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THE ROLE OF PROBABILISTIC CUES IN L2 PROCESSING: VERB BIAS IN SPANISH AND ENGLISH

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ABSTRACT

The majority of sentence processing research has focused on monolingual populations, but in today's global society bilinguals are ubiquitous. In light of this, it is important to investigate sentence processing in bilinguals, and especially what factors might lead to high proficiency in a bilingual's second language. One measure of this is how a bilingual achieves fully native-like performance in a bilingual's second language. Verb subcategorization bias is one probabilistic cue shown to be used in monolingual sentence processing. Previous research with Spanish-English bilinguals has pointed towards the importance of immersion in the L2 for developing target performance with experience-based cues such as verb bias, but in populations immersed in their L1, transfer of L1 verb bias information has not been observed, even when highly activated cognate verbs are present in the stimuli. This raises the question: Is it the case that probabilistic cues like verb bias are not subject to L1 transfer during L2 processing, in contrast with what has been observed for lexical and grammatical properties? Or is there information missing from the assumptions about verb bias in the two languages in previous studies? To answer these questions, the studies in this dissertation had two principal goals: 1) To conduct a corpus study of complement-taking verbs in Spanish and English to determine the subcategorization biases of those verbs, as well as the linguistic contexts which co-occur with them; and 2) To use the information derived from the corpus study to inform and provide materials for an eye-tracking study which investigates how bilinguals use L1 and L2 verb bias information during online sentence parsing. Given that verb bias is one of many experience-based sources of information found to be useful during processing, bilingual groups immersed in their L1 and their L2 were included to examine how L2 immersion modulates the use of L1 and L2 information during processing in the L2.

This dissertation is significant for a number of reasons. First, to my knowledge, this is the first large-scale corpus study investigating verb bias in Spanish. Through its design, this dissertation contributes a body of verb bias information in Spanish comparable to the existing information in English, thus paving the way for additional future verb bias research in other contexts when one of the languages studied is Spanish. In addition, this dissertation further strengthens and expands what is known about verb bias in English and cross-linguistically by developing among the first known multivariate models of verb bias in English and Spanish. The comparison of verb bias across corpora and cross-linguistically finds that while verb bias can differ from one language to another, the level of concordance across languages is actually quite high, and the level of concordance across corpora even higher, supporting a view that the structural features of verb bias are, to some extent, semantically driven.

This dissertation is also among the first efforts to employ naturally occurring sentences selected from a corpus as stimuli in a lab-based processing study, thereby helping to close the perceived gap between laboratory results and what speakers do when processing naturally-occurring language. Twice, eye-tracking data from monolingual English speakers in this dissertation, using both laboratory-created and corpus-extract stimuli, replicated processing patterns found in previous experimental studies of verb bias and demonstrated that native speakers are sensitive to frequency-based cues to structure during online processing. Moreover, evidence from bilingual groups finds that with enough proficiency and immersion experience, second language learners are able to make use of those same cues in their target language. However, when bilinguals are exposed repeatedly to cognates which share form and meaning across languages, even the most proficient among them fall prey to L1 transfer effects encouraged by the heightened parallel activation of shared lexical items. In contrast, bilinguals who are highly proficient but have not been immersed in their second language long-term, resort to simplicity heuristics. From a theoretical standpoint, the comparison of processing patterns for sentences containing cognates and non-cognates informs models of second language processing and test the limits of L1 transfer as an L2 parsing strategy. The results herein provide evidence that 'shallow structures' are a likely a developmental phase, but not a permanent state of L2 learning which can be supplemented or even overcome through extensive language experience. It furthermore provides evidence of a usage-based approach to grammar and processing.

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To all of my parents y nonni, sisters, fratelli y familia varia. Ai miei friends vicini y lejos. A mi amor. To everyone who has given and continues to give me love, support, nourishment, a voice and a place I call home.

Chapter 1 | Introduction

This dissertation examines processing and corpus data of English and Spanish complement-taking verbs from monolingual English speakers and highly proficient Spanish-English bilinguals[1]. It has two principle objectives. First, I investigate how usage frequency information, specifically verb subcategorization bias (henceforth simply *verb bias*), in a bilingual's two languages is used to form predictions during online processing in their second language. Second, I provide information about verb bias and other co-occurring linguistic factors for a series of Spanish and English verbs which serves to better understand the nature of verb bias both language internally and cross-linguistically and to facilitate the present and future experimental work on verb bias in both languages.

Verb bias is defined as a verb's preferred or most commonly occurring syntactic frame. That is to say, the verb *'believe'*, for example, can occur in a variety of syntactic frames, e.g. with a direct object (DO) (*'I believe the truth'*), with a sentential complement (SC) (*'I believe (that) the truth will set you free'*), or with a prepositional phrase (*'I believe in love'*). Because *'believe'* occurs most often in sentence complement structures (at a rate of 0.50 according to some calculations, (Garnsey, Lotocky, Pearlmutter, & Myers, 1997), it is said to have a sentence complement bias.

Investigating verb bias is important because although people rarely if ever have a conscious awareness of a verb's most likely syntactic structure, in fact much research indicates that speakers are sensitive to usage frequency information on lexical and structural levels and they use that information to make predictions and disambiguate temporary ambiguities during processing (Garnsey, Pearlmutter, Myers, & Lotocky, 1997; Trueswell, Tanenhaus, & Kello, 1993; Wilson & Garnsey, 2009). The processing system used to assign words to their lexical categories and structural roles in order to comprehend a sentence is often called the parser. To better understand the cues used to make these predictions during processing, I use verb bias, a lexically encoded cue to syntactic structure, as one such source of information on which parsers base their predictions. Because verb bias is a usage-based cue, its use or lack thereof during online processing helps to differentiate between extant models of language processing and comprehension.

Traditionally speaking, sentence processing models can be roughly divided into two categories which make different predictions about the role of verb bias information in

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[1] It should be noted that throughout this dissertation the word *bilingual* will be used, as it is in much of the foregoing literature and as defined by Merriam-Webster (2014), to refer to any person who is able to speak and understand two or more languages. As I use the term, it does not imply or require simultaneous or early childhood acquisition of a second language, nor does it require fully native-like competency in the second language. Rather, bilingual is a gradient term which refers to a range of people who are able to make use of two languages in their daily life. Where necessary, further specification about the characteristics of bilinguals will be clearly specified.

processing. One such category is defined as a serial, two-stage model based on simplicity heuristics. The other category is referred to as parallel and experience- or constraint-based.

Serial models of syntactic processing are often called *syntax-first* models. In such two-stage model, the processor first considers syntactic simplicity heuristics to posit a possible structure in phase one, and then, in phase two, the processor reviews that initial assumption by considering plausibility and semantic information (Hahne & Friederici, 1999). This can be further summarized by stating that the initial interpretation formulated by the parser is the simplest syntactic structure. To date, Frazier's Garden Path Model remains probably the most well-known of these models (Frazier, 1979; cf. Clifton & Frazier, 1989; Cuetos & Mitchell, 1988; De Vincenzi, 1991; 1996; Ferreia & Clifton, 1986; Ferreira & Henderson, 1990; Frazier & Clifton, 1996; Frazier & Rayner, 1982; Gibson, Pearlmutter, Canseco-Gonzalez, & Hickock, 1996; Kennison, 2001; 2009; Rayner, Carlson, & Frazier, 1983; Traxler, 2008). This model is based on two principles of least effort. The Late Closure principle states that new incoming information will be attached to the most recent clause (also referred to at times as the Recency Preference). The Principle of Minimal Attachment states that the parser will always build the simplest syntactic structure (the one with the fewest nodes) (Frazier, 1979). Such models are generally associated with a more formalist approach to syntax, basing processing on phrase structure rules, and as such are associated, also, with a Universal Grammar approach to grammar and language acquisition. Under such models verb bias information would not apply. More specifically, processing sentence complement structures should not be facilitated by sentence complement bias verbs if syntax-first processing models apply because sentence complement structures are structurally more complex.

However, ample evidence suggests that syntactic simplicity is neither the first nor the only relevant information the processor uses (Altmann & Steedman, 1988; Frank & Bod, 2011; Hale, 2001; Levy, 2008; Stevenson, 1998; Wells, Christiansen, Race, Acheson, MacDonald, 2009). Exposure-based models of sentence processing better account for the incorporation of other sources of information as cues for processing. Under such models, the parser is guided by probabilistic predictions based on the frequency and distribution of different information or structures in a person's linguistic experience, such as verb bias (Bates & MacWhinney 1982; Gennari & MacDonald, 2009; MacDonald, 1994; MacDonald, Pearlmutter, Seidenberg, 1994; MacDonald & Seidenberg, 2006; Seidenberg & McClelland, 1989). Unlike the two-stage syntax-first models discussed above, these models are comprised of a single continuous and dynamic phase of satisfying constraints. These constraints include cues based on frequency of usage or occurrence taken from an individual's own experiences with and exposures to language. More frequent patterns or syntactic structures are the structures favored when making predictions during processing (MacWhinney, 1998; Mitchell and Cuetos, 1991). Such models necessitate a view of acquisition of grammar which equates to the development of a probabilistic model by way of the tracking and calculation of usage frequencies (Chater & Manning, 2006; Misyak, Christiansen, & Tomblin, 2010).

Results which find that verb bias is used very quickly during online processing (Clifton, Frazier & Connine 1984; Garnsey, Pearlmutter, Myers, & Lotocky, 1997; Trueswell, Tanenhaus & Kello, 1993; Wilson & Garnsey, 2009) support exposure-based processing models. These studies demonstrate that verb bias information is used during native processing to make predictions for syntactic analysis. Thus, crucially, processing of sentence complements is facilitated after sentential complement bias verbs because the parser's knowledge of the usage patterns of that verb guides it to make predictions in keeping with the stronger tendency of that particular verb. Probabilistic predictions based on verb bias have been shown to be used in processing in special populations, as well, including patients (Gahl, 2002) and children (Kidd, Lieven & Tomasello, 2006; Trueswell & Gleitman, 2004). Even in findings which do not render syntax-first models entirely irrelevant, it has been found that a build-up of prior contextual information can guide structure building, and thus override a garden-path effect (Grodner, Gibson & Watson, 2005), as well as override the recency preferences (Altmann, van Nice, Garnham, Henstra 1998). Such results might explain why apparent syntax-first strategies appear in some studies of processing, but not others.

It is furthermore important to study verb bias in a language other than English and to study verb bias in L2 processing because monolingualism is not a global norm. For this reason, the choice was made in the present dissertation to study Spanish-English bilinguals and to investigate verb bias in Spanish, as well. It is important to include second or multiple languages as an integral component in models of grammar and processing. Because learning outcomes are often quite disparate between languages learned as children and languages learned later in life, it has been argued, traditionally, that second language acquisition is nothing like first language acquisition and in processing L2 speakers do not have access to the same information or skills they use to process their first language. Taking as their point of departure the Critical Period Hypothesis (Lenneberg, 1967), these models state that adolescence results in a fundamental change of one's linguistic processing system due to biological factors and loss of brain plasticity. The Less is More Hypothesis (Newport, 1988) argues that the more simplistic cognitive system of children allows, or even forces, them to analyze smaller components of language and permits them to build a grammar more quickly and completely, while adults, with greater working memory resources and a larger variety of other cognitive resources, are able to remember and repeat larger chunks without the aid of structural analysis (Johnson & Newport, 1989; Newport, 1990). In a similar line of research from the same era, Bley-Vroman (1988) proposed the Fundamental Difference Hypothesis. In this theory, a domain-specific language learning mechanism (Universal Grammar) was available to children during first language acquisition, but this mechanism is no longer functional in adult language learners (Bley-Vroman, 1989; 1990). It is argued that evidence from psycholinguistic studies of processing proves that late-acquired L2 processing mechanisms are never native-like (Clahsen & Felser, 2006a). In the Shallow Structure Hypothesis, Clahsen and Felser (2006b) propose that their and other processing research demonstrates that late learners of a second or foreign language make use of lexico-semantic information such as plausibility in the same way as native adult speakers, but that they are unable to take the same advantage of syntactic cues. From this they conclude that late language learners have shallower, less detailed syntactic representations of their L2. Theories arguing that L1 and L2 acquisition and processing are different at their core result in predictions which are very similar to those of syntax-first models, but for different reasons. Under a shallow structures approach, a parser will not be sensitive to verb bias information when parsing the L2, and will thus favor syntactically simpler structures regardless of the lexical verb in the sentence, even though verb bias information may be accessible and useful to that same parser when parsing the native language.

Such views are contrasted in second language processing research by various constraint-based or probabilistic theories which are by their very nature the same across first and second language processing. Under such models (e.g.; Bates & MacWhinney, 1982; MacWhinney, 1987) learners of any language at any age attend to multiple cues, such as semantic properties, word order, and morphology, in order to calculate probabilistic values for each of many competing interpretations. The relative weights (cue strengths) of each of these cues are what vary from language to language and these are learned inductively by evaluating the cue reliability and the cue applicability in a given language (Bates, MacWhinney & Kliegl, 1984). Under this model, MacWhinney has recently proposed the Fundamental Similarity Hypothesis in response to Bley-Vroman's (1990) Fundamental Difference Hypothesis. Under the Fundamental Similarity Hypothesis, acquiring a first language as a child or learning a second language as an adult are largely accomplished using the same cognitive resources. The only thing that differs between the two is the configuration of those resources. When learning a second language one must compare cues and learn the relative strengths of those cues which they track for the new language being learned (and which can be different from the first language) in order to make probabilistic determinations to be applied during L2 processing (MacWhinney, 2012).

Previous psycholinguistic research has supported comprehensive, exposure-based models and shown that bilinguals, when processing their second language, are able to use L2-specific syntactic information (inter alia Frenck-Mestre & Pynte, 1997, Hoover & Dwivedi, 1998; Jackson & Dussias, 2009). Other research indicates that some processing strategies are universal across languages, and should therefore be equally applicable in first and second language processing (Demiral, Schlesewssky, Bornkessel-Schlesewssky, 2008). Importantly, the bilingual experience also adds another facet to the investigation of language processing models. A wealth of psycholinguistic research in recent years has shown that a bilingual's two language systems are never wholly independent (Chambers & Cooke, 2009; Duyck, van Assche, Drieghe, & Hartsuiker, 2007; Hartsuiker, Pickering, & Veltkamp, 2004; Libben & Titone, 2009; Marian & Spivey, 2003; Schwartz, Kroll, & Diaz, 2007; van Assche, Duyck, Hartsuiker, & Diependaele, 2009; van Hell & De Groot, 2008) and both languages are activated even when only one language is clearly required (e.g., Kroll, Bobb, &

Wodnieka, 2006). A result of this parallel activation is that information from the language not in use (e.g., the native language) can influence processing of the language in use (e.g., the second language). This process is referred to as L1 *transfer*. Bilingual processing research must therefore determine not only whether or not the parser uses shallower information in the L2, as proposed by the Shallow Structure Hypothesis (Clahsen & Felser, 2006b), but also, if the bilingual parser is judged capable of using the same kinds of rich probabilistic information that are used in the L1, researchers must also determine from which language and under what conditions the parser draws this information during L2 processing.

The processing studies conducted in this dissertation have been set up in such a way as to create distinctly different predictions for each of the three possible parsing routines. This was done especially to be able to clearly delineate the differences between L1 and L2 verb bias information so that if transfer is happening, it can be seen, rather than offered only as a *post hoc* explanation of an unexpected result. This was necessary because the findings of L1 transfer are inconsistent and insufficiently understood. Second language speakers have been shown to be able to track frequency of use information in their L2 (e.g. Dussias, Marful, Bajo & Gerfen, 2010) and apply this information during processing in some cases (e.g. Dussias & Sagarra, 2007). Some evidence of this has been found previously using verb bias information (Dussias & Cramer, 2006; Dussias & Cramer Scaltz, 2008), and it is found again in the current dissertation (Chapter 2). In other cases, however, apparent transfer of L1 processing routines has also been observed (e.g. Frenk-Mestre, 1999; Chapter 4 of this dissertation). A complete model of bilingual processing should account for all of these findings, and this requires understanding the factors that modulate the recruitment of different processing routines under different conditions. The present dissertation seeks to accomplish this by considering both an external factor—language immersion experience—and a language-internal factor—cognate status—to better understand when and how native-like processes can be achieved in the second language and why the native language may sometimes interfere.

In order to determine the role of verb bias as a cue to processing in a second language, I focus on the following research questions. The first set of questions hones in on differentiating the three distinct processing routines predicted by extant models of second language processing. These questions are:

- Can bilinguals use probabilistic cues (i.e., verb bias information) specific to the L2 to parse sentences in the L2?
- If it is the case that L2 speakers do not demonstrate strategies like native speakers of the target language, is it because they transfer verb information from the L1?
- Does this happen more readily when L2 speakers are processing cognates?
- If it is that case that L2 speakers do demonstrate similar processing patterns as L1 speakers, is proficiency or immersion experience the relevant factor in demonstrating those patterns?

As we improve our understanding of the many facets of the language comprehension system, it becomes increasingly apparent that a person's experience with language is essential to their ability to understand these cues and assign them roles in this interactive process. The human linguistic system is capable of tracking the frequency of sound patterns, words, meaning, syntactic structures, and much more in order to avail itself of that information during online processing. Such findings call for a much closer integration of the fields of cognitive linguistics and corpus linguistics. The data found in naturalistic corpora offer a wealth of information about the frequency of linguistic material, as well as how that frequency affects production, which is hard, if not impossible, to properly reproduce in a laboratory setting (Chafe, 1994; DuBois, 2003; Gahl & Garnsey, 2004; 2006; Labov, 1984, Torres Cacoullos & Travis, 2011). Such conclusions also indicate that production and comprehension are very closely intertwined on a cognitive level and future research must treat them that way.

Keeping this in mind, the second set of questions I address in this dissertation is directed at better understanding verb bias as a lexically encoded property of a verb, as well as understanding how verb bias is similar or different cross-linguistically. These questions are:

- Based on naturalistic data, what are the biases of commonly used Spanish and English verbs?
- How do the biases determined from corpus data compare with those found in previous verb norming studies?
- What linguistic factors co-occur with the selection of a verb's particular complement in both Spanish and English?

Throughout this dissertation, I will show that while universal simplicity heuristics can explain some patterns observed in the resolution of temporary ambiguities in syntactic processing studies, a usage-based approach to language processing and grammar better accounts for the full range of results found here. The dissertation is organized as follows.

In Chapter 2, I present in detail the relevant models of sentence processing as they relate to the use of verb bias as a cue to temporary ambiguity resolution. These models are used to form the predictions for two different processing experiments conducted with highly proficient second language learners of English who all share Spanish as their native language. The predictions are threefold: i) participants could use syntactic simplicity heuristics to resolve the ambiguities in the stimuli; ii) participants could be sensitive to usage frequencies in their L2; iii) or participants could transfer usage frequency information form their L1 to aid in the resolution of temporary ambiguities. The first experiment was a self-paced reading task that was carried out to pilot the materials, which I created based on verb bias information from English and Spanish as determined by previous verb norming studies (Garnsey, Lotocky, Pearlmutter, & Myers, 1997; Dussias et al., 2010). This experiment focused only on Spanish-English bilinguals immersed in English at the time of testing. The result was a parsing strategy that mimicked native English speakers' strategies as found in the previous literature (Garnsey, Pearlmutter, Myers, & Lotocky, 1997; Wilson & Garnsey, 2009). Following that pilot, the study was migrated to an eye-tracking format that was used to test the (US) immersed Spanish-English bilinguals—henceforth referred to as US Bilinguals—as well as a second group of Spanish-English bilinguals—henceforth referred to as Spain Bilinguals—who have not had the benefit of L2 immersion experience (in Spain). The Spain bilingual group was included in order to investigate what role immersion has in the ability to use usage frequency information in native-like ways during online processing. These proficiency-matched bilingual groups were compared to a monolingual English control group. The results show that while monolinguals and US-immersed bilinguals used English verb bias information during processing, the non-immersed Spain bilingual group relies on simplicity heuristics to aid disambiguation. These two experiments show that late second language learners are capable of developing native-like processing strategies with enough immersion experience, but in the absence of that experience, they appear to fall back on universal simplicity information.

