deed	8	a	2	7	7	i
notebook	2	n	2	6	8	i
handling	38	h	3	7	8	i
spark	12	s	1	5	5	i
neighborhood	58	n	3	7	12	i

Control	Frequency	First Phoneme	Syllables	Phonemes	Length	Animacy
spring	127	s	1	5	6	i
wound	28	w	1	4	5	i
steak	10	s	1	4	5	i
fisherwoman	0	f	4	9	11	a
tower	13	t	1	3	5	i
report	174	d	3	9	8	i
dog	75	d	1	3	3	a
iron	43	a	1	3	4	i
wash	37	w	1	3	4	i
foam	37	f	1	3	4	i
dessert	7	d	2	5	7	i
ribbon	12	r	2	5	6	i
childhood	50	tS	2	7	9	i
printer	3	p	2	6	7	i
zipper	1	z	2	4	6	i
punishment	21	p	3	9	10	i
tie	23	t	1	2	3	i
workroom	0	A	2	4	6	i
soul	47	s	1	3	4	i
ladder	19	l	2	4	6	i
parade	25	p	2	5	6	i
ostrich	0	O	2	6	7	a
freezer	1	f	2	5	7	i
scale	60	s	1	4	5	i
hole	58	h	1	3	4	i
stepbrother	0	s	3	9	11	a
beggar	2	b	2	4	6	a
loin	1	l	1	3	4	i
survey	37	s	2	4	6	i
party	216	p	2	5	5	i
traveler	8	tr	3	6	8	a
screen	48	s	1	5	6	i
growth	155	g	1	4	6	i
cave	9	k	1	3	4	i
potato	15	p	3	6	6	i
flour	8	f	1	4	5	i
performance	122	p	3	9	11	i
manager	88	m	3	6	7	a
beauty	71	b	2	5	6	i

Control	Frequency	First Phoneme	Syllables	Phonemes	Length	Animacy
elevator	12	E	4	7	8	i
horse	117	h	1	4	5	a
socks	7	s	1	4	5	i
referee	1	r	3	5	7	a
hair	148	h	1	3	4	i
boys	143	b	1	3	4	a
friend	133	f	1	5	6	a
foreigners	13	f	3	7	10	a
rangers	2	r	2	6	7	a
wall	160	w	1	3	4	i
lamb	7	l	1	3	4	a
librarian	5	l	3	9	9	a
blind	47	b	1	5	5	a
peaches	1	p	2	5	7	a
plums	1	p	1	5	5	a
guests	62	g	1	5	6	a
building	160	b	2	6	8	i
puppy	1	p	2	4	5	a
elves	1	E	1	4	5	a

Table A.4: List of English noncognate control words

Appendix B

In context stimuli

B.1 English — Syntax Nonspecific — Cognates

The lion that sitting on the field saw the antelope while it was eating grass by the pond.

The farmer who labored intensively in the field hated the artist for the leisurely life he led.

The teachers who went to the event cheered on the athlete during his final race.

The woman who had made the call to the police spoke to the authorities about the burglary when they arrived.

The baker who works near the church has a baby who is four years old who can already play the piano.

The girl who I met at the store is a biologist who makes pharmaceuticals.

The girl who always forgets where she leaves her keys went to the store to buy some broccoli for the dish that she was preparing for dinner.

The man who was returning from the dinner drove the bus with the teachers from his school.

The postman who works for the city cut the cable that hung from the window because it caused a safety hazard.

The lawyer who studied at Harvard ordered the camera on the Internet because it was less expensive.

The historian who was sitting in the park knew all the capitals of the African countries.

The psychologist who studies memory loves it when her participants bring her caramels as a present.

The butler who works in the mansion called the carpenter to fix the main door of the guest house.

The mason who was cousin to the king built a cathedral with recycled materials.

The dalmatian that had very floppy ears ate the cereal the child spilled onto the floor.

The boy who is in third grade drew a circle with his blue pencil and then he cut it and glued it on his book.

The woman who had worked at a company that manufactures paper saw her client in the mall.

The actress who was on the balcony killed a cobra with a shovel that she grabbed from the shed.

The thief who robbed the bank drank some coffee before the robbery and then told his friends what he did.

The bookseller who opened the new store on the corner invited his colleagues to the inauguration.

The telegrapher who worked in the air base warned the colonel of the attack that the enemies were planning.

The actress who studied in Madrid had dinner with the composer from San Francisco.

The teller who works at the bank burned the computer on her desk with her cigarette.

The assistant who teaches at the school designed the cube for the Physics class.

The congressman who lives in Minnesota argued that his decision was the right one given the circumstances.

The writer who was trying to get ideas for his novel listened to the detective during the investigation.

The businessman who had invested a lot of money fired the director of the company last month.

The soldier who was anxious to prove himself set off the dynamite too early and almost jeopardized the mission.

The accountant who has three children called the engineer on his wedding day to congratulate him.

The man who loves animals brought home a kitten for his family without first telling his wife.

The hairdresser who bought a car opened the garage of her house with her remote control.

The king who governed the country invited the general to eat shrimp and drink a beer.

The firemen who arrived at the scene of the accident helped the giraffe in danger at the San Diego Zoo.

The gardener who was hired by the school prepared a hamburger to eat with his friends.

The archaeologist who has dedicated his life to science inaugurated the institute of Anatomic Research.

My father who has traveled the world had never seen a kangaroo until his trip to Australia.

The people who founded the United Nations were members of a hopeful generation of individuals.

The hostage who was trapped in the bank called the official while the thief was distracted.

The nurse who will be working with the cardiologist pushed the organizer out the door.

The specialist who is very famous spoke to the patient about various treatments to cure his sickness.