In Chapter 3, I present two corpus studies of verb bias, the first in Spanish, the second in English. These corpus studies were designed to arrive at more reliable Spanish verb bias information and to better understand the factors co-occurring with verb subcategorization frames in the languages tested. The Spanish study was needed because the small set of verbs examined in a previous study (Dietrich & Balukas, 2012) demonstrated important differences between the pilot data and the previous norming study. There was concern that the assumptions made about verbs sharing biases between Spanish and English may therefore have been incomplete or incorrect when creating the stimuli for the experiments in Chapter 2. More specifically, if the verb bias information used for the manipulation in the experimental work in Chapter 2 were incomplete, the verbs assumed to have different biases in the two languages may not actually have different biases. This would explain the unexpected lack of L1 transfer in the Chapter 2 data. However, both the Spanish and English studies show a high level of cross-study consistency between the previous norms and the current corpus-based biases. By additionally asking what other linguistic factors co-occur with a particular subcategorization frame, with this corpus study I seek to understand the dimensions of structural equivalency across languages as well as why verb bias results sometimes vary between studies.

In Chapter 4, I present another eye-tracking experiment, this time using stimuli extracted directly from the corpus data presented in Chapter 3. This experiment once again includes the same monolingual and bilingual populations studied in Chapter 2 above. The predictions for this experiment are also very similar to those of Chapter 2. Given that the results of the corpus study reported in Chapter 3 show high rates of cross-study consistency and reveal no recognizable effects of other co-occurring intra-linguistic factors, I constructed the experimental stimuli in the same manner as the experiments in Chapter 2, but with two important differences. First, the stimuli were based on naturally-occurring linguistic data extracted from a corpus of American English, rather than created based solely on judgments of plausibility. Second, all verbs in the experimental stimuli were cognate verbs in Spanish and English. In Chapter 2, the stimuli contained both cognate and non-cognate verbs. The choice to include cognates only in this experiment was based on previous findings that cognates occupy a special level of co-activation across languages because of their shared form and meaning, which could presumably facilitate L1 transfer where it has previously been absent. The pattern of L1 transfer was not initially apparent in these data because of my choice to repeat the experimental verbs several times, but an analysis of first trials only showed trends which point to an L1 transfer strategy by the US-immersed bilinguals and a simplicity heuristic-based approach by the Spain bilinguals. This result has important implications for bilingual processing, indicating that even at high levels of proficiency and extended immersion experience, second language learners are susceptible to effects of L1 transfer where cognates are present to facilitate co-activation of the language not in use. Furthermore, it provides evidence of syntactic priming as a strong force exerting influence on processing routines both in the short term and in the long term (implicit learning) and raises important considerations regarding materials selection and participant recruitment for future psycholinguistic processing research.

Finally, in Chapter 5, I review the main findings of this work and discuss the implications that those findings have for models of grammar and model of syntactic processing. Critically, this dissertation provides evidence from corpus-based production data and laboratory processing experiments which shows that the processing routines used by speakers of multiple languages are, for each of those languages, consistent with the strategies used by speakers of one language only. Those strategies are informed by multiple cues, among which experience-based cues to structural tendencies, i.e. verb bias, are included. This dissertation furthermore provides evidence that late second language learners are capable of developing native-like parsing strategies in their second language provided they have both high proficiency in the L2 and extended immersion experience in the target language environment. However, even when second language learners reach high levels of proficiency and experience they still appear to have access to their knowledge about their native language, which can interfere in the form of transfer, at least when cognate lexical items facilitate the activation of that information. In the absence of sufficient immersion experience, simplicity heuristics also play a role as a supplement because information derived from linguistic experience is insufficient or unavailable.

Together, these findings emphasize the need for both controlled, laboratory experimentation and studies based on natural language corpora to make precise predictions about language production and comprehension. They also suggest that a person's linguistic experience throughout their lifetime plays an ongoing role in the development of processing strategies which can change, even well into adulthood. The study of language experience and usage frequency data will help to lead us to a unified understanding of grammar and processing which accounts for all ranges of the human linguistic experience no matter how many languages one speaks or when or how those languages are acquired.

Chapter 2 | The role of L1 Spanish verbal information in L2 English syntactic processing

Recent psycholinguistic research has shown that a bilingual's two language systems are not entirely independent from one another (Chambers & Cooke, 2009; Duyck, van Assche, Drieghe, & Hartsuiker, 2007; Hartsuiker, Pickering, & Veltkamp, 2003; Libben & Titone, 2009; Marian & Spivey, 2003; Schwartz, Kroll, & Diaz, 2007; van Assche, Duyck, Hartsuiker, & Diependaele, 2009; van Hell & De Groot, 2008) and that both languages are activated when only one language is required (e.g., Kroll, Bobb, & Wodnieka, 2006). One consequence of this parallel activity is that information from the language not in use (e.g., the first language) can potentially affect processing of the language in use (e.g., the second language) (e.g., Kotz, 2009; Kroll, Dussias, Bogulski, Valdés Kroff, 2011; Morales, Paolieri, Dussias, Valdés Kroff, Gerfen & Bajo, submitted; Weber & Paris, 2004). Though some general theoretical models of sentence processing (e.g. Syntax-First models: Frazier & Fodor, 1978; Frazier & Rayner, 1982) or bilingual models more specifically (e.g., Clahsen and Felser's 2006b 'Shallow Structure Hypothesis') would argue that transfer of L1 information during L2 processing is not a feature of the processing system, such cross-linguistic transfer effects have occasionally been observed in L1 processing routines used to resolve syntactic ambiguity (e.g., Frenk-Mestre, 1999). Crucially, the findings in such studies have not always been consistent (see Frenk-Mestre's 2002 follow-up to the 1999 study) and seem to be modulated by L2 proficiency and experience (e.g., Dussias, 2001; Witzel, Witzel, & Nicol, 2012). The present study was conducted in an effort to elucidate a unified model of processing which can account for all of these findings in monolinguals and bilinguals alike. In fact, models of sentence processing based on exposure can better account for the observations mentioned above (e.g., MacDonald, Pearlmutter & Seidenberg, 1994; MacDonald and Thornton, 2009; Seidenberg & McClelland, 1989).

Given this, recent L2 processing research has often taken the approach of looking at different processing proposals as potential developmental stages in L2 processing, not necessarily competing models (see Witzel et al., 2012 for some discussion of this). In so doing, processing studies are now aimed not only at determining which model best explains the result, but also which conditions and variables modulate activity of the language not in use or the passage from one developmental phase to another. Some obvious candidates are linguistic similarity between the bilinguals' two languages, cognitive ability, immersion in the second language environment, and level of L2 proficiency. Unfortunately, L2 immersion experience and language proficiency are often confounded in bilingual studies, even when conclusions about one or the other are drawn from the data.

For this reason, the present study compares groups with comparably high L2 proficiencies but very different L2 immersion histories to examine how L2 immersion experience modulates the activation of information from the first language when L2 speakers process syntactically ambiguous structures in their second language. Immersion experience is hypothesized to be of particular import in the case of the present study because in this study the cue to processing under investigation is a frequency-based cue called verb subcategorization bias, also called simply *verb bias*. Verb bias is defined as the specific subcategorization frame in which a verb is most likely to occur. The construction chosen to test the role of this cue in second language processing follows in the example below, and contains a syntactically ambiguous noun phrase (*the mistake*) preceded by a verb (*admit*) that can take either a direct object noun phrase (1) or a sentential complement (2):

> The ticket agent admitted…
> (1) *the mistake because he had been caught*.
> (2) *the mistake might not have been caught*.

This ambiguity was chosen because research with monolingual English speakers (Trueswell, Tanenhaus & Kello, 1993; Garnsey, Pearlmutter, Myers, & Lotocky, 1997; Wilson & Garnsey, 2009) has shown that when readers encounter a sentence fragment that can continue in a variety of ways (e.g., *The ticket agent admitted*….), they anticipate a continuation that is consistent with the syntactic frame in which the verb is most likely to occur. In the example above containing the verb *admitted*, which according to some estimates (e.g., Garnsey, Lotocky, Pearlmutter, & Myers, 1997) is most often followed by a sentential complement, a match between verb bias and continuation, illustrated in (2), has been found to facilitate processing. A mismatch, illustrated in (1), causes readers to slow down. This shows that verb bias information is used during native processing to guide syntactic analysis. More recent research with bilingual populations points to similar results (Lee, Lu & Garnsey, 2013; Dussias and Cramer Scaltz, 2008), but crucially do not manipulate the differences between bilinguals' first and second languages to determine whether, in cases where native-like processing in the target language is absent, L1 information can also serve as a cue. The present study takes that next step to ask whether two groups of highly proficient L2 speakers of English, one immersed in their native language and one immersed in their L2, use verb bias information in English in a matter that resembles native readers while also leaving open the opportunity to observe L1 transfer effects if present.

BACKGROUND AND HYPOTHESES

Exposure-based accounts of sentence processing argue for the existence of a close correspondence between distributional patterns in the input and comprehension patterns (e.g., MacDonald & Thornton, 2009), such that sentence complexity effects observed during reading comprehension derive from particular distributional patterns in production, which in turn create distributional regularities that shape readers' interpretations. In the context of the examples presented earlier, if highly proficient L2 speakers are able to "zoom in" to verbal information from English, after the sentence fragment *'The ticket agent admitted'* is read, they are expected to pursue a sentential complement analysis. This is because the English verb 'admit' is most often followed by a sentential complement (Garnsey, Lotocky, Pearlmutter, & Myers, 1997). In behavioral terms, L1 and L2 readers of English alike should initially interpret the syntactically ambiguous noun phrase *'the mistake'* in (1) and (2) above as the subject of an embedded clause. In (2), the sentential-complement analysis is expected not to cause processing delays because the interpretation that the noun phrase *'the mistake'* functions as a sentential subject matches the reader's expectation about the verb's preferred continuation. In (1), however, readers are expected to show processing delays. Here, encountering the adjunct phrase *'because he…'* hints to the reader that the sentential complement analysis must be relinquished in favor of a direct-object interpretation. Additional processing time is expected at this region, reflecting the cost incurred in rejecting the initially-adopted sentential-complement analysis to establish the direct-object one. Hypothetical results which would support this prediction are shown in Figure 2-1 below. These results are based also on the results of Wilson and Garnsey (2009), a test of monolingual native English speakers on precisely this ambiguity, which finds effects of verb bias on both direct-object (DO) and sentence-complement (SC) bias verbs. That is, not only are sentence complements processed more quickly when facilitated by the preceding occurrence of a sentence-complement verb, which is relatively uncontested by any model of sentence processing, but, importantly, sentences with direct object continuations following SC bias verbs were *harder* to process than those following DO bias verbs, indicating that verb bias is important enough and occurs early enough in native processing to make even the simplest structures harder to read. This finding has been replicated by self-paced reading (Dussias & Cramer Scaltz, 2008) and ERP (Román, Ray, Contemori, Kaan, & Dussias, 2013) studies conducted with monolinguals, as well as by the monolingual participants in this study.

L2 models of sentence comprehension which postulate that learners prioritize lexical-semantic or pragmatic/plausibility information over syntactic information because they lack hierarchical detail (e.g., Clahsen & Felser's 2006b Shallow Structure Hypothesis) make a different prediction. In such models, L2 readers should always favor the direct object interpretation both because *'the mistake'* is a semantically plausible direct-object for the verb *'admit'* and because in the absence of useful lexically-encoded information about thematic roles, these readers should rely on principles of locality (e.g. the Syntactic Prediction Locality Theory (SPLT): Gibson, 1998) and incorporate the new noun phrase into the structure being built as soon as possible. Accordingly, (1) should cause little reading disruption, whereas encountering the embedded verb phrase in (2) is expected to trigger reanalysis of *'the mistake'* from a direct object to the subject of the sentential complement. It should be noted that this same prediction is made by modular two-stage theories of monolingual sentence processing (e.g., Ferreira & Henderson, 1990; Frazier & Rayner, 1982; Kennison, 2001, 2009; Rayner, Carlson, & Frazier, 1983), although for a different reason. Within these models, during the first stage of processing, decisions are driven by a fixed number of constraints on the comprehension system that guide the syntactic processor to select the syntactically simplest interpretation (i.e., the interpretation with the fewest number of syntactic nodes). If the resulting interpretation is inconsistent with late-arriving information in the sentence, a second stage revises the interpretation using other sources of information, including information learned through experience with language (Frazier & Clifton, 1996; Frazier & Fodor, 1978). If structural simplicity is the driving heuristic (Frazier, 1979), the direct object analysis, being syntactically simpler than the sentential complement analysis, should be the preferred interpretation for L2 learners and L1 speakers alike. Figure 2-2 below shows hypothetical results such as would be predicted by syntax-first or shallow structure models.

A third alternative is that, as predicted by experience-based models, L2 speakers are able to use frequency information as a cue to processing, but that for some reason they do not derive these cues from their L2. Instead, people processing in their second language may transfer the frequency information which is associated with the L1 translation equivalent of a particular verb in the L2 to form predictions. On a language-general scale, some indication of L1-to-L2 transfer of parsing cues has been found in the form of studies of relative clause attachment (Frenk-Mestre, 1999), wh- gap processing (Juffs, 2005), and grammatical gender processing (Sabourin & Stowe, 2008), but such transfer has not been instantiated in studies of verb-specific cues to structure. Studies aimed at this question (e.g. Frenck-Mestre & Pynte, 1997; Dussias & Cramer, 2006; Dussias & Cramer-Scaltz, 2008) only find tendencies towards the use of L2-specific information to resolve such ambiguities, but no evidence of L1 transfer. In the present study, if L2 speakers transfer L1 verb bias information to aid them in the parsing of sentences in their L2, results which pattern similarly to the hypothetical ones in Figure 2-3 can be expected.

Figure 2-1 Hypothetical results based on L2 verb bias information

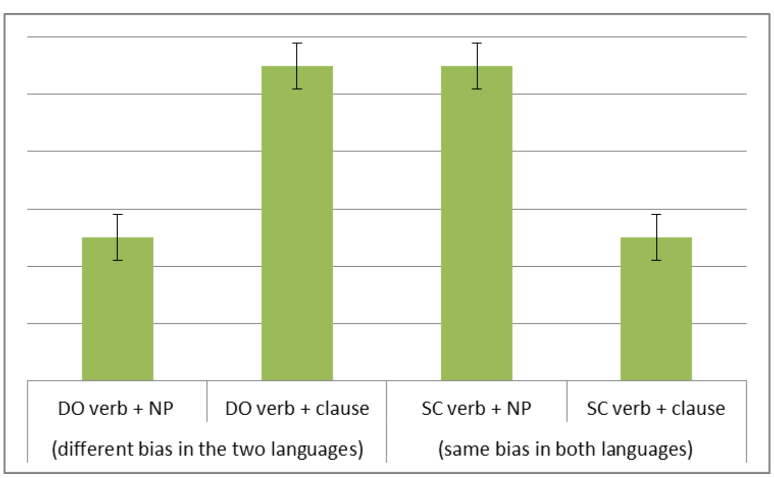


Figure 2-2 Hypothetical results under a syntax-first approach

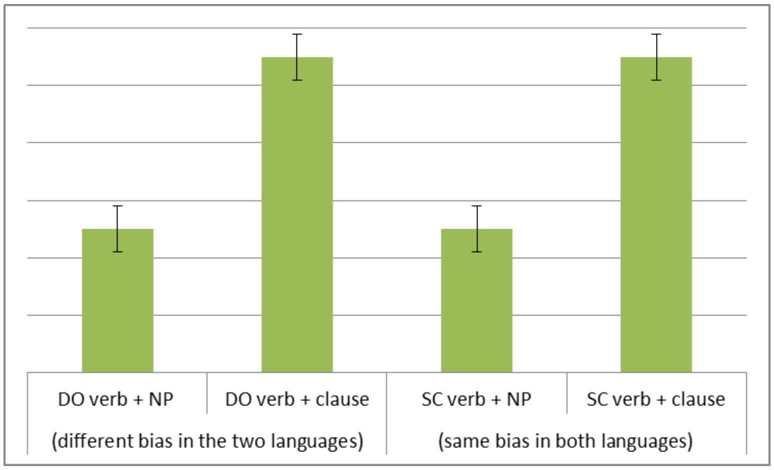
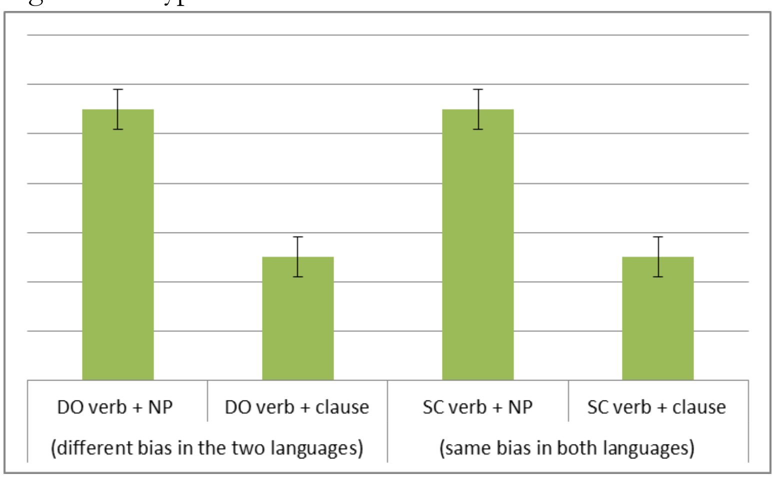


Figure 2-3 Hypothetical results based on L1 transfer



The speakers in the current study belong to one of three different groups: English monolingual speakers, Spanish-English bilinguals living immersed in their L2 in the United States, and Spanish-English bilinguals living immersed in their L2 in Spain. The study includes two experiments—one self-paced reading experiment and one eye-tracking experiment—to address which of the aforementioned models is at work during online processing. Experiment 1, the self-paced reading experiment included only Spanish-English bilinguals in the US. It was conducted first to refine the experimental conditions. Self-paced reading studies are far less laborious and so this was a first attempt to determine whether the manipulation in the experimental conditions produced the expected results. The continued use of the self-paced reading method is also important for the field of sentence processing research and for education in experimental approaches to language processing because it ensures continued access to and participation in this field to researchers and students working in laboratories and universities which lack the resources necessary to conduct eye-tracking research. To anticipate the findings, the first experiment did not yield conclusive results, but demonstrated a tendency by highly proficient second language learners of English immersed in their L2 to approximate the processing routines employed by native speakers of English. Therefore, to take a closer look at these processing routines, Experiment 2, an eye-tracking study, was conducted as a follow-up to Experiment 1 using the same materials because eye-tracking provides more nuanced information. Experiment 2 included a monolingual group as well as two bilingual groups, one in the US and one in Spain.

In previous work on verb bias as a cue to L2 processing, Dussias and Cramer Scaltz (2008) conducted a self-paced reading study of Spanish-English bilinguals using Wilson and Garnsey's (2009) materials to test L2 speakers who were university translation and interpretation students who were extremely highly proficient in their L2 but living immersed in their L1 in Granada, Spain. They found that their bilinguals showed processing strategies similar to those of native speakers of English. Similarly, Lee et al. (2013) tested Korean-English bilinguals and found native-like strategies in these participants, as well. This finding is particularly interesting given that Korean is a verb-final language, so verb bias information is not a potentially useful cue to form predictions during comprehension. This indicates that cues which are not useful in L1 processing can still be learned and applied for L2 processing. The addition of a group of Spanish-English bilinguals living in Spain with matched proficiency to the Spanish-English bilinguals being tested in the US was added to the second experiment to test the specific role of immersion as a factor which could mitigate the interference or transfer of L1 verbal information to L2 processing when it is a useful cue in both the native and second languages.

EXPERIMENT 1: SELF-PACED READING

Method

Participants

Twenty-five Spanish-English bilinguals were recruited for participation in the present study. Participants were students and staff affiliated with a large U.S. university and were immersed in an

English-speaking environment at the time of testing[2]. One participant was excluded from the final analysis because a computer malfunction resulted in incomplete recording of the data. Prior to beginning the experiment, participants completed an online language history questionnaire (LHQ) to assess their proficiency in both English and Spanish proficiency in the four principal areas of proficiency (speaking, listening, reading, and writing). This LHQ, adapted from Marian, Blumenfeld, and Kushanskaya (2007), included 23 questions (see Appendix A). Participants answered open-ended and Likert scale questions about their history with both languages, their language learning experiences, and their daily exposure to and use of both languages. Self-rating LHQ techniques are proven as accurate assessment tools for evaluating language proficiency (Birdsong, 1992; Oscarson, 1997).

Figure 2-4 'queen'

In addition, participants' English proficiency was measured objectively based on their performance in two tasks: a picture naming task which served as a measure of production proficiency and a lexical decision task which measures receptive proficiency in the L2. In the picture naming task, participants were shown 72 line drawings, such as the example in Figure 2-4 above, on a computer screen and were asked to name each drawing as quickly and as accurately as possible in English (in this example, *'queen'*). Each picture, depicting a high- or low-frequency concrete object, remained on the screen for 5 seconds—the time allotted to participants to name each picture. Prior to beginning the task participants were shown 10 practice drawings and encouraged to ask questions to ensure that the task was understood. (See Appendix B for all pictures along with a list of correct responses.) Answers were recorded and scores were determined later by a native speaker of English.

[2] In studies such as mine, there is always a preoccupation that some of the participants, as university students, were affiliated with language departments and have enhanced metalinguistic knowledge and abilities which would allow them to behave in ways that effect the results. Steps have been taken to counteract this potential problem. First, the study includes a large number of fillers, many of which were taken from another study aimed at investigating attachment preferences in second language learners. In debriefing after the experiment, or sometimes even offered spontaneously during the break in the middle of the experiment, participants often point out that these high-/low-attachment fillers are challenging for them or ask if that particular structure is the focus of the present research. This indicates that participant attention has been sufficiently distracted from the critical sentences and manipulations under observation in this study. Furthermore, while it is certainly the case that some of the participants in this study have linguistic training or are language instructors, it is not the case for all of them, and a subgroup of the bilinguals who show the same preference as native English speakers have not had training in linguistics or language instruction.

In the lexical decision task, participants were shown strings of letters on a computer screen and were asked to decide whether the string corresponded to a word in English by indicating their answers using a button box connected to the computer which also measured reaction times. Two-hundred sixty-four words were shown, half requiring a 'yes' response, such as in (3) below, and half requiring a 'no' response, such as (4) (see Appendix C for complete list of stimuli). Nonce words were created such that they observed the phonotactic constraints of English but were not actually English words. Prior to beginning the scored portion of the task, participants were shown 10 practice trials, 5 words and 5 non-words, and were encouraged to ask clarification questions before beginning the task. The presentation program E-Prime 2.0 (Psychology Software Tools, Pittsburgh, PA) recorded accuracy data which was used for later scoring. For each participant four scores were determined: correctly identified words, incorrectly identified words, correctly identified non-words and incorrectly identified non-words, also known as false alarms. False alarms are scored when the participant identifies a non-word letter sequence as a real word of English.

(3) YES response: friend
(4) NO response: dayed

The average results for these tasks are shown in Table 2-1.

Table 2-1 Experiment 1 - Participant information and proficiency measures

	N	Male	Average Age	Average Years in English-speaking country	Average English Age of Acquisition	Average English Age of Fluency	Average Self Rating – Proficiency	Average Self Rating - Understanding	Average Self Rating – Writing	How often are you rated as non-native? 0 - 10, never - always	Picture Naming Task in English (out of 72)	LDT – false alarms (out of 132)
Span-Eng Bilinguals	24	9	27	5.74 years	10.4	18.4	7.54	7.96	8.29	6.33	68.33	36
SD	.	.	6	4.49 years	5.3	7.8	1.47	1.43	1.27	3.68	5.47	36

Materials and Predictions

Seven verbs with the same subcategorization bias in Spanish and English (henceforth, same-bias verbs) and 15 verbs with a different subcategorization bias in Spanish and English henceforth, different-bias verbs) were used. Verb bias in English was based on the English norms found in Garnsey, Lotocky, Pearlmutter, and Myers (1997). Spanish verb norms were taken from Dussias, Marful, Bajo & Gerfen (2010). The critical sentences contained noun phrase/sentential complement ambiguities, illustrated in (5) through (8) and were closely modeled after the sentences used in Wilson and Garnsey (2009). The verbs were embedded in temporarily ambiguous direct object (DO) [(Condition 1) and (Condition 3)] and sentential complement (SC) [(Condition 2) and (Condition 4)] continuations (underlined below):

(5) Condition 1, The CIA agent confirmed the rumor <u>**when** he testified before Congress</u>
(6) Condition 2, The CIA agent confirmed the rumor <u>**could** mean a security leak</u>
(7) Condition 3, The CIA agent admitted the mistake <u>**when** he testified before Congress</u>
(8) Condition 4, The CIA agent admitted the mistake <u>**could** mean a security leak</u>

Each presentation of a particular verb contained a different subject and post-verbal noun. All post-verbal nouns were highly plausible as direct objects of the verbs they followed. Participants were exposed to all conditions but only saw each verb in one of the conditions. Experimental materials were constructed in such a way that the syntactic ambiguity could only be resolved when readers saw the text following the post-verbal NP (e.g., *'could mean'* or *'when he'* in the examples below). This region is emboldened in Conditions 1 through 4 above and will be referred to here as the disambiguating region.

Spanish-English bilinguals read 36 experimental sentences and 72 fillers. Of these, there were nine sentences from each condition included. The fillers, which were taken from another experiment, are shown in examples (9) through (14) below. These included: (9) 6 sentences containing sentential complements with an overt complementizer *'that'*, (10) 7 sentences containing sentential complements with complementizer deletion similar to Conditions 1 and 3 but with more varied disambiguating words and containing verbs which were not contained in the experimental stimuli, (11) 6 sentences containing direct object constructions with an adverbial clause that follows (similar to Conditions 2 and 4, but again with different verbs and disambiguating words than seen in the experimental stimuli), (12) 17 sentences containing subject relative clauses with the relative pronoun 'that', and 36 sentences containing temporarily ambiguous relative clauses lacking relative pronouns but requiring either (13) high or (14) low attachment based on gender information in the subject and object.

(9) The primary suspect established that the alibi did not reflect the truth.
(10) The reading instructor concluded the lesson stated its point very clearly.
(11) The elderly woman forgot the address while driving her friend home.
(12) The senator that the article accused was forgotten after the election.
(13) The boys poked fun at the niece of the man who walked her dog every Thursday in the park.

(14) The principal of the school spoke with the sister of the boy who forgot his bicycle at school.

Four different stimuli lists were created using different experimental sentences but the same fillers, resulting in a total of 36 sentences per condition, or 144 total stimuli sentences providing reading time data for analysis. All lists were pseudo-randomized so that no two participants read sentences in exactly the same order. These lists can be found in Appendix D. Presentation of lists was rotated across participants so that each list was presented a balanced number of times.

The predictions are as follows. If highly proficient L2 speakers use verb bias information from the L2 during processing, they are expected to show a behavior where sentences containing continuations consistent with the verbs' English biases are read faster than those with inconsistent continuations at critical regions. In other words, for sentences with DO bias verbs (5 and 6), participants are expected to show difficulty at the disambiguating region only in (6), because it is in this condition that there is a mismatch between verb bias and sentence continuation. For sentences with SC bias verbs (7 and 8), participants are expected to slow down at the disambiguating region only in (7), due to the mismatch between verb bias and sentence continuation. Because in (8) verb bias and sentence continuation match, participants are not expected to show processing difficulties. This would result in a graph of reading times similar to that shown in Figure 2-1 above (p. 13).

If participants are using universal strategies and are not sensitive to usage frequency information, as proposed by shallow structure and syntax-first accounts of processing, participants would be expected to treat (5) and (7) the same and read them faster than sentences (6) and (8) because of the simpler, DO structure they contain. This would result in a graph of reading times similar to that shown in Figure 2-2 above (p.14).

Critically for the purposes of this study, if verb bias information from the L1 is transferred when processing the L2, verb bias and sentence continuation were manipulated such that all sentences in all conditions contain verbs whose Spanish translation equivalents were either SC or EQUI bias. This means that if participants were accessing verb bias information from the L1 during L2 sentence processing, (5) and (7) should pattern similarly at critical regions and (6) and (8) should pattern similarly. In other words, both (6) and (8) should be easy to process because the sentence continuation is consistent with the expectations indicated by the Spanish verb bias. In contrast, sentences (5) and (7) should cause processing difficulty because the continuations are not consistent with the verb bias of the verb's Spanish translation equivalent. This would result in a graph of reading times similar to that shown in Figure 2-3 above (p.14).

Procedure

Sentences were presented word-by-word using a reading moving-window paradigm (Just, Carpenter, & Woolley, 1982). Participants were seated in front of a PC computer in a sound-attenuated booth. They were informed that for each trial, they would see lines of dashes representing each of the words in a sentence. See Figure 2-5 below for a visualization of this procedure. Each click of the space bar would change the line of dashes into the next word and would make the previous word disappear. Each word appeared in its corresponding position within the sentence, while the position of all previous and subsequent words remained indicated on the screen by the place-holding dashes.

Figure 2-5 Moving window paradigm

```
The ------ ----- -------- --- ------- ----- ---- - -------- ----.
---  ticket ----- -------- --- ------- ----- ---- - -------- ----.
--- ------ agent -------- --- ------- ----- ---- - -------- ----.
--- ------ ----- admitted --- ------- ----- ---- - ------- ----.
--- ------ ----- --------  the ------- ----- ---- - -------- ----.
--- ------ ----- -------- --- mistake ----- ---- - ------- ----.
--- ------ ----- -------- --- ------- could ---- - -------- ----.
--- ------ ----- -------- --- ------- ----- mean - ------- ----.
--- ------ ----- -------- --- ------- ----- ---- a --------- ----.
--- ------ ----- -------- --- ------- ----- ---- - security ----.
--- ------ ----- -------- --- ------- ----- ---- - --------- leak.
```

Participants were informed that their task was to read each word silently to themselves as naturally as possible, like reading a newspaper, and to press the spacebar to display each consecutive word on the screen. One example was given in the instructions. The time between the appearance of each word and the press of the space bar was recorded. A comprehension question followed each sentence. The answers, half 'yes' (15) and 'half' no (16), were indicated using the "C" and "N" keys respectively. Prior to beginning the experiment proper, participants were given 10 practice sentences to familiarize them with the task. During this practice session, they were encouraged to ask clarification questions.

(15) S: The jewel thief confessed the crime when he saw it on video.
Q: Did the thief see the video?
R: yes

(16) S: The office manager suspected the secretary when he noticed she showed up late every day.
Q: Was the secretary showing up on time?
R: no

Results and Discussion

Analyses were conducted on reading times for words 7 and 8 individually, which together make up the disambiguating region of the sentence. Word 8 was included due to the nature of the tasks, as well as the slower processing speeds associated with second language processing which can cause effects to spill over to the word following the disambiguation, especially because word 7 is always a short and highly frequent (i.e.: quickly read) word in each sentence. Sentences followed by incorrectly answered comprehension questions were not included in the analysis. These bilinguals answered accurately 85.9% of the time to questions following stimuli sentences. Results for the Spanish-English bilingual group are shown in Figures 2-6 and 2-7 below. These are compared to the published results reported in Experiment 1 conducted by Wilson and Garnsey (2009) for monolingual English speakers, and shown in Figure 2-8. It is generally assumed that longer reading times reflect more difficulty integrating the information currently being read into the structure that has been built up to that moment. Faster reading times reflect faster, easier processing and easier integration into the syntactic structure. For these Spanish-English bilinguals, the patterns for both words shown in Figures 2-6 and 2-7 below demonstrate a clear visual resemblance to the processing patterns that have been observed in past studies with monolingual English participants, including those reported in Wilson and Garnsey (2009), and shown in Figure 2-8 for comparison purposes.

A two-way repeated measures ANOVA was used to analyze the data to evaluate the effect of verb bias and continuation type on the reading times for each word in the critical region. Verb bias (direct object (DO) versus sentential complement (SC)) and continuation type (direct object continuation versus clause continuation) were the within-subjects factors. On word 7 reading times indicated no significant main effect of verb bias, $F_1(1,23) = 0.330$, $p = 0.751$, but did reveal a significant main effect of continuation, $F_1(1,23) = 6.684$, $p = 0.017$, whereby DO continuations were read faster than SC continuations. The interaction between bias and continuation was not significant, $F_1(1,23) = 0.759$, $p = 0.393$). The same analysis, when conducted on word 8 reading times, revealed no significant main effects (bias: $F_1(1,23) = 0.067$, $p = 0.798$; continuation: $F_1(1,23) = 0.181$, $p = 0.675$), but did reveal a significant interaction of bias and continuation, $F_1(1,23) = 8.282$, $p = 0.008$. Despite this interaction and an appearance of verb bias effects in both same-bias and different-bias conditions in Figure 2-7, subsequent pairwise comparisons indicated no significant differences based on verb bias information. More concretely, sentences in which DO bias verbs in English were followed by DO complements (Condition 1, m=411) took less time to read than those in which DO bias verbs in English were followed by SC complements (Condition 2, m=445), $t_1(23)=-2.002$, $p=0.057$, and sentences with SC bias verbs followed by SC complements (Condition 4, m=421) were read faster than SC bias verbs followed by DO complements (Condition 3, m=443), $t_1(23)=1.789$, $p=0.087$, but neither of these differences reach significance. These results suggest that the high proficiency L2 English speakers do not seem to be applying L1 verb bias information during processing, given that the condition which would predict one of the shortest reading times based on Spanish verb bias information, the DO verb + clause condition, actually demonstrates, on average, the longest reading times of all.

Figure 2-6 Reading times for word 7

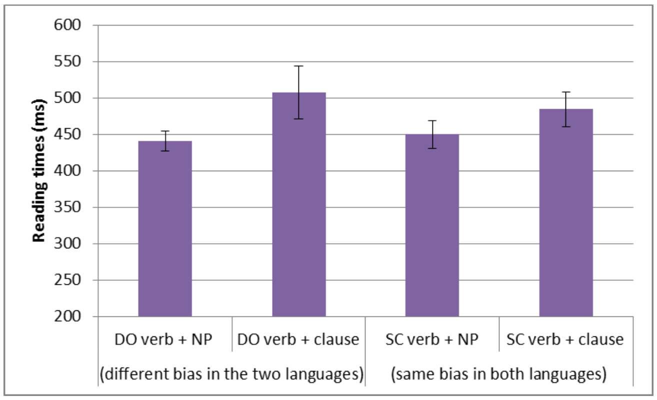


Figure 2-7 Reading times for word 8

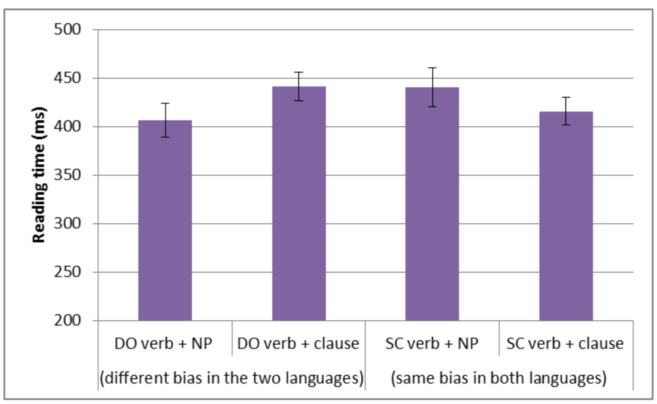
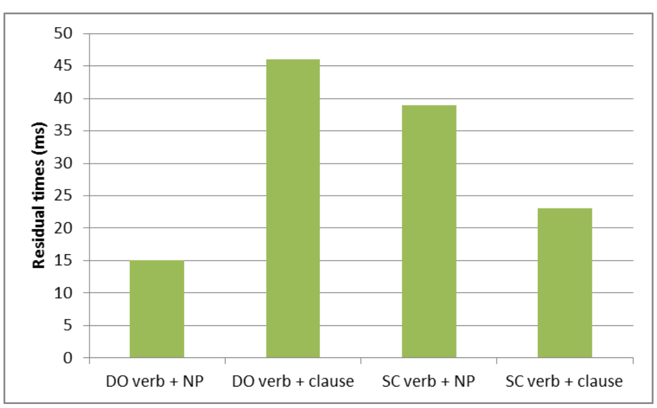


Figure 2-8 Residual readings times for English monolinguals (Wilson & Garnsey, 2009)



While the data from this initial experiment indicate a promising trend among these highly proficient bilinguals, the large standard errors and weak statistical effects called for a more refined measurement of reading times, as well as a more fine-grained view of proficiency to truly capture the effects of verb bias from the L1 or the L2 on making predictions about syntactic structure while parsing in the L2. For this reason, a second experiment was conducted using the same stimuli, but measuring reading times using a free reading, eye-tracking paradigm. Additionally, Experiment 2 explores the role of immersion in the L2 environment in a bilingual's ability to use L2 verb bias information during L2 processing and whether the absence of sufficient immersion experience can lead to L1 transfer of processing routines by including a second group of bilinguals, the so-called Spain bilinguals, who were not immersed in their L2 at the time of testing and have had little or no immersion experience overall.