The dentist who died last week had bought a pipe in Turkey for his collection.

The man who sailed across the ocean in his ship killed the pirate with a knife.

The waitress who smokes two packs of cigarettes a day carries a pistol in her handbag.

The politician who lives in Washington bought a plant for his wife because she likes them very

much.

The woman who opened the cabinet threw a plate at her husband because she was angry at him.

The news anchor who had been promoted recently encouraged the presenter to act naturally on the air.

The diplomat who travels to many countries asked the president whether she could become a spy.

The decorator who writes for the magazine predicted that the problems with the paint would be hard to solve.

The taxi driver who was parked at the corner of the bakery took the professor to her house.

The explorer who was interviewed yesterday said that the project required more funds for its completion.

The man who organized the event found a rat in the pantry of his kitchen last week.

The governor's sister who helped him during his campaign picked up the letters from the receptionist before leaving.

The skier who won the medal in the Olympics saw the reporter during his jump.

The baseball that was signed by a famous player landed on the sofa after it fell off the cabinet.

The lady who lives in our building left the soup on the window so that it would cool off.

The dancer who was at the exhibit will buy a statue in Berlin during her next visit.

The trainer who works for the school believes that his strategy will give good results.

The woman who attended summer camp as a child became the best student in her class.

The soldier who had fought in the battle sewed the sweater in his camping tent.

The pacifist who had organized the demonstration painted the tank with peace signs.

The caretaker who began to work yesterday cleaned the telephone with water and soap to disinfect it.

The spy who turned over the data interrogated the tourists in Cancun to obtain more information about the case.

The kids who were at the supermarket called the vendor through the window.

The actor who lived in Chile bought a violin for her daughter's birthday from a famous store.

B.2 English — Syntax Nonspecific — Noncognates

The audience who attended the fashion show recognized the beauty of the model from Romania.

The nun who had lost her mind attacked the beggar in the kitchen on Thanksgiving day.

The dog that was very sweet watched the blind to keep him out of harm's way.

The man who lives down the street has three boys who follow him everywhere he goes.

The businessman who worked obsessively around the clock watched the building while it was being demolished.

The historian who was recording a TV show investigated the cave before starting the recording.

The firefighter who was in danger inside the building remembered his childhood as he saved the newborn child.

The lawyer who dealt with the purchase of the building sent the deed to the city hall from the Post Office.

The dietitian who celebrated his birthday with his friends prepared a dessert for the dinner.

The tenant who loves animals always combed his dog with a natural bristle brush.

The agent who hated physical activity called the elevator to go the first floor.

The story that the boy was reading involved a group of elves who where trying to save the world from evil trolls.

The driver who had the day off for the break called the fisherwoman to go out.

The pie maker who owned a pastry shop in the city threw the flour on the main street to protest.

The lady who was doing the dishes removed the foam from her hands before answering the door.

The country that was formed ten years ago prohibited foreigners from becoming residents.

The grandmother who had won the lottery bought a freezer for her new house.

The woman who was hired by the company used to be a friend of the CEO who lived in Panama.

The zoologist who conducted experiments with monkeys stopped their growth with the compound that he had prepared.

The woman who always keeps a pristine house persuaded her guests to take off their shoes when they entered.

The girl who is an Olympic gymnast does not want to cut her hair despite the fact that it is too long.

The stylist who owns a store downtown sells hairspray and other products for hair.

The assistant who is in charge of preparing pizzas learned the proper handling of the machine to make dough.

The astronomer who worked at the observatory in Houston had a hole in his jacket.

The boy who wants to be a vet wanted to buy a horse with the money from his savings account.

The jockey who won the last race of the Kentucky Derby bought iron for his stable.

The painter who worked for my father in the mornings took the ladder out from the van.

My son who eats meat said that his friend bought lamb for the picnic.

The woman who needed a book stopped the librarian to ask her a question.

The pilot who threw a celebration at his house bought the best loin and ham for sale at the store.

The minister who came back from his holiday in Italy fired the manager for being incompetent.

The neighbor who lived on the sixth floor of the building decorated the neighborhood for the festivities.

The boy who lives near my house bought a notebook to take notes on a field trip.

The guide who visited several cities in Australia prepared an ostrich in the kitchen.

The writer who arrived in Madrid yesterday saw the parade from the balcony with his friends.

The writer who was concentrating on his new book didn't hear the party in the park.

The little girl who was wearing her favorite dress ate the peaches in the car on her way back home.

The girl who wants to be an artist received a prize for her performance in the school play.

The man who prepares jams pureed the plums and cooked them on the stove.

The cook who prepares stews bought a potato at the market for dinner.

The agent who rented a car at the airport fixed the printer for the company.

The swimmer who ate cakes and cookies received a punishment from her coach before the competition.

The carrot that the farmer had picked earlier that day hit the puppy causing it to yelp.

The police officer who visited the park arrested the rangers who were suspected of robbing a bank.

The man who likes to exercise decided to become a referee after seeing a soccer match.

The trainer who screamed loudly during the game tore the report with his notes.

The sister who is very meticulous bought a ribbon for the bride's veil.

The nurse who had a free hour after her lunch cleaned the scale in the laboratory.

The teacher who wanted to decorate the bedroom of her new house bought a screen on Friday.

The janitor who needed clothes for her job ordered some socks on the Internet.

The priest who preaches every Sunday saved the soul of every sinner last week.

The man who had taken a course on survival skills created a spark to start the fire.

The teenager who was in love with a friend waited for the arrival of the spring to express his love for her.

The plumber who had three kids at the university prepared a steak with vegetables.

The doctor who drank too many beers at the bar hurt his stepbrother in a fight.