EXPERIMENT 2: EYE-TRACKING

Method

Participants

For Experiment 2, data were collected from three different groups of participants: 26 Spanish-English bilinguals immersed in their L2 in the US, 37 Spanish-English bilinguals living in their L1 environment in Granada, Spain, and 25 English monolinguals. The US bilinguals were taken from the same population as Experiment 1, but did not include any of the same participants from Experiment 1 because of familiarity with the stimuli[3]. These participants were students and staff affiliated with a large US university who had been living in the US for an extended period of time and who were immersed in an English-speaking environment at the time of testing. Three of these participants were later excluded from the analysis because it was discovered that they had begun learning English at home at a very young age (before 5 years old); therefore, 23 US Spanish-English bilinguals were ultimately included in the analyses presented below. This group of bilinguals will henceforth be

[3] In addition to the considerations mentioned above in response to concerns about metalinguistic awareness or linguistic training, it stands to note that the average gaze durations of the US bilinguals (243 ms) and the Spain bilinguals (243 ms) in Experiment 2, reflect speeds very close to those of the native English readers in this study (229 ms), while also falling comfortably within the range of average reading times for native reader college students (250 ms) as reported by Rayner and Pollatsek (1989: 66). Thus, these bilinguals are not reading slowly enough to have time to apply any special metalinguistic knowledge they may have. Finally, there are linguistically trained bilinguals in both groups (US and Spain), so metalinguistic knowledge and training alone does not discount the differences found among these two bilingual groups.

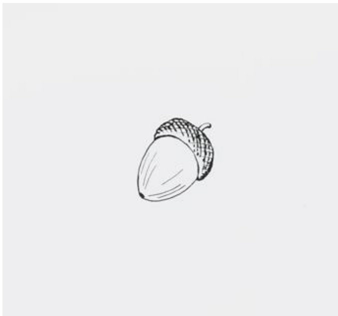
referred to as the US bilinguals. Among the group of 37 Spanish-English bilinguals living in their L1 environment in Spain, participants had only limited travel or study experience abroad in English-speaking countries and were immersed in a Spanish-speaking environment at the time of testing. Many of these participants were current or recently graduated majors in English literature and philology at the Universidad de Granada. Of these participants, henceforth called Spain bilinguals, six were excluded from analysis due to equipment failure which resulted in incomplete recording of their eye-tracking data. Another participant was excluded because she was an early childhood bilingual. This resulted in 30 Spain bilinguals being included in the final analysis. A third group of 24 English monolinguals was also tested to serve as the native controls and set the target for native-like processing which could be expected from the other groups (if achieved). The English monolinguals were students and staff affiliated with the same US institution as the US bilingual group, but who were functionally monolingual, having never studied more than a basic level of a foreign language (the equivalent of 3 college semesters) and never lived or studied in a country where a language other than English was spoken. One of these monolinguals was excluded from the analysis when it was discovered during debriefing that although he only spoke English, he was raised in an immigrant household where his grandmother only spoke her native language. This resulted in the inclusion of 24 monolinguals in the final analysis.

In addition to the eye-tracking experiment, all participants were administered a battery of secondary measures of language proficiency and experience to ensure balanced proficiency but differing experiences across groups. These tasks included: the same self-assessment LHQ as described in Experiment 1, the Boston Naming Vocabulary Test (BNT) (Kaplan, Goodglass, & Weintraub, 1983) in English, and grammar and reading tests in English and Spanish. Monolinguals completed all of the same tasks as the bilingual groups but in English only.

Boston Naming Vocabulary Test (BNT). This task was very similar to the equivalent picture naming task described in Experiment 1, above, but using a different set of images. The words in the BNT have been controlled for word frequency so that as the test progresses, frequency decreases, thus increasing difficulty, resulting in a more fine-grained language proficiency measure (as compared to the LHQ) which allows for the evaluation of lexical access, vocabulary size and naming performance in a single task. This test has been highly correlated with other experimental measures of language proficiency in bilinguals, such as language self-assessments like the LHQ (Kohnert, Hernández, & Bates; 1998).

During the BNT, participants are asked to name 60 outline drawings of objects and animals. Participants saw 60 pictures which they were asked to name in English, such as Figure 2-9 *'acorn'*. A complete list of images and correct responses for this task is included in Appendix E.

Figure 2-9 'acorn'



Grammar and reading tests. The grammar sections of the Michigan Test of English Language Proficiency (MTELP©)[4] and the Advanced Test of the Diplomas de Español como Lengua Extranjera (DELE) (Appendix F) were used to assess advanced grammatical skills and reading competency a multiple-choice format. Each test contains 50 multiple-choice items which evaluate grammar, vocabulary, and reading competence in both isolated sentences and a longer text. The MTELP begins with a Grammar section in which participants select the best choice from 4 options to fill in the blank in each of a series of 30 mini-dialogues. The second section, a Cloze paragraph, contains 20 blanks to be filled by choosing the best of 4 options to complete a paragraph talking about the influence of colors on people's moods. The DELE is formatted quite similarly. It begins with a cloze activity ('*Texto incompleto*') in which participants fill in blanks which have been placed in a text adapted from a Chilean newspaper article by choosing from 3 options. This section contains 20 questions. It is followed by a 10 item vocabulary ('*Vocabulario*') section in which participants read a sentence with a word or phrase indicated in bold and then select a synonymous word or phrase from 3 options. The DELE ends with a grammar ('*Gramática*') section which corresponds to the first section of the MTELP in which the participants select the best word from 2 options to fill in the blank which appears in each of 20 isolated sentences.

The average scores on all of these tasks for each group are shown in Table 2-2 below.

Materials and predictions

The materials used in this experiment are the same materials as used in Experiment 1. For this reason the predictions made are also very similar to those made for Experiment 1.

Predictions for monolingual group. Given that they have no familiarity with Spanish, the monolinguals should not be sensitive to the same- or different-bias manipulation in these stimuli. For this reason, the predictions are simpler than for the bilinguals. As seen in

[4] Use of this test has been permitted under an agreement with the creator, but reproduction of any portion of this test here or in the Appendices is prohibited by copyright protections.

monolinguals tested in previous work (Wilson & Garnsey, 2009), this group is expected to show slower reading times when the verb bias and the sentence continuation do not coincide, as in (5) and (8) above and faster reading of the disambiguating region in (6) and (7), where the verb bias and continuation are in agreement with one another. The results would look something like Figure 2-1 (p. 13).

Predictions for bilingual groups. For the bilingual groups there are three alternatives (graphical representations of hypothetical results for each of these can be found in the figures above, pp. 13-14): a processing routine which uses L2 verbal information and would be indicative of native-like use of frequency information to resolve temporary ambiguities, or, in the absence of that strategy, either a syntax-first approach, or an L1 transfer strategy. Native-like use of L2 verbal information (Figure 2-1) would predict that Conditions 2 (6) and 3 (8), where the continuation matches the expectation formed based on English verb bias information, should be read faster than Conditions 2 (6) and 3 (7) respectively, where there is a mismatch. Such a finding is also expected of the monolingual group as described above. Under an account driven by universal heuristics (Figure 2-2), the prediction is that direct object continuations should be read faster than sentence complement continuations regardless of the verb bias of the main verb because such theories contend that parsers, or at least L2 parsers, are only sensitive to structural simplicity information and not frequency of use during online processing. Finally, an L1 transfer strategy (Figure 2-3) would mean that the bilingual group uses Spanish verb bias information for the main verb's translation equivalent to help guide them in their parsing decisions during the experiment. If this is the case, the manipulation of same- and different-bias verbs becomes very important. In the stimuli for this experiment, verbs with a DO bias in English have a different (SC or EQUI) bias in their Spanish translation. Thus, L1 transfer would result in faster reading of Conditions 2 (6) and 4 (8) and slower readings of Conditions 1 (5) and 3 (7).

Procedure

Reading data were collected using an Eyelink 1000 desktop-mounted eye-tracker. Participants were seated in front of a PC computer in a sound-attenuated booth. They were informed that for each trial, they would see a sentence on the screen. All experimental trials were presented on a single line of text. Some fillers extended onto a second line. Participants were informed that their task was to read each sentence as naturally as possible to themselves, as if they were reading a newspaper. When they were finished reading each sentence, the participants were instructed to press a button on a game controller to trigger the presentation of a comprehension question following each sentence. To indicate 'yes' participants pressed the left rear button on the game controller. To indicate 'no', they pressed the right rear button. Prior to beginning the experiment proper, participants were given 10 practice sentences to familiarize them with the task. During this practice session, they were encouraged to ask clarification questions and given additional instructions when confusion or errors were observed.

Table 2-2 Language proficiency information by participant group

	Monolinguals *Mean (SD)*	US Bilinguals *Mean (SD)*	Spain Bilinguals *Mean (SD)*	ANOVA* (all groups) *F1*	ANOVA‡ (bilinguals only) *F1*
n	24	25	37	-	-
males	9	13	17	-	-
age	21.1 (1.8)	28.2 (5.7)	24.8 (3.9)	$F_1(2)$=18.138†	$F_1(1)$=7.632, p=0.008§
Years in a English-speaking country	20.4 (3.8)	4.9 (0.8)	0.7(3.8)	$F_1(2)$=342.637†	$F_1(1)$=41.172, p<0.001§
English Age of Acquisition	0.7 (.8)	8.1 (3.9)	8.3 (2.9)	$F_1(2)$=57.530†	$F_1(1)$=0.084, p=0.733
English Age of Fluency	3.3 (1.5)	17.4 (7.6)	17.5 (3.5)	$F_1(2)$=69.811†	$F_1(1)$=0.008, p=0.928
Self-rating - Proficiency	9.3 (2)	7.5 (1.4)	7.5 (1.1)	$F_1(2)$=12.827†	$F_1(1)$=0.065, p=0.800
Self-rating - Understanding	9.7 (0.5)	8.2 (1.2)	7.9 (1.0)	$F_1(2)$=25.932†	$F_1(1)$=1.142, p=0.289
Self-rating - Reading	9.6 (0.5)	8.4 (1.0)	8.2 (1.0)	$F_1(2)$=20.479†	$F_1(1)$=0.646, p=0.425
% current L1 exposure	-	44 (17)	75 (15)	-	$F_1(1)$=58.127, p<0.001§
% current L2 exposure	-	53 (20)	27 (13)	-	$F_1(1)$=35.742, p<0.001§
% of time participant would choose to read in L1	-	42 (22)	59 (22)	-	$F_1(1)$=8.490, p=0.005§
% of time participant would choose to read in L2	-	52 (26)	42 (20)	-	$F_1(1)$=3.246, p=0.077
% of time participant would choose to speak L1 with person fluent in both	-	64 (27)	61 (22)	-	$F_1(1)$=0.307, p=0.581
% of time participant would choose to speak L2 with person fluent in both	-	33 (27)	40 (22)	-	$F_1(1)$=1.249, p=0.268
How often are you rated as non-native? (0-10, never-always)	0.7 (2.3)	7.5 (3.7)	7.1 (2.6)	$F_1(2)$=43.932†	$F_1(1)$=0.245, p=0.623
MTELP score (out of 50)	47 (3.6)	38 (7.5)	34 (6.6)	$F_1(2)$=32.744†	$F_1(1)$=6.272, p=0.015§
DELE score (out of 50)	-	44 (4.4)	44 (3.7)	-	$F_1(1)$=0.000, p=0.993
BNT score (out of 30)	27 (2.3)	21 (3.6)	14 (3.7)	$F_1(2)$=97.583†	$F_1(1)$=45.446, p<0.001§
Comprehension question accuracy (out of 36)	34 (1.6)	32 (2.0)	32 (2.4)	$F_1(2)$=8.635†	$F_1(1)$=0.259, p=0.613

*A one-way analysis of variance was conducted to compare the mean performance on each of these tasks and ratings between the three groups.

†p < 0.001

‡A subsequent one-way ANOVA was conducted to compare the mean performance on each of these tasks and ratings between the bilingual groups only.

§The difference in means between the US and Spain bilingual groups is significant at a level of 0.05

Results and Discussion

The analysis focused on three separate measurements on each region of analysis: gaze duration (also called first pass, i.e., the sum of all left-to-right eye-fixations on the critical region before leaving it the first time it is read), regression path time (i.e., the sum of all temporally contiguous fixations from the time the reader first enters the region of interest until advancing to the right beyond that region, including regressive fixations outside the critical region), and total time (i.e., the sum of all fixation durations on the critical region at any time, including re-reading). These measures were chosen to evaluate both early (gaze and regression path) and late (total times) processes (Clifton, Staub, & Rayner, 2007; Rayner, 1998; Rayner, Sereno, Morris, Schmauder, & Clifton, 1989). The analyses were conducted on the seventh word in the sentence, which represents the disambiguating region (in bold in examples (5)-(8) above, on p. 18). This word immediately following the ambiguous noun phrase is where participants are first able to disambiguate whether the preceding noun phrase represents a direct object of the preceding verb or the subject of a new clause.

Because the three different predictions presented above do not each have wholly different expected patterns for each condition, analyses were conducted for each participant group individually. In other words, a syntax-first approach would show the same patterns for the DO bias conditions as an L2 verb bias approach, but different patterns for conditions with SC bias verbs. In contrast, a transfer approach would show the same pattern for conditions with SC bias verbs as an L2 verb bias approach, but different patterns for conditions with DO bias verbs. Considering all groups simultaneously, if they indeed take different processing approaches, would result in an obfuscation of the processing patterns observed in each individual group, making their different approaches difficult or impossible to note. For each group of participants, data was submitted to a two-way repeated measures analysis of variance (ANOVA) to evaluate the effect of verb bias and continuation type on the three extracted reading measures. Verb bias (direct object (DO) versus sentential complement (SC)) and continuation type (direct object continuation versus clause continuation) were the within-subjects factors for the F1 analyses and as the within-items factors for the F2 analyses. This section will present the results by group, beginning with the monolinguals, followed by the immersed bilingual group tested in the US, and finally the Spanish bilingual group. To be sure that participants paid attention to and understood the stimuli, the proportions of correct responses to the comprehension questions were also calculated. Mean accuracy on these is given in Table 2-2 above in the cells under "Comprehension question accuracy (out of 36)." Reading measures for both correctly and incorrectly responded stimuli were included in the final analyses. Incorrect responses were included because the results were the same as when these responses were excluded, but inclusion of these items added power.

Monolinguals

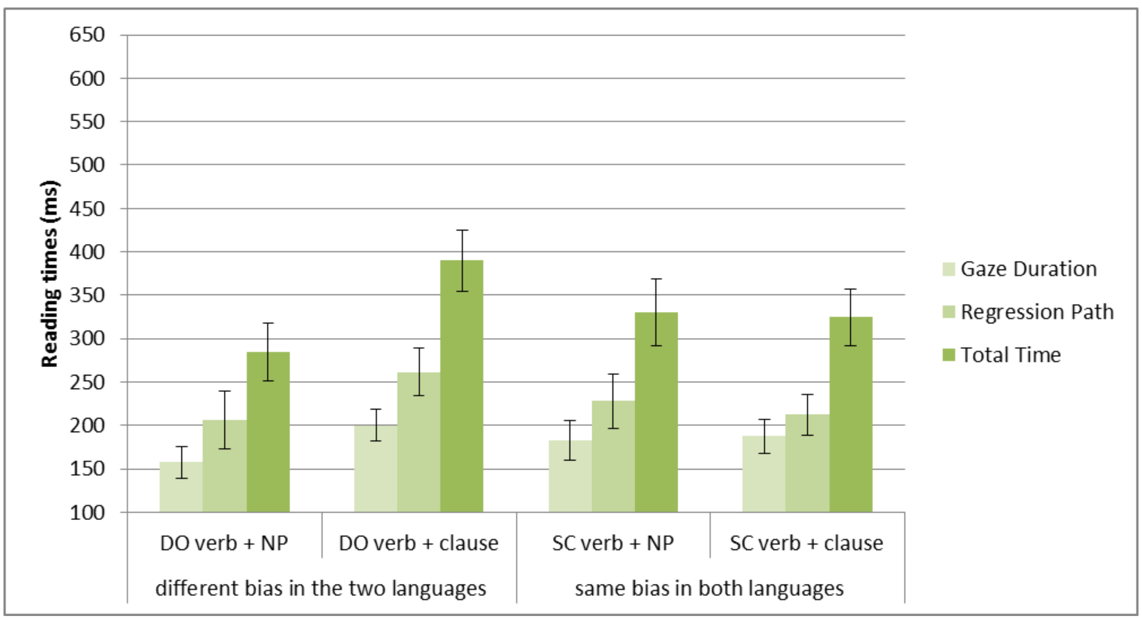
The monolingual group's average times for each of the three reading measures are shown in Figure 2-10 below.

Gaze. A repeated measures ANOVA conducted on monolingual gaze duration revealed no significant main effect of bias, $F_1(1,23)=0.638$, $p=0.433$; $F_2(1,35)=0.434$, $p=0.515$, but did reveal a significant main effect of continuation, $F_1(1,23)=4.536$, $p=0.044$; $F_2(1,35)=5.306$, $p=0.027$. The interaction of bias and continuation approached significance in the subjects analysis, $F_1(1,23)=3.861$, $p=0.063$[5], and slightly less so in the item analysis, $F_2(1,35)=3.126$, $p=0.086$.

[5] Subsequent pairwise comparisons indicate that this near-significant interaction of bias and continuation in the subjects analysis is driven primarily by the conditions containing DO bias verbs, whereby sentences in which DO bias verbs were followed by DO complements (Condition 1, m=157) took less time to read than those in

Regression path. For regression path durations, the results become clearer and more closely replicate those found in Wilson and Garnsey (2009). The repeated measures ANOVA revealed no significant main effect of bias, $F_1(1,23)=1.261$, $p=0.273$; $F_2(1,35)=0.255$, $p=0.617$, or continuation, $F_1(1,23)=0.872$, $p=0.360$; $F_2(1,35)=0.844$, $p=0.365$, but did show a significant interaction of bias and continuation in the subjects analysis, $F_1(1,23)=9.783$, $p=0.005$, though not in the item analysis, $F_2(1,35)=2.347$, $p=0.135$. Pairwise comparisons by subject revealed, as in the results for gaze duration, that this effect was driven primarily by the conditions containing DO bias verbs, given that sentences containing DO bias verbs followed by DO complements (Condition 1, m=206) were read faster at a rate nearing significance than when the same verbs were followed by SC complements (Condition 2, m=261), $t_1(23)=-1.905$, $p=0.069$, while sentences with SC bias verbs followed by SC complements (Condition 4, m=212) were not read significantly faster than SC bias verbs followed by DO complements (Condition 3, m=228), $t_1(23=0.897$, $p=0.379)$.

Figure 2-10 Reading times for Monolingual group



Total time. Total reading times of the critical region by monolingual speakers show the same patterns which persist from the earlier reading measures. A repeated measures

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which DO bias verbs were followed by SC complements (Condition 2, m=200), $t_1(23)=-3.029$, $p=0.006$, while sentences with SC bias verbs followed by SC complements (Condition 4, m=187) were read neither faster or slowly, statistically speaking, than SC bias verbs followed by DO complements (Condition 3, m=183), $t_1(23)=-0.269$, $p=0.791$).

ANOVA revealed no significant main effect of bias, $F_1(1,23)=0.472$, $p=0.499$; $F_2(1,35)=0.294$, $p=0.591$ and a significant main effect of continuation, $F_1(1,23)=8.409$, $p=0.008$; $F_2(1,35)=6.392$, $p=0.016$. A significant interaction of bias and continuation, $F_1(1,23)=14.773$, $p=0.001$; $F_2(1,35)=6.031$, $p=0.019$, was also found. This was once again driven primarily by conditions containing DO verbs, as indicated by pairwise comparisons which demonstrate that sentences containing DO bias verbs followed by DO complements (Condition 1, m=284) were read significantly faster than when DO bias verbs were followed by SC complements (Condition 2, m=389), $t_1(23)=-4.875$ $p<0.001$, while sentences with SC bias verbs followed by SC complements (Condition 4, m=324) were not read significantly faster than SC bias verbs followed by DO complements (Condition 3, m=330), $t_1(23)=0.269$, $p=0.790$.

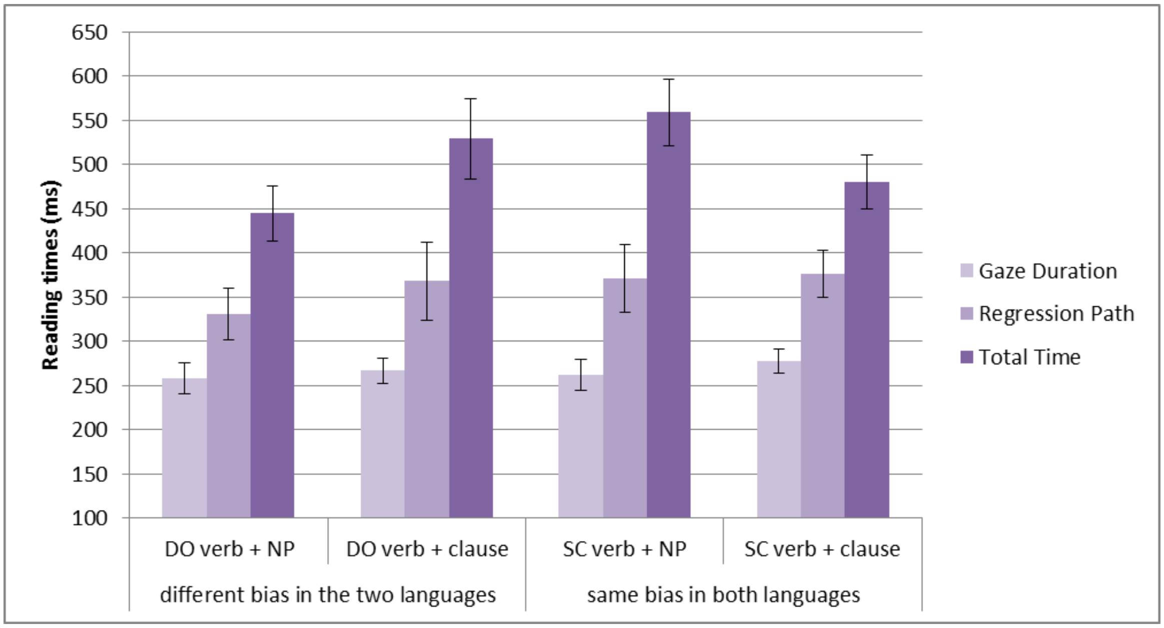
Discussion. The monolinguals in the present study replicate the previous native-speaker results found by Wilson and Garnsey (2009), but do not quite reach significance on all measures where effects were found in previous research. This is likely due to a much smaller sample size in this study that in the previous one (this study: n=23; Wilson and Garnsey (2009): n=84). These large samples are often needed to observe significant effects in this type of monolingual research because of the much faster reading and recovery times of young adult monolingual native speakers of the language of investigation when compared with their older, bilingual counterparts in this study. The interaction of bias and continuation, the critical measure of the use of verb bias as a cue to ambiguity resolution, where observed, is driven largely by the DO bias conditions. Still, when revisiting Figure 2-10 it can be observed that the reading patterns of the SC bias conditions consistently show slightly faster average reading times when the verb's bias and the sentence's continuation match (Condition 4) than when they do not (Condition 3), further suggesting that with a larger sample size, this group would fully replicate the findings of previous research conducted with native English speakers. The conclusions to be drawn from this group, therefore, are that native speakers of English can and do use verb subcategorization bias as a cue to the resolution of temporary ambiguity during online processing of written language.

US bilinguals

The US bilingual group's average times for each of the three reading measures are shown in Figure 2-11 below.

Gaze. A two-way repeated measures ANOVA of gaze duration for the US bilinguals revealed no significant main effects (bias: $F_1(1,22)=0.570$, $p=0.458$; $F_2(1,35)=0.503$, $p=0.483$, continuation: $F_1(1,22)=1.270$, $p=0.272$; $F_2(1,35)=1.243$, $p=0.272$), nor did it reveal a significant interaction of bias and continuation, $F_1(1,22)=0.104$, $p=0.750$; $F_2(1,35)=0.058$, $p=0.811$.

Figure 2-11 Reading times for US Bilingual group



Regression path. The pattern observed for gaze duration persists in analyses of regression path duration, where a two-way repeated measures ANOVA again revealed no main effects or interaction (bias: $F_1(1,22)=0.597$, $p=0.448$; $F_2(1,35)=0.458$, $p=0.503$, continuation: $F_1(1,22)=0.787$, $p=0.385$; $F_2(1,35)=0.601$, $p=0.443$, bias*continuation: $F_1(1,22)=0.399$, $p=0.534$; $F_2(1,35)=0.986$, $p=0.327$).

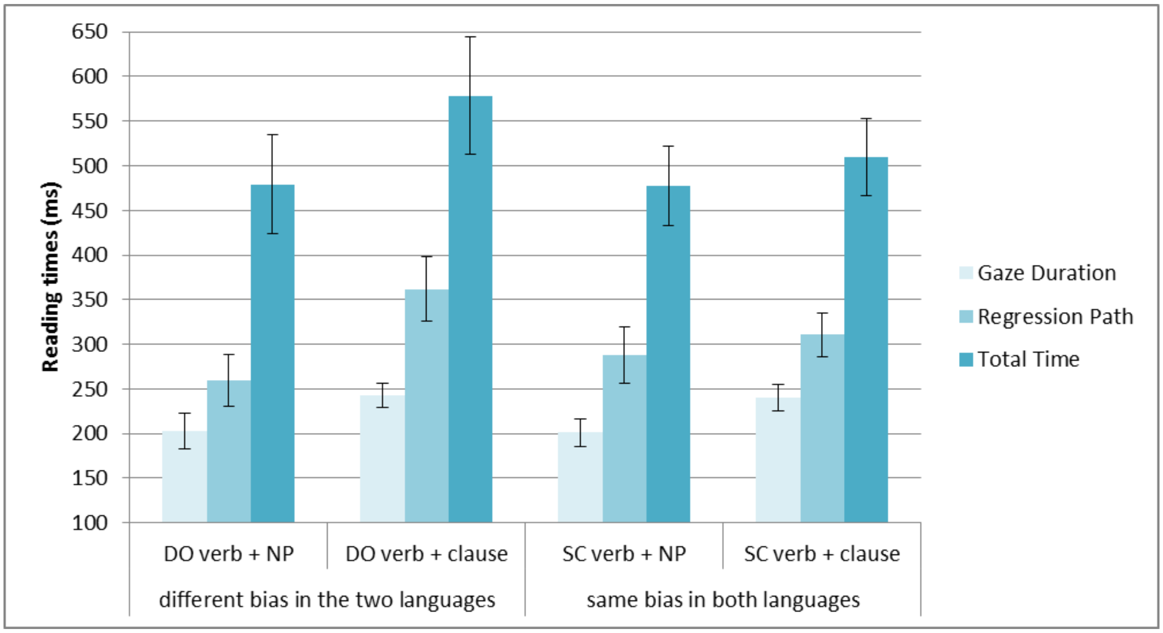
Total time. In total times, a pattern emerges which is similar to that observed in the monolingual group. A two-way repeated measures ANOVA revealed no significant main effects (bias: $F_1(1,22)=1.322$, $p=0.262$; $F_2(1,35)=0.333$, $p=0.567$, continuation: $F_1(1,22)=0.018$, $p=0.894$; $F_2(1,35)=0.670$, $p=0.419$), but revealed a significant interaction of bias and continuation, $F_1(1,22)=14.246$, $p=0.001$; $F_2(1,35)=12.154$, $p<0.001$. Subsequent pairwise contrasts revealed significant effects of verb bias for conditions containing both DO and SC bias verbs, with sentences containing DO bias verbs being read faster at this critical region when followed by a DO completion (Condition 1, m=444) than when followed by an SC completion (Condition 2, m=549), $t_1(22)=-2.928$, $p=0.008$. Critically, sentences containing SC bias verbs were also read faster when followed by an SC completion (Condition 4, m=480) than when followed by a DO completion (Condition 3, m=559), $t_1(22)=2.374$, $p=0.027$.

Spain bilinguals

The Spain bilingual group's average times for each of the three reading measures are shown in Figure 2-12 below.

Gaze. A two-way repeated measures ANOVA of gaze duration for the Spain bilinguals revealed no significant main effect of bias, $F_1(1,29)=0.061$, $p=0.806$; $F_2(1,35)=0.056$, $p=0.815$, but demonstrated a significant main effect of continuation, $F_1(1,29)=11.518$, $p=0.002$; $F_2(1,35)=13.302$, $p<0.001$). Sentences containing a DO continuation (Condition 1, m=203; Condition 3, m=201) were read faster than sentences containing an SC continuation (Condition 2, m=243; Condition 4, m=240). This ANOVA did not reveal a significant interaction of bias and continuation, $F_1(1,29)=0.001$, $p=0.975$; $F_2(1,35)=0.097$, $p=0.757$.

Figure 2-12 Reading times for Spain Bilingual group



Regression path. The same pattern seen in gaze duration measures was repeated in observations of regression path duration for this group. A two-way repeated measures ANOVA once again revealed no significant main effect of bias, $F_1(1,29)=0.238$, $p=0.629$; $F_2(1,35)=0.122$, $p=0.729$, but demonstrated a significant main effect of continuation, $F_1(1,29)=8.822$, $p=0.006$; $F_2(1,35)=9.957$, $p=0.003$). Sentences containing a DO continuation (Condition 1, m=259; Condition 3, m=288) were read faster than sentences containing an SC continuation (Condition 2, m=362; Condition 4, m=311). This ANOVA did not reveal a significant interaction of bias and continuation, $F_1(1,29)=2.2696$, $p=0.112$; $F_2(1,35)=3.515$, $p=0.069$.

Total time. The same pattern persists strongly even into the latest reading measure, total time. The repeated measures ANOVA again showed no significant main effect of bias, $F_1(1,29)=1.290$, $p=0.266$; $F_2(1,35)=2.067$, $p=0.163$, and a significant main effect of continuation by subjects, $F_1(1,29)=7.803$, $p=0.009$, though this main effect was not significant by items, $F_2(1,35)=3.548$, $p=0.068$. Sentences containing a DO continuation (Condition 1, m=479; Condition 3, m=477) were read faster than sentences containing an

SC continuation (Condition 2, m=578; Condition 4, m=509). This ANOVA once again failed to reveal a significant interaction of bias and continuation, $F_1(1,29)=1.745$, $p=0.197$; $F_2(1,35)=0.829$, $p=0.369$.

Discussion. For the Spain bilinguals, the story is quite different than that observed in the previous groups. Across all early and late measures, this group repeatedly shows a strongly significant effect of continuation. Sentences containing DO continuations are consistently read much faster than sentences with SC continuations regardless of the bias—in any language—of the preceding main verb. This result supports a syntax-first approach to processing by these bilinguals. This finding furthermore indicates that without the experience of immersion in their L2 that the US bilingual group has had, these bilinguals, who match the US bilingual group on self-ratings of ability and motivation and who, in the end, comprehend the sentences they have read with equal levels of accuracy to the other group, are simply not sensitive to verb bias information in their L2, nor do they appear capable of transferring similar information from their L1 to resolve ambiguities while reading. This would indicate that immersion experience and language exposure are important in the development of native-like processing strategies in the L2.

GENERAL DISCUSSION

The present pilot study investigated whether L2 speakers of English are able to resolve DO-SC ambiguities using verb bias information from English, much like native English speakers do. The findings from Experiment 1 show that the reading times of highly proficient L2 speakers of English closely mirrored the patterns of those native speakers reported in Wilson and Garnsey (2009)—both groups indicate sensitivity to English verb bias information at the disambiguating region. Observing the need for a more carefully controlled bilingual group and a more fine-grained analysis of reading times, Experiment 2 was conducted using the eye-tracking methodology to further investigate the role of verb bias in L2 processing by Spanish-English bilinguals.

Experiment 2 compared the performance of monolingual English native speakers with two groups of highly proficient Spanish-English bilinguals, an immersed group (US bilinguals) and one that was not immersed in their L2 at the time of testing (Spain bilinguals), to further investigate what role immersion might have in the ability of second language learners to gain sensitivity to frequency-based cues such as verb bias. Analyses of the same disambiguating region as in Experiment 1 were conducted on gaze duration, regression path duration and total reading times to more closely look at the time course for processing these sentences by each group. These analyses found that monolingual English speakers, like the group studied by Wilson and Garnsey (2009), are sensitive to verb bias information even in the earliest phases of comprehension and use that information to aid in the resolution of ambiguity. The L2-immersed US bilinguals also demonstrated sensitivity to English verb bias information, but only in the later reading measure. This indicates that they, too, have learned and are sensitive to verb bias information during comprehension, though they appear to be reliably slower in applying their knowledge when resolving ambiguities online (see, e.g. Kaan, Dallas and Wijnen, 2010 for a proposal which accounts for these delays). In contrast, the non-immersed Spain bilinguals appear to have relied only on structural cues to parse the sentences in this study, suggesting that they do not know or are unable to deploy verb bias information from their L2 to resolve temporary ambiguities while reading.

Returning now to the processing models mentioned in the Background and Hypotheses section, exposure-based accounts of sentence processing better account for the data presented here. As seen in previous studies of monolingual speakers (e.g., Wilson & Garnsey, 2009) the monolingual group in the present study demonstrates the effect of co-occurrence frequencies of verbs and their complements on the ease or difficulty of processing a given sentence in gaze duration, an early measure of reading, on the first word of the disambiguating region. This means that native English speakers are using verb bias information from the main verb to resolve ambiguity very quickly. Furthermore, as indicated by Frazier (1995) and Binder, Duffy and Rayner (2001), the key test for interactional, exposure-based models of processing is to demonstrate the influence of verb bias on processing of the simpler (DO) structure, that is to say, to show that an SC bias can make a DO structure more difficult to process. This effect was observed in Wilson & Garnsey's (2009) native speakers of English. Though not replicated completely in the present study due to a lack of statistical power, such a pattern is observed in all early and late measures of reading by the monolingual group in the present study.

The US bilingual group follows the monolingual reading patterns quite closely, but do not exhibit a reliable interaction of verb bias and continuation until total time, the latest measure of reading. That the influence of verb bias is only observed reliably on later measures of reading, not on gaze duration as in the monolinguals, could be viewed as an indicator that while monolinguals use verb bias early to make predictions, second language learners are only able to use this information at the revision stage. Still, critically, the effect of verb bias is present not only in clause continuations, but also in direct object constructions. The presence of a SC bias main verb makes reading of DO continuations slower, indicating the influence of the verb's bias on this group's processing behavior. Under the Garden Path and other modular two-stage models, a direct object construction should never require reanalysis because it is the simpler structure. That reanalysis is required at all indicates a role for verb bias in bilingual processing as seen in monolinguals. The later appearance of the effect in this group as compared to the previous may be attributable to slower processing in the L2, as well as simple issues of statistical power. In any case, this group's results support an exposure-based account of L2 processing, further promoting a model of human language processing which is consistent cross-linguistically and regardless of age or order of acquisition of a given language.

The Spain bilingual group only manifests a strong and consistent effect of continuation, indicating that these bilinguals are applying universal parsing principals based on syntactic simplicity to make predictions during processing. This would support a Shallow Structures approach to processing, whereby second language learners neither acquire the L2 information necessary to process in native-like ways, nor do they have access to cues from their native language to deploy during L2 processing (Clahsen & Felser, 2006b). Such a conclusion, however, is complicated by the fact that the results of the US bilingual group in this study point toward reliance on shallow structures as a phase of learning, not a permanent state of late-acquired bilingualism as the hypothesis originally proposed. The present study demonstrates that with high levels of proficiency in the second language and extended immersion experience it is possible to observe native-like processing routines in the L2. This, too, when taken as a part of the bigger picture of all groups included in the present study, supports exposure-based accounts of processing, whereby universal strategies are used initially in the absence of sufficient exposure to the target language. Over time if exposure and naturalistic language experience continue, those universal strategies can eventually be supplemented or replaced by L2-specific cues, as seen in the US bilingual group.

To summarize, the present study provides support for an experience-based approach to language processing, demonstrating sensitivity to verb bias information in both monolingual and immersed bilingual participants. For those participants who have not had the benefit of immersion, a preference for simpler syntactic structures (direct objects) was observed, indicating that when exposure to the L2 has not been sufficient, even high proficiency second language learners fall back on universal strategies to resolve ambiguity in their L2. The data from the immersed bilingual participants demonstrated knowledge and use of subtly acquired L2 information during L2 processing. These results also suggest that highly proficient L2 speakers are able to process input in the L2 using information taken from the second language and that with immersion, these L2 usage frequencies can completely override existing L1 knowledge or universal simplicity heuristics as cues to L2 syntactic processing.

Chapter 3 | Exploring equivalent structures of Spanish and English verbs

The study of verb subcategorization bias as a frequency-based lexical property of verbs has been the subject of much corpus research and psycholinguistic inquiry for many years, but there are some assumptions about the nature of verb bias and its relationship to the linguistic contexts in which a verb is used that have gone largely unexplored and questions remain unanswered. As stated in the previous chapters, verb subcategorization bias, also called simply *verb bias*, is defined as the most common subcategorization frame in which a verb is likely to occur based on usage frequency information. For example, the verb *believe* in English can occur with several different subcategorization frames following it, including (1) a direct object construction, (2) a sentential complement or clause construction, or (3) a prepositional phrase, among others.

I believe…
(1) …the truth.
(2) …(that) the truth will set you free.
(3) …in love.

All of these frames are grammatically correct and allowable structures in standard English uses of the verb *believe*, but according to Garnsey, Lotocky, Pearlmutter and Myers' (1997) estimates, *believe* occurs 14% of the time with a DO, 50% of the time with clause complement, and 36% of the time with other (including prepositional) complements. This would indicate that *believe* has a sentential complement bias in English.

This frequency information is assumed to be stored lexically on a verb and has been shown to aid in the formation of predictions used to facilitate online sentence processing in English as a first (Garnsey, Pearlmutter, Myers & Lotocky, 1997; Wilson & Garnsey, 2009) and second language (Dussias & Cramer Scaltz, 2008; and see Chapters 2 and 4 of this dissertation for new evidence). In much of the previous research, the investigation of a verb's structural alternatives focuses on clause structure, more specifically the continuations which follow the verb, while other linguistic features of verbs have been ignored or glossed over. One exception to this has been the work of Hare, McRae & Elman (2003; 2004), in which the authors argue for the consideration of verb sense, not just lexical verb, when considering a verb's bias. In fact, they find that uses of different senses of a verb can show different usage tendencies (i.e., biases) and that the inclusion of verb sense into a corpus analysis "makes sense" because meaning plays a role in determining structure (Hare, McRae & Elman, 2004: 183). The previous research has also been almost exclusively in and about English (but see Dietrich & Balukas, 2012; Dussias, Marful, Bajo & Gerfen, 2010), leaving pending questions about the extent to which verb bias may be used as a processing cue in other languages, and failing to take advantage of cross-linguistic comparisons to help answer the questions about structure and meaning such as those raised by Hare and colleagues.