The student who participated in an experiment returned the survey for the study in an envelope.

The business man who dressed very well bought a tie in a store next to his house.

The waiter who ran every morning arrived at the tower in less than an hour.

The actress who loved her job more than anything else invited the traveler for a glass of wine.

The juror who had been listening to the case for three days straight faced the wall when he declared that he needed a rest.

The student who had many chores completed the wash with fabric softener before going back home.

The man who is very intelligent but messy cleaned his workroom before his friend arrived.

The wrestler who defeated the world champion covered his wound with a bandage after the

fight.

The goalkeeper who played soccer for the school sewed the zipper of his pants before the game.

B.3 English — Syntax Specific — Cognates

The veterinarian injected the antibiotics that she had in her cabinet to the antelope after it began to shake uncontrollably.

The rich businessman gave the photograph that he had taken of his wife to the artist in order to paint her portrait.

The nurse gave the medicine that she dissolved in water to the athlete with a headache.

The suspect gave the knife that he had been hiding to the authorities when he decided to turn himself in.

The uncle gave the crib that he had restored a few months ago to the baby for her birthday.

The police gave the blood sample that they had found at the crime scene to the biologist to analyze.

The woman put the cheese that she bought at the store on the broccoli that she was preparing for dinner.

Marcos put some decals that he bought at the store on the bus over the weekend.

The woman wrapped the tape that she grabbed from the storage room around the cable in the electric panel.

The technician put the film that he purchased yesterday in the camera before the photo shoot.

My son put some pins that he bought yesterday on the capitals shown on the map hanging in the classroom.

The woman added the sweet cream that she bought from the farmer to the caramels she was making.

Susana showed the house that she wants to renovate to the carpenter who lives next door.

The young girls returned the sculptures that they found last week to the cathedral during the festivities.

The girl added the sugar that she found in the cupboard to her cereal after she drank her orange juice.

The artist applied some strange color that he had mixed to the circle on the canvas.

The gentleman gave the ticket that he bought for the football game to a client from his company.

The Indian gave the food that he had found on the floor to the cobra during the show.

The guest added filtered water that he got from the refrigerator to the coffee that was sitting on the table.

The architect sold the book that he wrote last year to some colleagues who work at another university.

The soldier described the beating that he saw to the colonel of his division.

My sister threw a tomato that she got from the refrigerator at the composer at the end of the concert.

My mother installed some software that she considers very useful on the computer in the office.

The teacher drew the lines that he considered most important on the cube during the math lesson.

Simon added a change that he thought of a few minutes ago to the decision made by the committee.

The doctor gave the pictures that he found on the floor to the detective at the police station.

The nuns took the quilts that they no longer used to the director of the orphanage.

The thief added the gun powder that he bought the other day to the dynamite to create a huge explosion.

The worker sent the advertisements that he selected from the catalog to the engineer in Madrid.

The kitten gave the mouse that he caught last night to his family during dinner.

The company put up a door that it manufactured last week on the garage of my neighbor's home

The scientist gave the plan that he had drafted to the general during the meeting.

The boy gave an apple that he had in his bag to the giraffe during his visit to the zoo.

The mother put the lettuce that she bought at the store on the hamburger before serving it.

The geologist sent the stones that he analyzed last month to the institute of natural history.

The farmer put the ointment that she brought with her on the kangaroo to make it feel better.

The magician told the secrets that he had gathered over the years to the members of the audience after his show.

The spy turned over the sketches that he found in the drawer to the official in Iran.

The artist sent the pictures that he finished in his studio to the organizer of the fundraiser.

The therapist recommended the diet that he had followed himself to the patient during the appointment.

The agent applied the solution that he had in his case to the pipe to find the fingerprints.

The prisoner gave the treasure that he had in the cupboard to the pirate during the fight on the boat.

The man deactivated the safety mechanism that he had installed on the pistol the day before the accident.

The farmer added the fertilizer that he bought at the store to the plant that was dying.

The chef put the piece of meat that he had stuffed the day before on the plate during the

TV program.

The teacher gave the discussion topic that he had chosen for the conference to the presenter a month ago.

The diplomat described the country that she visited to the president who hadn't been there yet.

The business man added several issues that he was worried about to the list of problems that will be discussed tomorrow.

The students recounted the story that they heard the other day to the professor of English literature.

The linguist added the comments that she had thought of the night before to the project written by the students.

The girl gave a piece of bread that she had in the pantry to the rat in the apartment.

The woman explained the illness that she had come down with to the receptionist who scheduled her an appointment.

The defendant revealed the information that he found in his cell phone to the reporter during the press conference.

The wife put the cover that she had sewn yesterday on the sofa to hide all the stains.

The girl added the cheese that she liked the most to the soup that her mother prepared.

The man bolted the plaque that arrived yesterday to the statue of the unknown soldiers.

Sandra added some new ideas that she read about in a book to her strategy for increasing her success.

The mathematician recommended the program that she had created to the best student in her class.

My mother sewed some silk flowers that she had designed to the sweater that she was knitting for my sister.

The specialist welded the replacement part that he bought at the store to the tank at the campsite.

The inspector connected the microphone that he bought at the store to the telephone in his house.

The guide showed the trail that he knew about to the tourists who were waiting to go hiking.

The farmers gave the apples that they harvested last week to the vendor at the market.

The photographer applied the varnish that he had mixed in his study to the violin in the auditorium.

B.4 English — Syntax Specific — Noncognates

The Romans used to dedicate a tribute that they organized every year to the beauty of women.

The priest gave a slice of bread that he had in his backpack to the beggar in the street.

The millionaire donated the money that he earned over his lifetime to the blind to help them.