The unexplored aspects of verb bias are further complicated by the existence of two distinct ways of determining verb bias: absolute and relative calculations. While both absolute and relative definitions of verb bias focus on a direct object (DO) versus sentential complement (SC) binary distinction, under certain absolute treatments of verb bias, one would say that a verb has a particular complement bias only if that verb occurs with that complement more than two-thirds of the time (e.g. Gahl, Jurafsky & Roland, 2004). When taking a common relative approach, a verb is said to have a particular complement bias if that verb occurs with that bias twice as often as with the alternative and has at least a 15% different between the rates of occurrence of the two complement types. Previous cross-corpora comparisons have based their conclusions on absolute measures of verb bias only, from them concluding that verb bias is highly variable and that across corpora and verb norming studies results are not always reliable (e.g. Lapata, Keller, & Schulte Im Walde, 2001; Merlo, 1994). A subsequent comparison of those and other studies conducted by Gahl, Jurasky and Roland (2004), assigned relative verb biases to the percentages observed in each of those studies and evaluated how many verbs switch biases when the relative method of calculation was applied. In fact, they found that the choice of criterion greatly influenced the verb bias classification (Gahl et al., 2004: 436). They furthermore determined that due to an extremely low number of SC bias verbs under absolute methods of classification, perhaps the absolute method is too strict an expectation. Given that previous processing studies have found effects of SC bias when basing their stimuli selection on relative methods of assigning verb bias (Garnsey, Pearlmutter, Myers & Lotocky, 1997; Trueswell et al., 1993, Wilson & Garnsey, 2009; Chapter 2 of this dissertation), it would appear that the relative method better accounts for the results of syntactic processing studies (see also: Gahl et al., 2004: 440). Thus, the lack of effect of verb bias observed in some processing studies may be due to an issue of imprecise definition of verb bias rather than due to a lack of effect itself.

These issues call for a more detailed understanding of the structures in which a verb occurs and why it occurs more often with some structures than others. The present study seeks to address these issues and adds a cross-linguistic comparison with Spanish. Linguistic inquiry has long benefitted from cross-linguistic comparison as a way of both a) understanding certain universal characteristics of human communication and b) finding evidence in one language which can help to enlighten a linguistic problem observed in another (see, e.g., Biber, 1995:22 for further discussion of the usefulness of cross-linguistic comparisons). Little previous research has been done on verb bias in non-English languages, but two previous studies of Spanish verb bias do exist: Dussias and colleagues (2010) conducted an extensive verb norming study of Spanish verbs; and Dietrich and Balukas (2012) conducted a small corpus study of a subset of those verbs, intended as a pilot for the current large-scale study. The present study therefore includes Spanish and English in a side-by-side study of verb bias so as to continue building on and refining the existing understanding in the field as regards verb bias and usage patterns. Relative verb biases for a series of verbs in each of the two languages—translation equivalents of one another—based on samples from two Spanish and one American English corpora, are calculated and compared to each other, as well as to previous studies of the same verbs (Garnsey, Lotocky, Pearlmutter, & Myers, 1997; Dussias et al., 2010). The Spanish verbs were selected because they were the same verbs which have been studied in the previous study of Spanish verb bias (Dussias et al., 2010), 81 of which were selected because they were translations of verbs included in Garnsey Lotocky, Pearlmutter, & Myers' (1997) previous English study. Translations were determined using the Collins Dictionary of Español-Inglés/English-Spanish (2000) and verified by a Spanish-English professional translator. The remaining 44 verbs were new to the Dussias et al. (2010) study, selected because they are cognate verbs, as selected from Nash's (1993) Spanish-English cognate dictionary.

After that analysis of verb bias, the present study also takes aim at questions of cross-linguistic structural equivalence by using multivariate analysis to determine linguistic cues which co-occur with different subcategorization frames. This is done to achieve a more fine-grained vision of what verb bias is and how it is determined. By including studies of the translation equivalents of verbs in two different languages, Spanish and English, this study can also bring clarity to issues of cross-linguistic equivalency of meaning-to-structure mappings, as well as to how equivalent the cues generally treated as equivalent in bilingual research really are. This study additionally paves the way for a more thorough exploration of verb bias as a processing cue, to be explored in Chapter 4 of this dissertation.

BACKGROUND

The use of verb bias information as a cue to parsing has been the subject of much psycholinguistic inquiry in English, especially in situations where temporary ambiguity arises. The Direct Object/Sentence Complement bias dichotomy becomes a useful one when a noun phrase which follows a verb could be either the direct object of that verb (as in (1) above) or the subject of an upcoming sentence complement (as in (2) above). The ability to determine whether verb bias information is used to aid the parsing of sentences such as these is necessarily predicated on approximating the typical usage patterns of verbs based on a sample of linguistic material in which that verb appears. This is generally done in one of two ways: either by eliciting sentence completions from participants and later evaluating the frequency with which different completion types are used (often referred to as norming studies, e.g., Garnsey, Lotocky, Pearlmutter, & Myers, 1997) or by extracting examples from pre-existing corpora instead (e.g.. Gahl, et al., 2004). After determining the biases of individual verbs, one can construct experimental stimuli which contain that verb in its more and less frequent contexts and can subsequently use psycholinguistic methods such as self-paced reading or eye-tracking studies to observe whether a verb appearing in a more frequent context is read more quickly—and therefore processed more easily—than in a less frequent one. The earliest processing work of this sort was inconsistent, finding late or no effect of verb bias information on ambiguity resolution (Ferreira & Henderson, 1990; Mitchell, 1987), while more recent work finds early effects in both native (Garnsey, Pearlmutter, Myers, & Lotocky, 1997; Wilson & Garnsey, 2009) and non-native (Dussias & Cramer Scaltz, 2007; Lee, Lu & Garnsey, 2013; Chapter 2 of this dissertation) speakers of English (but see Kennison, 2001). The lack of consistency in these findings has in turn inspired additional and more careful examinations of verb bias information for particular lexical items. Is it the case that verb bias is not useful, as the early studies may indicate? Or is it the case that verb bias information can be useful for parsing, but the assumptions on which the experimental manipulations are based are insufficiently detailed?

The first step to answering these questions has been cross-corpora comparisons of verb bias. In English, such comparisons are well-instantiated. Gahl, Jurafsky and Roland (2004) conducted a study of two corpora of English and compared it with previous studies of verb bias as determined based on 5 other corpora as well as five different norming studies. When assigning verb biases based on relative rates of occurrence (a common practice in both the linguistic and psycholinguistic literature on this topic, described in more detail in the Methods section below), they found high rates of cross-corpora continuity, despite differences in regional dialect, genre and register and regardless of elicitation or corpus-based methods of sampling. The present study includes a calculation of verb bias for 80 English verbs which have been the subject of previous inquiry, this time based on data taken from the Corpus of Contemporary American English (Davies, 2008-), a newer corpus which has not yet served as the source for data in studies of this nature. Given previously high rates of cross-corpora consistency, it was predicted that the data which are analyzed in this study would also closely replicate the biases observed in previous work, and, in fact, they do. More importantly, the present study also contributes a corpus study of Spanish verb bias, based on data for the Corpus del Español (CdE) (Davies, 2002-) and the Corpus diacrónico del español (CORDE) (Real Academia Española, [2013]). This portion of the study is intended to confirm verb biases in Spanish with the same rigor as has been applied to English.

The reason for studying verb bias in Spanish verbs is two-fold. First, it was conceived with the intent to conduct cross-linguistic comparisons of verb tendencies. Second, it can facilitate psycholinguistic studies of verb bias as a processing cue in Spanish-speakers, as well as in bilinguals and second language learners. The little prior work on Spanish verb bias does exist is promising in terms of its consistency. Exploratory studies of the Peninsular Spanish (Dietrich & Balukas, 2012) and Argentine (Balukas & Dietrich, 2011) segments of the CdE found high rates of consistency between verb biases in those two dialects, as well as between the corpus data and the verb biases determined by a previous elicitation study (Dussias, Marful, Bajo & Gerfen, 2010). In that study (Dussias et al., 2010), conducted on monolingual and bilingual (Spanish-English) participants in Granada, Spain over the course of a five-year period, were given sentence fragments such as (4) and asked to complete the sentence so that it was both grammatically correct and semantically plausible.

(4) Julia creyó ____
'Julia believed'

The results of the monolingual Spanish portion of the Dussias et al. (2010) study are reported alongside the findings of the present study in Table 3-1 below. That the results of that norming study largely agree with the findings for the ten verbs studied by Dietrich and Balukas (2012) and Balukas and Dietrich (2011) would seem to indicate that the consistency of verb bias in Spanish is on par with that observed in the various studies of English that have been compared in past work (Gahl, et al., 2004). To pursue further confirmation of said consistency, the present study includes all verbs studied in the previous elicitation study (Dussias et al., 2010), which included Spanish translation equivalents of all of the verbs studied by Garnsey, Lotocky, Pearlmutter and Myers (1997), thereby establishing a body of work on verb bias in Spanish comparable to those found for English. As in past work, in this study, a high rate of cross-corpora consistency is observed.

Interestingly, when comparing translation equivalents between English (the Garnsey, Lotocky, Pearlmuttter, & Myers, 1997 norms) and Spanish cross-linguistically, the consistency in verb biases is lower, indicating that verb biases can be different for translation equivalents in different languages even though they have apparently the same meanings and the same allowable constructions. This finding is in large part a reason for conducting the present comparative study. More information is needed to understand how and why verb bias varies across languages when the verbs' meanings and propositions are apparently the same. Of additional interest is the results from the bilingual Spanish-English speakers in Dussias et al.'s (2010) same study, which did not indicate the same tendencies towards verb subcategorization biases in Spanish as those found for the monolingual speakers and in the later corpus data (Dietrich and Balukas, 2012). Dussias and colleagues (2010) suggest that the differences in Spanish verb bias observed among the bilingual group's data could be a result of their bilingualism and may represent a change in progress in usage patterns by these speakers because of their knowledge of and contact with English. This hypothesis can be tested by later psycholinguistic experimentation, but development of such an experiment would benefit greatly from a more thorough examination of verb bias in Spanish as well as English, which provides still more impetus for the completion of the present study.

In the far more extensive corpus and elicitation work on verb bias in English, researchers have taken a more detailed approach to verb bias, sometimes proposing that bias is best defined not at the level of the lexical verb, but at the level of verb sense. In this work, Hare, McRae and Elman (2003; 2004) conducted a corpus study which found that a DO construction for a given verb (e.g. *find*) tends to communicate one sense of the verb (here: *locate*), while an SC construction with that same verb conveys a different sense (*realize*). In a follow-up elicitation task, they found that they were able to elicit certain verb senses based on previous context, which in turn influenced subcategorization probabilities (Hare, McRae & Elman, 2004). In a self-paced reading study, participants showed sensitivity to sense-based verb bias information to aid ambiguity resolution in the disambiguating region. Cross-corpora analysis of verb bias based on sense rather than lexical verb yielded even more reliable rates of cross-corpora comparability than when verb sense was not taken into account (Hare, McRae & Elman, 2003). Such results draw attention to the usefulness of a more fine-grained understanding of how verb bias should be determined and the assumptions that can be made about it when testing processing models in psycholinguistic research. It is for this reason the second, multifactorial analysis is also being conducted for each language in the present study.

While Hare and colleagues would appear to argue that meaning in terms of verb sense is what dictates structural choices such as subcategorization frame, there is an alternative view, congenial with such theories as construction grammar (Goldberg, 1995; Jackendoff, 2002), linking rules (e.g. Bresnan & Kanerva, 1989; Davis, 1996; Dowty, 1991), or lexical templates (Rappaport Hovav & Levin, 1998), which would argue that it is rather the case that the meaning of most verbs is learned or derived at least partially from the construction or structural template in which a particular verb finds itself. Under such theories of usage-based grammar, the acquisition of form-meaning mappings of individual verbs is carried out on two levels. First, there is the level of "verb islands", whereby children acquire the meaning and argument structure of a particular verb and can substitute nominal elements within that structure, but tend to reproduce that same schematic construction very carefully (Tomasello, 1992). Second, children seem to generalize over verbs (Bowerman, 1982), which is, in fact, appropriate given that verbs which are closely semantically related also tend to appear in the same argument structure constructions (Goldberg, 1995; Levin, 1993; Pinker, 1989). That verbal constructions are learned in this manner is supported by both corpus and experimental evidence found by Goldberg, Casenhiser and Sethuraman (1995). In that work, they found that dominance of a single verb repeated many times in a particular construction allows young children to fix that construction's meaning, which can in turn be generalized to other less frequently used verbs which appear in the same construction.

Furthermore, as first proposed by Fillmore, Kay and O'Connor (1988), there is much more about language that speakers know beyond simple rules of subjects, objects and complement and relative clauses. Their proposal focused primarily on idiomatic meanings, but individual verbs lacking idiomatic expressions still often have very specific and individualized limitations as regards the complements with which they can co-occur, e.g. *think* requires a finite clause '*I think it is going to snow*', *want* an infinite clause '*I want it to snow*', and *saw* a gerundial '*I saw it snowing*' (Bybee, 2010: 77). Under usage- and construction-based theories of grammar, then, the clause structure surrounding a verb is equally essential as the verb itself in establishing a form-meaning mapping in acquisition and in processing. If verbs are learned through constructions and if constructions are essential for the determination of the function of an argument as it relates to the verb in order to decipher the meaning of a clause (Goldberg, 2006), it stands to reason, then, that when considering verb bias as a lexical property and processing cue, the nature of the arguments present in a given construction are also likely to be relevant considerations. That is to say, what has been heretofore referred to as verb bias may be a shorthand reference to a confluence of several linguistic factors that make up the constructions from which meaning is derived. Or, at the very least, the lack of robust and consistent findings of verb bias effects in past processing studies could be a result of other linguistic factors, such as characteristics of nominal elements, which eliminate or overpower the useful information which can be gleaned from the verb's bias.

The present study therefore seeks to identify additional linguistic factors, aside from verb sense, which may alter or constrain the subcategorization frames (either DO or SC) which occur with particular verbs. This study of semantic class, animacy and form of nominal elements and word order factors is done for both English and Spanish verbs in order to arrive at a probabilistic model of verb bias in each language. In so doing, the present study contributes the first known probabilistic models of verb bias in any language, one for Spanish and one for English. The choice to study not one but two languages was initiated by the need for comparable verb bias information in a second language other than English in order to conduct psycholinguistic research on bilinguals and second language learners, but the need for cross-linguistic comparisons is also necessitated by the failure of generative approaches to syntax to adequately account for the subtle differences in form-meaning mappings within and across languages, a sentiment echoing concerns raised by Newmeyer (2005) and in much of Croft's work on morphosyntactic typology (e.g. Croft, 2001). Together, these independent studies of verb bias in English and Spanish pave the way for a more complete picture of how sentence interpretations are constructed cross-linguistically, while also facilitating improved experimental design for future psycholinguistic studies of verb bias in language processing.

The chapter is structured as follows. Individual extraction and coding methods will be described for the Spanish corpus study. The verb bias results for this study as compared with the results of the norming study conducted by Dussias et al. (2010) will be will then be presented, followed by the multivariate analysis results for factors co-occurring with verb subcategorization frames in Spanish. The methods and results for the English study will then be presented in the same order. This will be followed by a general discussion of the cross-linguistic implications of this work before summarizing the main points in a brief conclusion.

STUDY 1: SPANISH COMPLEMENT-TAKING VERBS

Data Extraction: Methodology and Exclusions

The existence of easily searchable, large-scale corpora in Spanish remains much more elusive than such resources are for research in English. The absence of such a body of language data may, in fact, have much to do with the dearth of inquiry into verb bias in Spanish as compared to the many studies conducted on English verbs. For this reason, for the present study, two corpora were used to provide data for the study of Spanish verbs. This choice was made because for many of the less frequent verbs to be included in the study, one corpus alone did not contain sufficient tokens of 3sg preterit forms of the verb for any meaningful analysis of the verb's bias and usage patterns to be conducted. The first corpus selected was the mixed-genre, mixed-dialect Corpus del Español (CdE) (Davies, 2002-). This is a freely and easily accessible corpus of over 100 million words from dialects of Spanish world-wide. Because of its composition, the CdE corpus provides a holistic view of how these Spanish verbs are used in all varieties of Spanish language production. The choice to deliberately include all geolects, rather than restrict inquiry to a specific country location is based in part on a pilot study conducted in preparation for this work (Balukas & Dietrich, 2011) and in part on previous work in English (Gahl, et al., 2004) which found no major differences in the verb biases, nor, in the case of the pilot Spanish data, in the factors co-occurring with complement selection between Peninsular and Argentine data extracted from the same corpus. This would indicate that regional variation is not a factor of much import as regards verb bias information.

Beginning with the CdE, for each of 135 Spanish verbs analyzed by Dussias et al. (2010), of which 81 are translation equivalents of the English verbs used in Garnsey's verb bias research (Garnsey, Lotocky, Pearlmutter, & Myers, 1997), all 3sg preterit forms were extracted from the 20th century sources of the CdE. For those verbs occurring less than fifty times in the CdE, supplementary data were extracted from a second corpus, the Corpus diacrónico del español (CORDE) (Real Academica Española, [2013]). This corpus is also a mixed-genre and mixed-dialect corpus of over 200 million words which is freely available online. However, the corpus was created by and for lexicographers and can therefore be unwieldy as a search tool for researchers using it for other purposes such as the present study, which is why its use here was limited to a supplemental, rather than primary, source of tokens. For those verbs occurring less than 50 times in the CdE, all occurrences of the 3sg preterit form of the verb were extracted from the 1900-2013 section of the CORDE and combined with the list of tokens previously extracted from the CdE. For 10 of the chosen verbs, this method still yielded very small numbers of tokens, and so those verbs were excluded from all further coding and analysis. Those verbs were: *destestó* 'detested', *documentó* 'documented', *especuló* 'speculated', *infirió* 'inferred', *planificó* 'planned', *postuló* 'postulated', *reguló* 'regulated', *se arrepintió* 'repented', *se jactó* 'boasted', and *valoró* 'valued'.

Once all occurrences of each verb were extracted from each corpus according to the procedure outlined above, 50 tokens of each verb were pseudo-randomly selected from the total selection (or all tokens in cases where the available tokens were still less than or equal to 50 after searching both corpora), taking care not to repeat tokens because some verbs were included in both corpora. Reflexive forms (5) of the verbs were excluded from the token selection because they can have different meanings and different allowable structures than their non-reflexive counterparts. Tokens appearing in questions (6) or relative clauses (7) were also excluded due to restrictions these uses places on word order and subcategorization frame selection. Finally, tokens of the verb used as an intransitive, non-complement-taking verb (8) were excluded from the final 50 token list.

(5) *…se* ***aclaró*** *ruidosamente la garganta y apagó las colillas sobre los mármoles de las consolas.*
‘…he-NULL se-REF cleared noisily his throat and put out the butts on the marble of the side table.’

CDE, ACLARÓ-21

(6) *¿Qué* ***explicó****? ¿Qué él no tenía nada que ver?*
‘What (did) he-NULL explain? That he had nothing to do with it?’

CDE, EXPLICÓ-544

(7) *…el ayudante del gobernador fue quien* ***propuso*** *la ley…*
‘the governor’s helper was who proposed the law’

CDE, PROPUSO-19

(8) *Mary* ***protestó****, pero la señora Inés se mantuvo en su posición.*
‘Mary protested, but Mrs. Inés se-REF maintained in her position.’

CDE, PROTESTÓ-62

Hypotheses and Coding of Tokens

The tokens were then coded for complement type to determine the verb subcategorization frequency for each verb in this corpus. The complement type also served as the dependent variable for the multivariate analysis. For the multivariate analysis, I followed the same methods as the previous exploratory study (Dietrich & Balukas, 2012) and coded tokens for animacy of the subject, animacy of the direct object (when present), the form of the subject and direct object and presence of an indirect object. New factor groups were also included to pursue an in depth analysis of structure and meaning. These include: clause type, word order, presence of a pre-verbal clitic, position of the direct object (when present), presence of other structural elements, and semantic class of the verb. The impact of these other factor groups was analyzed using multivariate analysis (Sankoff, Tagliamonte & Smith, 2005). This analysis allows consideration of all factor groups at once, and at the same time permits consideration of the impact that each individual factor has on complement selection for the verbs in question. The verbs which include *se* as a necessary component of their translation from English were exluded from this analysis because the required preverbal clitic places other constraints on the structures which can co-occur with the verb. Those verbs are: *se acordó* 'remembered'*, se dio cuenta* 'realized', *se olvidó* 'forgot', *se preocupó* 'worried', *se quejó* 'complained'.

Complement type. Coding for complement type was originally split into 5 categories: Direct Object, Sentence Complement, Infinitival Complement, Prepositional Complement and Quotative. For the purposes of direct comparison with the findings of Dussias et al. (2010), only two categories (Direct Object and Sentence Complement) were ultimately considered. These two complement types come into focus because this contrast gives rise to the syntactic ambiguity of interest for the experimental processing studies of verb bias as a cue to online parsing.

Clause type. Each clause containing a token was coded as being either a main (9) or subordinate (10) clause. Due to certain structural constraints on subordinate clauses, only main clauses were included in the final multivariate analysis presented below.

(9) *Ahí, entonces, él* ***confesó*** *que el dinero no se lo había entregado a doña Fulana…*
'There, then he confessed that the money no-NEG him-IO it-DO had delivered to Doña Fulana…'

CDE, CONFESÓ-9

(10) *Les confesaba que nunca* ***sospechó*** *tanto apocamiento en esos hombres…*
'He-NULL them-IO confessed that he-NULL never suspected so much bashfulness in those men…'

CORDE, SOSPECHÓ-3

Word order. Clauses containing tokens were also coded for word order in terms of the position of the subject in relation to the object. Word order was identified as either SV (11), VS (12), having a null subject (13), or containing an impersonal (non-reflexive) *se* (14).

(11) *el magistrado* ***pensó*** *que estos humildes labradores…procedían del Ande…*
'el magistrate thought that these humble Labradors…came from the Andes…'

CDE, PENSÓ-718

(12) *O sea, me lo* ***propuso*** *él, ¿ eh?*
'I mean, me-IO it-DO he-NULL proposed, ok?'

CDE, PROPUSO-21

(13) *…cuando se fue a acostar* ***soñó*** *que el cascanueces se hacía hombre…*
'…when se-REF he-NULL went to bed, he-NULL dreamed that the nutcracker se-REF turned into a man…'

CDE, SOÑÓ-5

(14) *Al principio se* ***creyó*** *que esa partícula, que se denominó muón, era el " pegamento " nuclear.*
At the beginning se-IMPERSONAL believed that this particle, which se-IMPERSONAL called a muon, was nuclear 'glue'.
CDE, CREYÓ-348

Animacy of the subject. All tokens were coded for animacy. Human subjects were coded separately (15) from group or organizations comprised of humans (16). Ultimately, as in a previous study of this factor group, animate subjects were so overwhelmingly frequent that non-animate subjects were excluded from the multivariate analysis (Dietrich & Balukas, 2012). Given that higher animacy in the subject NP relative to the object NP correlates with high transitivity in the clause (Thompson & Hopper, 1980), it was hypothesized that higher animacy arguments (humans are more animate than groups) might motivate DO verb complements.

(15) *Rojas anunció que acudirá ante las autoridades superiores de justicia…*
'Rojas announced that (he-NULL will appear before the higher authorities of justice…
CDE, ANUNCIÓ-662

(16) *Un tribunal superior* ***sostuvo*** *la demanda y el Tribunal Supremo confirmó.*
'A higher court sustained the lawsuit and the Supreme Court confirmed.'
CDE, SOSTUVO-4

Form of the subject. In the Dussias et al. (2010) norming study, all sentences began with a full proper noun phrase as a subject, followed immediately by the 3sg-conjugated verb. Under DuBois' (1987) Preferred Argument Structure (PAS), transitive verbs having two core arguments will only express one of those using a full lexical NP. For Spanish, DuBois (2003) argued that full NPs are disfavored as subjects of transitive verbs. In light of this, it is predicted that the use of Full NPs as the obligatory subjects in the Dussias et al. (2010) materials may have influenced participants in that study to select more sentential complements than lexical direct object complements than would be expected in more naturally occurring settings. To evaluate this hypothesis, a distinction was made between five different types of subject form: proper name (17), full NP (18), heavy NP (including modifiers) (19), pronominal subject (20), or null subject (21).

(17) *Olga* ***aprobó*** *esta reflexión de la señora Inés con entusiasmo.*
'Olga approved this reflection of Mrs. Ines' with enthusiasm.'
CDE, APROBÓ-79

(18) *El chico* ***aprendió*** *mucho, también, de faenas y cultivos.*
'The boy learned a lot, also, about chores and crops.'

CdE, aprendió-66

(19) *El propio príncipe los **apreció** grandemente.*
'The prince himself them-IO appreciated greatly.'

CdE, apreció-8

(20) *Se solicitó el parecer de Joyce y éste no sólo **autorizó** el proyecto sino que seleccionó los ensayos que deberían incluirse…*
Se-IMPERSONAL sought the opinion of Joyce and he-DEMONSTRATIVE not only authorized the project but also selected the essays that should be included…

CdE, autorizó-14

(21) *Entonces, Toño comprendió dónde se hallaba y para qué. **Asumió** el desafío.*
'Then, Toño understood where he-NULL se-REF found himself and what for. He-NULL accepted the challenge.'

CdE, asumió-18

Presence of an indirect object. The presence (22) or lack of an indirect object was coded as an independent factor group because this factor was found to be significant in the exploratory study and accounts for the differences in verb bias found between the Dietrich and Balukas (2012) corpus study and the Dussias et al. (2010) norming study. As in that study, in this one it is predicted that the presence of an indirect object may reveal a bias toward taking additional complements only after core arguments have been taken and may thus favor direct object complements. As with form of the subject and direct object above, this factor could be driving incomplete perceptions of verb bias information in sentence completion studies and is therefore important to include in the present dissertation.

(22) *Lo que sí es cierto es que después del nombramiento de Forero, alguien le **contó** al alcalde un hecho que lo intranquilizó…*
'What is certain is that after the nomination of Forero, someone him-IO told to the mayor a fact that him-IO worried'

CdE, contó-499

Presence of preverbal clitic. Though not studied in the previous Dietrich and Balukas (2012) study, this factor group could have important implications for online studies. The limited range of allowable arguments in previous verb bias norming studies could be influencing the types of complements participants choose to complete sentences, causing such studies to conclude that verbs have different biases than what the parser has actually formulated. Each token was coded as to whether any kind of preverbal clitic—direct or indirect objects—was present (23) or not (24). It should be noted that negative elements were not treated as clitics in this coding because they do not have the syntactic restrictions pronominal clitics do (see e.g. González López, 2008, for a more detailed discussed of negative elements as clitics).

(23) … *destacó la trayectoria de este incansable luchador y lo* ***consideró*** *un ejemplo a seguir por la juventud cubana…*
'he-NULL emphasized the path of this tireless fighter and him-DO considered an example to be followed by the Cuban youth…'
CDE, CONSIDERÓ-159

(24) …*pues, acertadamente, Bill Clinton* ***consideró*** *las pruebas como "un ciclo de autodestrucción"…*
'since, rightly, Bill Clinton considered the tests "a cycle of self-destruction" '
CDE, CONSIDERÓ-277

In the Dussias et al. (2010) norming study, the insertion of a preverbal clitic was not an option (e.g. *María contó* ______________ 'Maria told…'), thereby making it impossible for participants to complete sentences with grammatical direct or indirect object constructions for some verbs, which in turn could be making the bias of that verb appear less strongly in favor of DO constructions than is actually true of natural language use due to limitations placed on participants by the study, not by their grammar. This factor group may seem redundant in addition to the previous two, but was included because it focuses specifically on the structural features of word order as opposed to the features of the nominal elements in the clause (form of the object) or the number and nature of the arguments of the clause (presence of indirect object).

Form of the direct object (when present). In keeping with concerns about word order and sentence structure as described in the previous section, a separate code was also added for the position of the direct object when present in the clause containing the token. For form of the object, it is also necessary to consider the possibility of clitic pronouns, which are not possible in the norming studies conducted in laboratory settings. Thus, direct objects were coded for form in one of the following categories: proper name, definite NP, indefinite NP, clitic pronoun (25), or other pronoun type. Additionally, in many dialects of Spanish with many verbs a direct or indirect object complement cannot be referred to post-verbally if a pre-verbal clitic has not been used before it. This is known as clitic doubling. Doubled clitics (26) were also given a separate code. The form of the object was only coded in those tokens in which the verb takes an object complement. For instance, in the case of sentential complements or quotative complements, coding for the direct object form is, obviously, not applicable. For this reason it was also not included as a factor in the multivariate analysis, but was still coded for consideration in creating naturalistic stimuli.

(25) *Entonces ella sola se lo* ***comunicó*** *el domingo, tres días antes para que prepare sus cosas con tiempo.*
'Then she alone him-IO it-DO told on Sunday, three days before so that he-NULL could prepare his things in time.'

CDE, COMUNICÓ-21

(26) *A los niños los* ***adoró*** *siempre, quizá porque no pudo tenerlos.*
'She-NULL children them-DO adored always, maybe because she-NULL could not have them.'

CDE, ADORÓ-14

Position of the direct object (when present). From the codes above, a simple position code was later derived. This code simplified to either pre-verbal direct objects (which include examples like (25) above), post-verbal (27), or both, in the case of clitic doubling (26).

(27) ***Apreció*** *su fino traje azul - gris de cachemir, su corbata de legítima seda…*
'She-NULL appreciated his fine blue suit – cashmere grey, his tie of real silk…'

CDE, APRECIÓ-7

Presence of other structural elements (adverbials). A final code as regards overall clause structure was also considered. This was simply to code for the presence (28) or absence (29) of additional structural material such as adverbials which are not complements of the verb but which could influence the placement of other elements of the sentence.

(28) … ***admiró*** *inconscientemente el claro de luna…*
'…she-NULL admired unconsciously the light of the moon…'

CDE, ADMIRÓ-1

(29) ***Aceptó*** *mi apretón de manos.*
'She-NULL accepted my handshake.'

CDE, ACEPTÓ-70

Verb class. A full study of semantic features of verbs is outside the scope of the present study, but semantic class was included here as a factor to quantify the tendency of verbs with similar meanings appearing in similar constructions as argued by Goldberg (1995), Levin (1993) and Pinker (1989). Verbs were placed into semantic classes based on criteria borrowed from Quirk, Greenbaum, Leech and Svartik (1985) and following fairly closely the coding used by Torres Cacoullos and Walker (2009). The semantic classes included in this factor group were: propositional attitude (e.g., *creyó* 'believed'), factual knowledge (*comprendió* 'understood'), suasive (*sugurió* 'suggested'), commentative (*denunció* 'denounced'), utterance (*anunció* 'announced'), and sensory (*oyó* 'heard'). Ultimately, only utteratives and sensory verbs were included in the multivariate analysis. The others, showing no significant preference for either structure, were not considered in this factor group.

These tokens and their codes were then subject to two separate analyses as described in the section to follow.

Analysis

Verb Bias

The subcategorization bias for each verb was determined following the same calculations employed in Garnsey et al (1997). Complement types were collapsed into three categories: Sentential Complement (SC), Direct Object (DO) and Other. The frequency of overall occurrence of each of these categories was determined for each verb. The assignment of a bias was then completed based on a relative measurement as follows: If a verb occurs at least twice as frequently with one type of complement (e.g. SC) than the other (e.g. DO), it was a candidate for, in this example, SC bias. If DO complements are twice as frequent as SC complements, the verb is a candidate for DO bias. Additionally, there must be at least a 15% difference between the rates of occurrence of the two complement types in order to definitely be called a DO bias or SC bias verb. Regardless of the first criterion, if the 15% difference is not present, the verb is said to be EQUI bias. If none of the criteria are met, the verb is said to have no bias. The frequency rates and verb biases resulting from this calculation are shown in Table 3-1 in the next section. The biases resulting from this analysis are compared with the biases found in the Dussias et al. (2010) elicitation study in that table.

Multivariate Analysis

The multivariate analysis was conducted using Goldvarb X (Sankoff, Tagliamonte, & Smith, 2005). In variable-rule analysis, multiple factor groups can be simultaneously taken into consideration, while at the same time allowing for a determination of the relative contributions of individual factors. The difference between weights for variables within a given factor group (see i.e. *Animacy* in Table 3-2 below) reflects its statistical significance within the multivariate analysis. Due to low token counts for other completions, only those tokens with SC or DO completions were included in this analysis. The continuation type (SC or DO) was the dependent variable. The following independent variables were submitted to the final analysis, the results of which are shown in Table 3-2 below: word order, animacy of the subject, presence of an indirect object, presence of other structural material, verb class, and form of the subject.

Results

Verb bias

Out of the 125 verbs for which there were sufficient tokens for an estimation of verb bias, 56% (n=70) of them were found to have a DO bias, 14% (n=18) were found to have an SC bias, 27% (n=34) were identified as EQUI bias, and 2%(n=3) had no bias in the 3sg preterit form. The overall distribution of these biases across this list of verbs is quite similar to those observed in the previous work. Dussias et al. (2010:108) observed 50% DO bias, 16% SC bias, 23% EQUI bias and 11% no bias. This high rate of similarity across the two studies is echoed by individual verb-by-verb comparisons of the verb bias estimates in each study. Out of 125 verbs, 71 of them (56%) demonstrated the same subcategorization bias in the corpus data presented here as in the previous elicitation data. Among the remaining verbs, only 3 (2%) of them reversed bias: *aclaró* 'clarified' and *indicó* 'indicated' showed SC biases in the corpus data when DO biases had been assigned to them according to the previous norming study and *se preocupó* 'worried' demonstrated a DO bias in this corpus study, while it was classified as SC bias in the norming study. It should, however, also be noted that *se preocupó* has extremely high rates of other completions in this study (96%) as well as in the Dussias et al. (2010) norming study (91%), making classification of this verb as having either an SC or a DO bias rather uninformative. The remaining 42% of the verbs studied switched biases, but 41 (33%) verbs had either an EQUI bias or no bias in one study and an SC or DO bias in the other, and 11 (95) had EQUI bias in one study and no bias in the other. This indicates a shift in the relative frequency of completions across corpora, but not a complete reversal in tendencies from one corpus to another. These results indicate a high level of cross-corpora consistency between this and the foregoing study and validate the results of both studies as well as the processing studies based on these verb bias classifications.

Table 3-1 Study 1: Spanish verb biases compared with Dussias et al. (2010)

[on next page]

	STUDY 1				Dussias et al. (2010)					
Spanish verb	**Bias**	**Rate of DO**	**Rate of SC**	**Rate of Other**	**Bias**	**Rate of DO**	**Rate of SC**	**Rate of Other**	**Match the Dussias et al. (2010) findings?**	**Reversal?**
abogó	EQUI BIAS	0	0	1	EQUI BIAS	0.12	0.17	0.71	yes	-
aceptó	DO BIAS	0.41	0.19	0.41	DO BIAS	0.89	0.05	0.06	yes	-
aclamó	DO BIAS	0.82	0	0.18	DO BIAS	0.68	0.20	0.12	yes	-
adivinó	DO BIAS	0.54	0.16	0.3	DO BIAS	0.60	0.17	0.23	yes	-
admiró	DO BIAS	0.9	0.1	0	DO BIAS	0.97	0	0.03	yes	-
adoró	DO BIAS	0.92	0	0.08	DO BIAS	0.93	0.07	0	yes	-
advirtió	SC BIAS	0.14	0.38	0.48	SC BIAS	0.17	0.58	0.25	yes	-
afirmó	SC BIAS	0.04	0.34	0.62	SC BIAS	0.1	0.69	0.21	yes	-
analizó	DO BIAS	0.68	0.04	0.28	DO BIAS	1	0	0	yes	-
anunció	EQUI BIAS	0.32	0.36	0.32	EQUI BIAS	0.56	0.43	0.01	yes	-
apreció	DO BIAS	0.54	0.08	0.38	DO BIAS	0.87	0.1	0.03	yes	-
aprobó	DO BIAS	0.54	0	0.46	DO BIAS	0.94	0.01	0.05	yes	-
apuntó	DO BIAS	0.32	0.04	0.64	DO BIAS	0.67	0.16	0.17	yes	-
aseguró	SC BIAS	0.12	0.42	0.46	SC BIAS	0.12	0.81	0.07	yes	-
asumió	DO BIAS	0.64	0.04	0.32	DO BIAS	0.73	0.23	0.04	yes	-
autorizó	DO BIAS	0.52	0.04	0.44	DO BIAS	0.29	0.09	0.62	yes	-
celebró	DO BIAS	0.6	0	0.4	DO BIAS	0.99	0.01	0	yes	-
citó	DO BIAS	0.36	0.04	0.6	DO BIAS	0.95	0.03	0.02	yes	-
comentó	EQUI BIAS	0.18	0.14	0.68	EQUI BIAS	0.44	0.48	0.08	yes	-
concedió	DO BIAS	0.72	0	0.28	DO BIAS	0.96	0.02	0.02	yes	-
confesó	SC BIAS	0.14	0.36	0.5	SC BIAS	0.31	0.62	0.07	yes	-
consideró	EQUI BIAS	0.38	0.32	0.3	EQUI BIAS	0.42	0.57	0.01	yes	-
denunció	DO BIAS	0.88	0.08	0.04	DO BIAS	0.91	0.09	0	yes	-
describió	DO BIAS	0.78	0	0.2	DO BIAS	0.91	0.02	0.07	yes	-
descubrió	DO BIAS	0.62	0.26	0.12	DO BIAS	0.70	0.29	0.01	yes	-
deseó	EQUI BIAS	0.28	0.22	0.5	EQUI BIAS	0.09	0.17	0.74	yes	-
detectó	DO BIAS	0.78	0.2	0.02	DO BIAS	0.76	0.24	0	yes	-
determinó	EQUI BIAS	0.42	0.46	0.12	EQUI BIAS	0.43	0.53	0.04	yes	-
dictó	DO BIAS	0.8	0.02	0.18	DO BIAS	0.95	0.05	0	yes	-
disputó	DO BIAS	0.79	0	0.2	DO BIAS	0.63	0.02	0.35	yes	-
encontró	DO BIAS	0.86	0.06	0.08	DO BIAS	0.91	0.06	0.03	yes	-
enseñó	DO BIAS	0.44	0.04	0.52	DO BIAS	0.51	0.02	0.47	yes	-
enunció	DO BIAS	0.85	0.3	0.12	DO BIAS	0.76	0.23	0.01	yes	-
escribió	DO BIAS	0.7	0	0.3	DO BIAS	0.89	0.03	0.08	yes	-
estableció	DO BIAS	0.9	0.08	0.02	DO BIAS	0.95	0.04	0.01	yes	-
examinó	DO BIAS	0.94	0	0.06	DO BIAS	0.97	0	0.03	yes	-
expresó	DO BIAS	0.66	0.12	0.22	DO BIAS	0.93	0.01	0.06	yes	-
expuso	DO BIAS	0.54	0.04	0.42	DO BIAS	0.88	0.05	0.07	yes	-
interpretó	DO BIAS	0.86	0.04	0.1	DO BIAS	0.82	0.08	0.10	yes	-
justificó	DO BIAS	0.88	0.02	0.1	DO BIAS	0.90	0.08	0.02	yes	-
juzgó	DO BIAS	0.42	0.12	0.46	DO BIAS	0.83	0.01	0.16	yes	-
leyó	DO BIAS	0.78	0	0.22	DO BIAS	0.93	0.04	0.03	yes	-