The father gave the snacks that he warmed up in the microwave to the boys before the game.

The architect added the final details that he had dreamed of to the building a month before it opened.

The electrician installed the lights that he bought yesterday on the cave behind the Roman ruins.

The governor dedicated a tribute that he had organized with his friends to the childhood of the founder of the university.

The notary public put the accent marks that he saw were missing on the deed of the house.

The pastry cook put some flowers that she had seen in a magazine on the dessert that she prepared for the event.

The actress brought a diamond collar that she bought at the jewelers to her dog after her trip.

The man put the flyer that he had printed on the elevator before leaving the building.

The ogre showed the ring that he was protecting to the elves who were hiding him.

The man gave a lobster that he grabbed from a case to the fisherwoman so that she could weigh it.

The cook added the amount of water that he read off the recipe to the flour to prepare the dough.

The waiter ran a spoon that he had behind the bar across the foam of the beer.

The car rental office gave the GPS they owned to the foreigners so they wouldn't get lost.

The girl attached the drawing that she had done at school to the freezer in the basement.

The girl told the secret that she had learned last night to her friend from high school.

During the meeting the doctors put limits that they stipulated as necessary on the growth of the hospital.

The hotel concierge offered the soccer tickets that he had just received to the guests after he spilled a vase of flowers all over them.

The woman added the color that she had mixed to her hair while she was standing in the shower.

The ballerina put the lid that she had lost the day before on the hairspray after putting her make-up on.

The pilot contributed the experience that he acquired over many years to the handling of the supersonic jet.

The plumber hammered a plank that he had in his van onto the hole under the sink.

The man put the saddle that he designed on the horse to make sure it fit.

The geologist added some tin that he had melted down in his shop to the iron in order to create steel.

The technician put the screw that he found yesterday on the ladder of the airplane.

The father put the rub that he had previously mixed together on the lamb before cooking it.

My children asked the questions that they had been thinking of to the librarian after she was done talking.

The swimmer removed the fat that he didn't want to cook from the loin that he bought at the butcher's shop.

The painter gave a picture that he had painted during his free time to the manager who assists him.

The police officer restored the peace that he had sought for so long to the neighborhood with the capture of the thieves.

The mother glued the label that she had filled out on to the notebook that was on the table.

The farmer took the egg that he saw in the nest from the ostrich before leaving the farm.

The host of the festivities donated some antique chariots that he owned to the parade in the small town.

The school board added some restrictions that they felt were necessary to the party for the end of the year.

My mother added the custard that she had prepared to the peaches before putting them in the oven.

The judges awarded a special prize that they give every year to the best performance in the street.

The photographer added some wax that he had bought to the plums to make them look more appetizing.

The cook put a spicy sauce that he cooked with his friend on the potato that he was going to bake.

The secretary replaced the ink cartridge that she bought at the store on the printer before going home.

The nuns included the work that they hadn't completed to the punishment they gave to the girls.

The girl gave the toy that she had bought to her puppy after he sat and patiently waited for it.

The children showed the firewood that they had cut to the rangers who were in the cabin.

The soccer organization gave the award that it had created to the referee for his hard work.

The accountant made some corrections that he considered necessary to the report that his associate gave him.

The seamstress put some decorations that she had designed on the ribbon of the wedding dress.

The architect added the new base that he designed to the scale before showing it to his boss.

The technician installed the new rods that he received yesterday on the screen that separates his dining room from his living room.

The soldier sewed the patches that he got at the mall to the socks in his drawer.

According to the legend the devil snatched the happiness that he had longed for from the soul that was rising to heaven.

The instructor poured a few drops of water that she had in a bottle on the spark of the cigarette.

The woman attributed the cause of the allergies that she had on spring and its flowers.

The man added some spices that he bought in the market to the steak before cooking it.

The man threw a chair that he grabbed from the dining room at his stepbrother and then ran away.

The teacher erased the questions that she hadn't written from the survey for her students.

The commentator removed the wine stain that he noticed from his tie before the show.

The architect glued some marble pieces that he had sanded down on to the tower in order to restore it.

The gypsy sold a sprig of rosemary that he cut from the tree to the traveler that was walk-

ing around the square.

The man added some bricks that he collected yesterday to the wall of the house he was building.

The woman added the shoe laces that she had on her shoes to the wash that she was doing for her daughter.

The man put the furniture that he bought at the store yesterday in his workroom on the first floor.

The saleswoman applied a disinfectant that she had in her bag to the wound that she got while moving some boxes.

The seamstress wanted to sew some small flowers that she had bought on to the zipper of her daughter's jacket.

B.5 Spanish — Syntax Nonspecific — Cognates

El león que estaba sentado en el campo fijó la mirada en el antílope mientras comía hierba junto la laguna.

El granjero que trabajaba intensamente en el campo odiaba al artista por la vida tan tranquila que llevaba.

Los profesores que fueron al evento animaron al atleta durante su carrera final.

La mujer que había hecho la llamada a la policía habló con las autoridades acerca del robo cuando llegaron.

La panadera que trabaja cerca de la iglesia tiene un beb de cuatro años que ya puede tocar el piano.

La muchucha que conocí en la tienda es bióloga y fabrica productos farmacuticos.

La chica que siempre olvida dónde deja las llaves fue a la tienda a comprar brócoli para el platillo que estaba preparando.

El hombre que estaba regresando de la cena condujo el bus con los maestros de la escuela.

El cartero que trabaja para la ciudad cortó el cable que colgaba de la ventada porque representaba un peligro.

El ladrón que robó el banco bebió un caf antes del atraco y luego le dijo a sus amigos lo que hizo.

El abogado que estudió en Harvard pidió la cámara por internet porque era más barata.

Mi papá quien ha viajado por el mundo no había visto un canguro hasta su viaje a Australia .

El historiador que estaba sentado en el parque sabía todas las capitales de los países africanos.

La psicóloga que estudia la memoria adora cuando sus participantes traen caramelos como obsequio.

El mayordomo que trabaja en la mansión llamó al carpintero para reparar la puerta principal de la casa de visitas.

El cantero que era primo del rey construyó una catedral con material reciclado.

El dálmata que tenía las orejas caídas se comió el cereal que el niño derramó al piso.

El niño que está en tercer grado dibujó un círculo con su lápiz azul y luego lo cortó y lo pegó en su libro

La mujer que había trabajado en una empresa que hace papel vio a su cliente en el centro comercial.

La actriz que estaba en el balcón mató a una cobra con una pala que sacó del depósito

El librero que abrió la nueva tienda en la esquina invitó a sus colegas a la inauguración.

La actriz que estudió en Madrid cenó con el compositor de San Francisco.

La cajera que trabaja en el banco quemó la computadora de su escritorio con su cigarrillo.

El telegrafista que trabaja en la base area avisó al coronel del ataque que estaban planeando los enemigos.

El asistente que enseña en la escuela diseñó el cubo para la clase de física.

El congresista que vive en Minnesota argumentó que su decisión fue la correcta dadas las circunstancias.

El escritor que estaba tratando de buscar ideas para su novela escuchó al detective durante el interrogatorio.

El soldado que estaba ansioso por demostrar sus capacidades encendió la dinamita demasiado pronto y casi pone la misión en peligro.

El empresario que había invertido mucho dinero despidió al director de la compañía el mes pasado.

La bailarina que estaba en la exposición comprará una estatua en Berlín durante su próxima visita.

El entrenador que trabaja en la escuela cree que su estrategia dará buenos resultados.

La mujer que asistió a un campamento de verano de niña se convirtió en la mejor estudiante de su clase.

El hombre que ama a los animales llevó a su casa un gatito para su familia sin antes decirle a su esposa.

La peluquera que compró un coche abrió el garaje de su casa con su mando.

El rey que gobernaba el país invitó al general a comer gambas y tomar una cerveza.

El jardinero que fue contratado por la escuela preparó una hamburguesa para comer con sus amigos.

El contable que tiene tres hijos llamó al ingeniero el día de su boda para felicitarlo.

El arqueólogo que ha dedicado su vida a las ciencias inauguró el instituto de Investigación Anatómica.

Los bomberos que llegaron al sitio del accidente ayudaron a la jirafa en peligro en el zoo de San Diego.

Las personas que fundaron las Naciones Unidas eran miembros de una generación esperanzada de individuos.

El rehn que estaba atrapado en el banco llamó al oficial miestras el ladrón estaba distraído.

La enfermera que trabajará con el cardiólogo empujó al organizador por la puerta.

El especialista que es muy famoso habló con el paciente sobre varios tratamientos para curar su enfermedad.

El dentista que murió la semana pasada había comprado una pipa en Turquía para su colección.

El hombre que navegaba por los mares en su barco mató al pirata con un cuchillo.

La camarera que fuma dos cajetillas de cigarrillos al día carga una pistola en su bolso.

El político que vive en Washington compró una planta para su esposa porque le gustan mucho.

La mujer que abrió la vitrina tiró un plato a su marido porque estaba molesta con l.

El narrador de noticias que había sido ascendido recientemente animó al presentador a actuar con naturalidad en el aire.

La diplomática que viaja a muchos países preguntó al presidente si podía convertirse en una espía.

El decorador que escribe para la revista predijo que los problemas con la pintura serían difícil de resolver.

El taxista que estaba estacionado en la esquina de la panadería llevó a la profesora a su casa.

El explorador que fue entrevistado ayer dijo que el proyecto requería más dinero para que se puediera completar.

El señor que organizó el evento encontró una rata en la despensa de la cocina la semana pasada.

La hermana del gobernador que lo ayudó durante su campaña recogió las cartas de la recepciónista antes de irse.

El esquiador que ganó la medalla en las olimpiadas vio al reportero durante el salto.

La pelota de bisbol que fue autografada por el jugador famoso aterrizó en el sofá despus de

haberse caido de la vitrina.

La señora que vive en nuestro edificio dejó la sopa en la ventana para que se enfriara.

El soldado que había luchado en la batalla cosió el suter en su tienda de campaña.

El pacifista que había organizado la manifestación pintó el tanque con símbolos de paz.

La cuidadora que empezó a trabajar ayer limpió el telfono con agua y jabón para desinfectarlo.

El espía que facilitó los datos interrogó a los turistas en Cancún para obtener más información sobre el caso.

Los chicos que estaban en el supermercado llamaron al vendedor por la ventana.

El actor que vivió en Chile compró un violín para el cumpleaños de su hija en una tienda famosa.

B.6 Spanish — Syntax Nonspecific — Noncognates

La niña que quiere ser artista recibió un premio por su actuación en el acto escolar.

El astrónomo que trabajaba en el observatorio en Houston tenía un agujero en la chaqueta.

El cura que da la misa los domingos salvó el alma de todos los pecadores la semana pasada.

La mujer que fue contratada por la compañia era amiga del ejecutivo que vivió en Panamá.

El hombre que disfruta cuando hace ejercicio decidió convertirse en arbitro despus de haber visto un partido de fútbol.

El agente que odiaba la actividad física llamó el ascensor para ir al primer piso.

La guía que visitó varias ciudades en Australia preparó un avestruz en la cocina.

El vecino que vivía en el sexto piso del edificio adornó el barrio para los festejos.

La enfermera que tenía una hora libre despus de su almuerzo limpió la báscula en el laboratorio.

El público que asistió al desfile de moda reconoció la belleza de la modelo de Rumanía.

La mujer que necesitaba un libro detuvo al bibliotecario para hacerle una pregunta.

La maestra que quería decorar la habitación de su nueva casa compró un biombo el viernes.

El fontanero que tenía tres hijos en la universidad preparó un bistec con verdura.

El portero que jugaba al fútbol en el colegio cosió la bragueta de los pantalones antes del partido.

El escritor que llegó ayer a Madrid vio la cabalgata desde el balcón con sus amigos.

El chico que quiere ser veterinario quería comprar un caballo con el dinero de su cuenta de ahorros.

La niña que es gimnasta olímpica no quiere cortarse la cabellera a pesar de que está muy larga.

Mi hijo que come carne dijo que su amiga compró cabrito para el picnic.

La zanahoria que el granjero recogió ese día golpeó al cachorro hacindolo geñir.

La limpiadora que necesitaba ropa para su trabajo pidió unos calcetines por internet.

La nadadora que comió dulces y galletas recibió un castigo de la entrenadora antes de la competición.

El hombre que había tomado un curso sobre supervivencia creó la chispa para empezar el fuego.

El perro que era muy dulce cuidaba a los ciegos para mantenerlos fuera de peligro.

La hermana que es muy meticulosa compró una cinta para el velo de la novia.

El hombre que prepara mermeladas hizo un pur de ciruelas y lo puso a cocinar.

La abuela que había ganado la lotería compró un congelador para su casa nueva.

El hombre de negocios que vestía muy bien compró una corbata en la tienda al lado de su

casa.

El zoólogo que hacía experimentos con monos frenó su crecimiento con el compuesto que había preparado.

El chico que vive cerca de mi casa compró un cuaderno para tomar apuntes en un paseo.

El historiador que estaba grabando un programa de TV investigó la cueva antes de empezar la grabación.

El hombre que es muy inteligente pero desordenado limpió el despacho antes de que llegara su amigo.

La historia que el niño estaba leyendo involucraba un grupo de duendes que estaban tratando de salvar el mundo de los gnomos malos.

La pequeña niña que llevaba su vestido favorito comió duraznos en el auto de camino a casa.

El hombre de negocios que trabajaba arduamente vió el edificio mientras lo estaban demoliendo.

El ministro que volvió de sus vacaciones en Italia despidió al encargado por haber sido incompetente.

El estudiante que participó en un experimento devolvió la encuesta para el estudio en un sobre.

El pintor que trabajaba para mi padre por las mañanas sacó la escalerilla de la camioneta.

El abogado que tramitaba la compra del edificio mandó la escritura al ayuntamiento desde la oficina de correos.

La señora que estaba lavando los platos se quitó la espuma de las manos antes de contestar el puerta

El país que fue formado hace diez años prohibió que los extranjeros se convirtieran en residentes.

El escritor que estaba concentrado en su nuevo libro no oyó la fiesta en el parque.

El entrenado que gritaba con fuerza durante el partido rompió el folio con sus anotaciones.

El oficial de policia que visitó el parque arrestó al guardabosques que era sospechoso de robar un banco.

El tartero que tenía una pastelería en la ciudad tiró la harina por la calle principal para protestar.

El luchador que derrotó al campeón del mundo cubrió su herida con una venda despus de la pelea.

El mdico que bebió demasiadas cervezas en el bar hirió a su hermanastro en una pelea.

El jinete que ganó la ultima carrera del Kentucky Derby compró hierro para su establo.

La mujer que mantiene su casa muy limpia persuadió los huspedes a que se quitaran los zapatos antes de entrar.

El representante que alquiló un coche en el aeropuerto arregló la impresora para la empresa.

La estilista que tiene una tienda en el centro vende laca y otros productos para el cabello.

El estudiante que tenía muchos quehaceres completó el lavado con suavizante antes de volver a casa.

El piloto que dio una celebración en su casa compró el mejor lomo y jamón que vendían en la tienda.

La ayudante que está encargada de preparar las pizzas aprendió el correcto manejo de la máquina para hacer masas.

La monja que había perdido la cabeza atacó al mendigo en la cocina durante Acción de Gracias.

El jurado que había escuchado el caso por tres días consecutivos miraba hacia el muro cuando declaró que necesitaba un descanso.

El bombero que estaba en peligro dentro del edificio recordó su niñez al salvar al recin nacido.

El hombre que vive por aquí cerca tiene tres hijos que lo siguen por dónde quiera que va.

La cocinera que prerara guisos compró una papa en el mercado para hacer la cena.

El inquilino que ama los animales siempre peina a su perro con un cepillo de cerda natural.

El conductor que tenía el día libre por las vacaciones llamó a la pescadora para salir.

El dietista que celebró su cumpleaños con sus amigos preparó un postre para la cena.

El adolescente que estaba enamorado de una amiga esperó la llegada de la primavera para declararle su amor.

El camarero que corría todas las mañanas llegó a la torre en menos de una hora.

La actriz que amaba su trabajo más que nada invitó al viajero a una copa de vino.

B.7 Spanish Sentences — Syntax Specific — Cognates

La veterinaria le inyectó el antibiótico que tenía en el gabinete al antílope cuando empezó a temblar de forma incontrolable.

El hombre rico le dio la fotografía que había tomado de su esposa al artista para que pintara su retrato.

La enfermera le dio la medicina que disolvió en agua a la atleta con dolor de cabeza.

El sospechoso le dio el cuchillo que había estado escondiendo a las autoridades cuando decidió entregrarse.

El tío le regaló la cuna que había restaurado hacía unos meses al beb para su cumpleaños.

La policía le dio la muestra de sangre que encontró en la escena del crímen a la bióloga para que la analizara.

La mujer le puso el queso que compró en la tienda al brócoli que estaba preparando para la cena.

Marcos le colocó unas calcomanías que compró en la tienda al bus durante el fin de semana.

La mujer le pegó la cinta aislante que usó el año pasado al cable en el cuadro elctrico.

El invitado le agregó el agua filtrada que sacó de la nevera al caf que estaba en la mesa.

El informático le puso el carrete que compró ayer a la cámara antes de la sesión fotográfica.

La granjera le puso la pomada que trajo con ella al canguro para hacerlo sentir mejor.

Mi hijo le puso unas chinchetas que compró ayer a las capitales en el mapa colgado en la clase.

La mujer le añadió la crema dulce que compró del granjero a los caramelos que estaba preparando.

Susana le mostró la casa que quiere renovar al carpintero que vive al lado.

Las chicas le entregaron las esculturas que encontraron la semana pasada a la catedral durante las fiestas.

La niña le añadió el azúcar que había encontrado en el aparador al cereal despus de haber tomado el zumo de naranja.

El artista le aplicó un color extraño que había mezclado al círculo en el lienzo.

El señor le regaló la entrada que compró para el juego de futbol a un cliente de su oficina.

El indio le dio la comida que había encontrado en el suelo a la cobra durante el espectáculo.

El arquitecto les vendió el libro que escribió el año pasado a unos colegas que trabajan en otra universidad.

Mi hermana le lanzó un tomate que cogió del frigorífico al compositor al final del concierto.

Mi madre le instaló un programa que considera muy útil a la computadora en la oficina.

El soldado le describió la paliza que vió al coronel de su escuadrón.

El maestro le dibujó las líneas que consideraba más importantes al cubo durante la lección de matemáticas.

Simón le añadió un cambio que se le occurió hace pocos minutos a la decisión de la junta.

El doctor le dio las fotografías que encontró en el suelo al detective en la comisaría.

El ladrón le añadió la pólvora que había comprado el otro día a la dinamita para crear una explosión enorme.

Las monjas le llevaron las mantas que no usaban más al director del orfanato.

El hombre le atornilló la placa que llegó ayer a la estatua de los soldado caidos.

Sandra le añadió algunas ideas que leyó en un libro a su estrategia para incrementar su xito.

La matemático le recomendó el programa que había escrito al mejor estudiante de su clase.

El gatito le dió el ratón que atrapó anoche a su familia durante la cena.

La compañía le colocó una puerta que manufacturaron la semana pasada al garaje de la casa de mis vecinos.

El científico le dio el plan que había ideado al general durante la reunión.

La madre le puso la lechuga que compró en la tienda a la hamburguesa antes de servirla.

El obrero le envió los anuncios que seleccionó del catálogo al ingeniero en Madrid.

El geólogo le mandó las piedras que analizó el mes pasado al instituto de historia natural.

El niño le dio una manzana que tenía en su bolso a la jirafa durante la visita al zoo.

El mago le dijo algunos secretos que había compilado a lo largo de los años a los miembros de la audiencia despus de su demonstración.

El espía le facilitó los planos que encontró en el cajón al oficial en Irán.

El artista le envió los cuadros que terminó en su estudio al organizador del evento benfico.

El terapeuta le recomendó la dieta que había seguido a la paciente durante la consulta.

El agente le aplicó la solución que tenía en su maletín a la pipa para encontrar las huellas..

El prisionero le dio el tesoro que tenía en el armario al pirata durante la pelea en el barco.

El hombre le quitó el seguro que había instalado a la pistola el día antes del accidente.

El agricultor le añadió el fertilizante que compró en la tienda a la planta que se estaba muriendo.

El cocinero le puso el trozo de carne que había rellenado el día anterior al plato durante el programa de televisión.

La maestra le dio el tema de la discusión que había elegido para la conferencia al presentador hace un mes.

La diplomática le describió el país que visitó al presidente que todavía no había estado ahí.

El empresario le agregó varios temas que le preocupan a la lista de problemas que se discutirá mañana.

Los estudiantes le contaron el cuento que oyeron el otro día a la profesora de literatura inglesa.

El linguista le añadió los comentarios que había pensado la noche anterior al proyecto escrito por los estudiantes.

La niña le dio un trozo de pan que tenía en la despensa a la rata en el apartamento.

La señora le explicó la enfermedad que tenía a la recepcionista que le dio una cita.

El defensor le reveló la información que encontró en el móvil al reportero durante la rueda de prensa.

La esposa le puso la funda que había cosido ayer al sofá para esconder las manchas.

La niña le añadió el queso que más le gustaba a la sopa que preparó su mamá.

Mi madre le cosió unas flores de seda que había diseñado al suter que estaba tejiendo para mi hermana.

El especialista le soldó el repuesto que compró en la tienda al tanque en el campamento.

El inspector le conectó el micrófono que compró en la tienda al telfono de su casa.

El guía le mostró el camino que conocía a los turistas que estaban esperando para hacer senderismo.

Los agricultores le dieron las manzanas que cosecharon la semana pasada al vendedor en el mercado.

El fotógrafo le aplicó el barniz que había mezclado en su estudio al violín en el auditorio.

B.8 Spanish — Syntax Specific — Noncognates

Los jueces le otorgaron un premio especial que dan cada año a la mejor actuación en la calle.

El fontanero le clavó una tabla que consiguió en su camioneta al agujero debajo del lavamanos.

Según la leyenda el demonio le arrebató la felicidad que tanto deseaba al alma que subía al cielo.

La muchacha le contó el secreto que había guardado a su amiga de la escuela.

La organización de fútbol le dio el premio que había creado al árbitro por su arduo trabajo.

El hombre le colocó el anuncio que imprimió al ascensor antes de irse del edificio.

El granjero le quitó el huevo que vio en el nido a la avestruz antes de irse de la granja.

El policía le devolvió la paz que había buscado por tanto tiempo al barrio con la captura de los ladrones.

El arquitecto le puso la base que diseñó a la báscula antes de mostrasela a su jefe.

Los romanos le dedicaban un tributo que organizaban todos los años a la belleza de la mujer.

Mis hijos le hicieron las preguntas que habían estado pensando al bibliotecario despus de que l terminó de hablar.

El tcnico le clavó las varas nuevas que recibió ayer al biombo que separa el comedor de la sala.

El hombre le añadió unas especias que compró en el mercado al bistec antes de cocinarlo.

La costurera le quería coser unas florecillas que había comprado a la bragueta de la chaqueta de su hija.

El anfitrión del evento festivo le donó algunas carrozas antiguas que tenía a la cabalgata del pueblito.

El hombre le puso la silla de montar que diseñó al caballo para ajustarla.

La mujer le agregó el color que había preparado a su cabellera mientras estaba en la ducha.

El papá le puso las especias que había mezclado previamente al cabrito antes de cocinarlo.

La niña le dio el juguete que había comprado a su cachorro después de que él se sentó y esperó pacientemente.

El soldado le cosió los parches que había comprado en el centro comercial a los calcetines en el cajón.

Las monjas le incluyeron el trabajo que no habían completado al castigo de las chicas.

La instructora le tiró unas gotas de agua que tenía en una botella a la chispa del cigarillo.

El millonario le dio el dinero que había estado ahorrado a los ciegos para ayudarlos.

La modista le puso unos adornos que había diseñado a la cinta del vestido de novia.

El fotógrafo le añadió un poco de brillantina que había comprado a las ciruela para hacerlas ver más apetitosas.

La niña le pegó el dibujo que había hecho en el colegio al congelador en el sótano.

El comentarista le quitó la mancha de vino que notó a la corbata antes del programa.

Durante la reunión los médicos le pusieron los límites que estipularon necesarios al crecimiento del hospital.

La mamá le pegó la etiqueta que había completado al cuaderno que estaba en la mesa.

El eletricista le instaló las luces que compró ayer a la cueva detrás de las ruina romanas.

El hombre le puso los muebles que compró en la tienda ayer en su despacho del primer piso.

El ogro mostró el anillo que estaba protegiendo a los duendes que lo estaban escondiendo.

Mi madre le añadió la crema pastelera que había preparado a los duraznos antes de ponerlos en el horno.

El arquitecto le añadio los últimos detalles que había soñado al edificio un mes antes de que lo abrieran.

El pintor le regaló un cuadro que había pintado en su tiempo libre al encargado que lo ayuda.

La maestra le borró las preguntas que no había escrito a la encuesta para los estudiantes.

El técnico le puso el tornillo que encontró ayer a la escalerilla del avión.

El escribano le puso los acentos que había visto que faltaban a la escritura de la casa.

El camarero le pasó una cuchara que tenía detrás de la barra a la espuma de la cerveza.

La oficina de alquiler de autos le dió un GPS que tenía a los extranjeros para que no se fueran a perder.

La junta directiva le agregó algunas restricciones que consideró importartes a la fiesta de fin de año.

El contable le hizo unas correcciones que consideró necesarias al folio que le entregó su socio.

Los niños le enseñaron la leña que habían cortado al guardabosques que estaba en la cabaña.

El cocinero le añadió la cantidad de agua que leyó en la receta a la harina para preparar la masa.

La vendedora le aplicó un desinfectante que tenía en su bolso a la herida que se hizo moviendo unas cajas.

El hombre le tiró una silla que cogió en el comedor a su hermanastro y después se escapó.

El geólogo le añadió el estaño que había fundido en su taller al hierro para conseguir acero.

El conserje del hotel le ofreció las entradas de fútbol que había recibido recientemente a los huéspedes después de derramar el jarrón con agua encima de ellos.

La secretaria le cambió el cartucho que compró en la tienda a la impresora antes de irse a su casa.

La bailarina le puso la tapa que había perdido el día anterior a la laca después de maquillarse.

La señora le agregó los cordones que tenía en sus zapatillas al lavado de la ropa de su hija.

El nadador le quitó la grasa que no quería cocinar al lomo que compró en la carnicería.

El piloto le añadió la experiencia que había adquirido durante muchos años al manejo del avión supersónico.

El cura le dio un trozo de pan que tenía en su mochila al mendigo en la calle.

El hombre le añadió algunos ladrillos que recogió ayer al muro de la casa que estaba construyendo.

El governador le dedicó un tributo que había organizado con sus amigos a la niñez del fundador de la universidad.

El papá le dio la merienda que calentó en el microondas a los niños antes del partido.

El cocinero le puso una salsa picante que cocinó con su amigo a la papa que iba a hornear.

La actriz le trajo un collar con diamantes que compró en la joyería a su perro después de su viaje.

El hombre le dió una langosta que sacó de una caja a la pescadora para que la pesara.

La repostera le colocó unas flores que había visto en una revista al postre que preparó para el evento.

La mujer le attribuyó la causa de las alergías que tiene a la primavera y sus flores.

El architecto le pegó unas piezas de marmol que había lijado a la torre para poder restaurarla.

El gitano le vendió una ramita de romero que cortó del árbol al viajero que paseaba por la plaza.

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