Spanish verb	Bias	Rate of DO	Rate of SC	Rate of Other	Bias	Rate of DO	Rate of SC	Rate of Other	Match the Dussias et al. (2010) findings?	Reversal?
mantuvo	DO BIAS	0.78	0	22	DO BIAS	0.86	0.12	0.02	yes	-
negoció	DO BIAS	0.72	0	0.28	DO BIAS	0.70	0	0.30	yes	-
observó	DO BIAS	0.52	0.2	0.28	DO BIAS	0.64	0.31	0.05	yes	-
ocultó	DO BIAS	0.96	0	0.04	DO BIAS	0.92	0.04	0.04	yes	-
oyó	DO BIAS	0.64	0.06	0.3	DO BIAS	0.87	0.09	0.04	yes	-
pensó	SC BIAS	0.04	0.32	0.64	SC BIAS	0.04	0.72	0.24	yes	-
percibió	DO BIAS	0.68	0.2	0.12	DO BIAS	0.66	0.32	0.02	yes	-
prefirió	DO BIAS	0.22	0	0.78	DO BIAS	0.88	0.10	0.02	yes	-
probó	DO BIAS	0.72	0.06	0.22	DO BIAS	0.91	0.03	0.06	yes	-
proclamó	DO BIAS	0.62	0.8	0.3	DO BIAS	0.74	0.23	0.03	yes	-
promovió	DO BIAS	1	0	0	DO BIAS	0.94	0.05	0.01	yes	-
pronunció	DO BIAS	0.78	0	0.22	DO BIAS	0.96	0.02	0.02	yes	-
propuso	DO BIAS	0.38	0.1	0.52	DO BIAS	0.79	0.17	0.04	yes	-
protestó	EQUI BIAS	0.04	0	0.96	EQUI BIAS	0.06	0.03	0.91	yes	-
proyectó	DO BIAS	0.82	0.02	0.16	DO BIAS	0.97	0	0.03	yes	-
publicó	DO BIAS	0.96	0.04	0	DO BIAS	1	0	0	yes	-
repitió	DO BIAS	0.52	0.02	0.46	DO BIAS	0.69	0.22	0.09	yes	-
reportó	DO BIAS	0.48	0.3	0.22	DO BIAS	0.83	0.06	0.11	yes	-
requirió	DO BIAS	0.7	0.02	0.28	DO BIAS	0.74	0.13	0.13	yes	-
respetó	DO BIAS	0.98	0	0.02	DO BIAS	0.92	0.05	0.03	yes	-
reveló	DO BIAS	0.68	0.24	0.08	DO BIAS	0.77	0.22	0.01	yes	-
se acordó	SC BIAS	0.1	0.22	0.68	SC BIAS	0.01	0.39	0.60	yes	-
se dio cuenta	SC BIAS	0	0.78	0.22	SC BIAS	0	0.71	0.29	yes	-
se quejó	SC BIAS	0	0.24	0.76	SC BIAS	0.01	0.26	0.73	yes	-
sintió	DO BIAS	0.64	0.26	0.1	DO BIAS	0.69	0.30	0.01	yes	-
soñó	SC BIAS	0.12	0.42	0.46	SC BIAS	0.02	0.24	0.74	yes	-
sospechó	SC BIAS	0.64	0.28	0.08	SC BIAS	0.06	0.69	0.25	yes	-
temió	SC BIAS	0.24	0.58	0.18	SC BIAS	0.13	0.40	0.47	yes	-
aclaró	SC BIAS	0.12	0.68	0.2	DO BIAS	0.65	0.29	0.06	NO	***yes***
indicó	SC BIAS	0.2	0.52	0.28	DO BIAS	0.67	0.27	0.06	NO	***yes***
se preocupó	DO BIAS	0.04	0	0.96	SC BIAS	0.01	0.08	0.91	NO	***yes***
aconsejó	NO BIAS	0.18	0.34	0.48	EQUI BIAS	0.50	0.48	0.02	NO	no
admitió	EQUI BIAS	0.24	0.38	0.38	SC BIAS	0.26	0.59	0.15	NO	no
anticipó	EQUI BIAS	0.36	0.48	0.16	NO BIAS	0.56	0.32	0.12	NO	no
aprendió	DO BIAS	0.34	0	0.66	EQUI BIAS	0.27	0.23	0.50	NO	no
calculó	EQUI BIAS	0.28	0.36	0.36	DO BIAS	0.86	0.08	0.06	NO	no
certificó	EQUI BIAS	0.27	0.27	0.44	NO BIAS	0.59	0.37	0.04	NO	no
comprendió	EQUI BIAS	0.44	0.48	0.08	NO BIAS	0.34	0.56	0.10	NO	no
comprobó	SC BIAS	0.22	0.68	0.1	NO BIAS	0.34	0.65	0.01	NO	no
comunicó	EQUI BIAS	0.32	0.22	0.45	NO BIAS	0.58	0.38	0.04	NO	no
concluyó	DO BIAS	0.36	0.06	0.56	NO BIAS	0.48	0.32	0.20	NO	no
confió	DO BIAS	0.3	0.06	0.64	EQUI BIAS	0.08	0.12	0.80	NO	no
confirmó	NO BIAS	0.46	0.3	0.24	EQUI BIAS	0.49	0.43	0.08	NO	no
contestó	EQUI BIAS	0.1	0.12	0.78	NO BIAS	0.59	0.31	0.10	NO	no
contó	EQUI BIAS	0.4	0.26	0.34	DO BIAS	0.74	0.03	0.23	NO	no
creyó	SC BIAS	0.18	0.44	0.38	NO BIAS	0.26	0.44	0.30	NO	no
decidió	EQUI BIAS	0.12	0.16	0.72	SC BIAS	0.09	0.38	0.53	NO	no
declaró	EQUI BIAS	0.2	0.22	0.58	NO BIAS	0.28	0.47	0.25	NO	no
dedujo	EQUI BIAS	0.36	0.46	0.18	SC BIAS	0.30	0.67	0.03	NO	no
demostró	EQUI BIAS	0.38	0.36	0.26	SC BIAS	0.26	0.71	0.03	NO	no

Spanish verb	Bias	Rate of DO	Rate of SC	Rate of Other	Bias	Rate of DO	Rate of SC	Rate of Other	Match the Dussias et al. (2010) findings?	Reversal?
discutió	DO BIAS	0.6	0.06	0.34	EQUI BIAS	0.11	0.01	0.88	NO	no
dudó	SC BIAS	0.06	0.14	0.8	EQUI BIAS	0.07	0.09	0.84	NO	no
enfatizó	EQUI BIAS	0.2	0.2	0.6	DO BIAS	0.53	0.25	0.22	NO	no
especificó	EQUI BIAS	0.22	0.34	0.44	DO BIAS	0.56	0.26	0.18	NO	no
esperó	DO BIAS	0.5	0.18	0.32	EQUI BIAS	0.40	0.47	0.13	NO	no
estimó	SC BIAS	0.02	0.54	0.34	NO BIAS	0.58	0.40	0.02	NO	no
exclamó	EQUI BIAS	0	0	1	SC BIAS	0.24	0.63	0.13	NO	no
exigió	DO BIAS	0.64	0.18	0.18	NO BIAS	0.61	0.38	0.01	NO	no
explicó	EQUI BIAS	0.34	0.24	0.42	DO BIAS	0.66	0.24	0.10	NO	no
fingió	DO BIAS	0.38	0.08	0.54	EQUI BIAS	0.23	0.22	0.55	NO	no
garantizó	DO BIAS	0.70	0.28	0.02	EQUI BIAS	0.45	0.53	0.02	NO	no
imaginó	DO BIAS	0.62	0.26	0.12	EQUI BIAS	0.39	0.47	0.14	NO	no
informó	SC BIAS	0.02	0.28	0.70	EQUI BIAS	0.18	0.32	0.50	NO	no
insinuó	EQUI BIAS	0.32	0.30	0.38	SC BIAS	0.13	0.84	0.03	NO	no
mencionó	DO BIAS	0.58	0.18	0.24	NO BIAS	0.62	0.32	0.06	NO	no
murmuró	EQUI BIAS	0.10	0.02	0.88	NO BIAS	0.37	0.20	0.43	NO	no
negó	DO BIAS	0.46	0.12	0.42	EQUI BIAS	0.50	0.38	0.12	NO	no
notificó	EQUI BIAS	0.23	0.35	0.42	DO BIAS	0.72	0.26	0.02	NO	no
permitió	EQUI BIAS	0.14	0.18	0.68	SC BIAS	0.19	0.79	0.02	NO	no
predijo	NO BIAS	0.50	0.30	0.20	EQUI BIAS	0.39	0.47	0.14	NO	no
preguntó	EQUI BIAS	0.08	0.06	0.62	DO BIAS	0.50	0.07	0.43	NO	no
prohibió	DO BIAS	0.58	0.12	0.30	EQUI BIAS	0.23	0.35	0.42	NO	no
prometió	EQUI BIAS	0.20	0.28	0.52	SC BIAS	0.27	0.55	0.18	NO	no
recomendó	EQUI BIAS	0.42	0.28	0.30	DO BIAS	0.76	0.23	0.01	NO	no
reconoció	DO BIAS	0.76	0.12	0.12	EQUI BIAS	0.50	0.50	0	NO	no
recordó	DO BIAS	0.54	0.60	0.20	EQUI BIAS	0.55	0.40	0.05	NO	no
reiteró	DO BIAS	0.54	0.36	0.10	EQUI BIAS	0.50	0.30	0.20	NO	no
respondió	EQUI BIAS	0.10	0.06	0.80	NO BIAS	0.50	0.28	0.22	NO	no
se olvidó	DO BIAS	0.12	0.04	0.84	EQUI BIAS	0.03	0.05	0.92	NO	no
señaló	EQUI BIAS	0.32	0.40	0.28	DO BIAS	0.69	0.09	0.22	NO	no
sostuvo	DO BIAS	0.70	0.22	0.08	EQUI BIAS	0.53	0.45	0.02	NO	no
sugirió	EQUI BIAS	0.18	0.30	0.52	SC BIAS	0.24	0.72	0.04	NO	no
supuso	EQUI BIAS	0.42	0.48	0.08	SC BIAS	0.05	0.95	0	NO	no

Multivariate analysis

This analysis finds that overall, direct object constructions are more common than sentence complement constructions, as evidenced by an input value of 0.305. Five factor groups were found to be statistically significant predictors of sentence complement continuations: Word order, animacy of the subject, presence of an indirect object, and verb class. Sentence with over subjects, both SV and VS word order, slightly favor sentence complement continuations with factor weights of 0.52 each, while null subjects neither favor not disfavor sentence complements with a factor weight of exactly 0.50. Human subjects were found to slightly favor SC complements with a factor weight of 0.53, while groups of humans as subjects strongly disfavor SC complements with a factor weight of 0.30. In clitic or full NP form, the presence of an indirect object in a clause favors SC complements with a factor weight of 0.59, while an absent indirect object disfavors SC complements with a factor weight of 0.49. The absence of additional structural material, e.g. adverbials, in the clause slightly favors sentence complements with a factor weight of 0.52 which the presence of such material disfavors sentence complements with a factor weight of 0.42. Finally, in the case of verb class, though utterative verbs favor SC complements with a factor weight of 0.57, while sensory verbs strongly disfavor SC complements with a factor weight of 0.26.

Table 3-2 Factors contributing to the selection of a sentential complement in Spanish

Factor Group	Factor Weight	% SC	% Data
Word order			
SV	0.52	441/1381 (46.9%)	49.5%
Null subject	0.50	416/1314(46.3%)	18.8%
VS	0.32	17/93(18.3%)	3.3%
Range:	--		
Animacy			
Human	0.52	825/2510(32.9%)	90.1%
Group	0.30	49/226(21.7%)	9.9%
Range:	0.22		
Presence of an indirect object			
Present	0.59	745/2472(30.1%)	88.6%
No IO	0.49	131/319(41.1%)	11.4%
Range:	0.10		
Presence of other structural material			
Absent	0.52	760/2330(32.6%)	83.5%
Present	0.42	116/461(25.2%)	16.5%
Range:	0.10		
Verb Class			
Utterative	0.57	286/745(38.4%)	26.7%
Other	0.49	568/889(63.9%)	67.7%
Sensory	0.26	22/157(14.0%)	5.6%
Range:	--		
Form of Subject			
Lexical	[0.52]	218/716 (30.4%)	25.7%
Proper	[0.52]	185/556(33.3%)	19.9%
Reduced	[0.48]	473/1516(31.2%)	54.3%
Range:	--		
N=876/2791	Overall Rate= 31.4%		
[non-significant factor]	Input: 0.305		

Factors included in the analysis but not selected as significant: Form of Subject

Study 1: Summary

The results of Study 1 yield some interesting results. First, expressed subjects are more likely to co-occur with sentence complement constructions than null subjects. Furthermore, while groups of humans functioning as a single, collective subject neither favor nor disfavor sentence complements, individual human subjects favor sentential complements. This is counter to the prediction above, which proposed based on previous findings (Dietrich & Balukas, 2012) and Thompson and Hopper's Transitivity Hypothesis that more animate subjects would create greater transitivity within the clause, perhaps in the form of DO complements. Instead, because sentential complements often express propositions such as thoughts and utterances, it seems that the more sentient animate human subjects facilitate expression of such concepts. In contrast, though composed of thinking, human subjects, a body or group of people cannot, by its nature, think collectively.

The presence of an indirect object in any form favors sentence complement completions, but different object forms could have different implications for processing. In order to further investigate that, Table 3-3 below shows a cross-tabulation of the presence of an indirect object according to the presence of a preverbal clitic. This table demonstrates that a majority (1468/2265, 65%) of preverbal clitics in this data were in DO constructions, and only a mere 36/2265 (2%) also had indirect objects, indicating that, in fact, most preverbal clitics in this data represented direct objects, not indirect objects. This would indicate that preverbal clitics serve as better cues to upcoming direct object continuations than for some other construction.

Table 3-3 Presence of indirect object according to presence of pre-verbal clitic

		Clitic	**%**	**None**	**%**	**Total**	**%**
None	SC	745	34	0	0	745	30
	DO	1468	66	259	100	1727	70
IO	SC	16	31	115	43	131	41
	DO	36	69	152	57	188	59
Total	*SC*	*761*	*34*	*115*	*22*	*876*	31
	DO	*1504*	*66*	*411*	*78*	*1915*	69

Taken together under a construction-based approach to acquisition of a grammar of Spanish, these tendencies would indicate that even before the verb is processed, a person can begin to construct the meaning of the clause to form predictions about the structure they can expect to see.

The presence of additional structural information, mostly adverbial information in the form of adjuncts, disfavors to some extent sentence complement completions. This, too, may serve as a tool for prediction. The presence of such additional information adds extra complexity to a sentence's structure. The significance of this factor group may point towards a legitimate roll for cognitive load in constraining sentence structures. While human language is recursive, the memory limitations of the human brain are not infinite and highly complex sentences (e.g. sentence complements + adjuncts) may be disfavored for practical reasons related to cognitive load.

Additionally, verb class was also significant in this analysis, showing that verbs representing semantically related concepts can have strong tendencies towards certain kinds of complements. Thus, meaning has structural implications, as argued by Hare, McRae and Elman (2003, 2004), or the opposite, meaning is constructed by structural templates. For this reason the semantics of verbs likely merits further investigation in Spanish and cross-linguistically as those previous researchers have called for in English.

In an unpredicted contrast with the previous work on this topic (Dietrich & Balukas, 2012), the presence of an indirect object is a significant predictor of continuation type here, but favoring the opposite continuation. In the previous work on a much smaller set of tokens, the existence of an indirect object favored direct object completions (Dietrich & Balukas, 2012: 267). In the current study, indirect objects favored sentence complements with a comparably large factor weight. The differences between studies make result from the inclusion of many more verbs and many more tokens and merits further investigation in the future. Still, the importance of indirect objects here could account for some of the differences between the verb biases found in this study and those found in the previous norming study (Dussias et al., 2010). The verb *indicó* 'indicated' shows a reversal in biases. In the present work, it is a SC bias verb, but Dussias and colleagues classified it as a DO bias verb. In the corpus data, out of 30 tokens of *indicó* which were included in the multivariate analysis, 24 (80%) of them were SC constructions. Ten of those SC constructions (33% of the total SCs) co-occurred with indirect objects, and 8 (27%) of those were doubled objects, such that the indirect object clitic appeared before the verb and the lexical indirect object appeared post-verbally. The ability to include an indirect object clitic before the verb is not an option in completion studies such as the one employed in the previous work (Dussias et al., 2010), and may, at least in the case of *indicó*, be biasing the results of the verb's bias.

Finally, for the purposes of comparison with previous work on this topic, the factor weights for form of the subject were included in the table below despite their non-significance. In a previous model of verb bias, Dietrich and Balukas (2012: 268) found stark differences in the tendencies of different subject forms and proposed that proper names, which are often assumed to be more like full, lexical NPs actually function more like reduced forms. The current data do not corroborate that finding, showing little difference at all among any of the subject forms.

STUDY 2: ENGLISH COMPLEMENT-TAKING VERBS

Data Extraction: Methodology and Exclusions

To provide a point of comparison in English, and to allow for the analysis of factors co-occurring with complement selection in English, which is the first of its kind, 100 instances of the past (*-ed*) tense form of each of 80 verbs from Garnsey. Lotocky, Pearlmutter &

Myers' (1997) list of English verbs were also extracted for analysis. The verbs were selected such that there was complete overlap among all studies: all English verbs analyzed in the present study have translations equivalents which were studied in both Dussias et al.'s (2010) Spanish norming study as well as the Spanish corpus study presented above. These instances were extracted from the Corpus of Contemporary American English (COCA) (Davies, 2008-), a new and ever-growing corpus of 450 million words and counting which has not been evaluated in previous English verb bias literature. Unlike Spanish, English does not have unambiguous verbal morphology to distinguish 3sg preterit forms from other grammatical persons and numbers, nor to distinguish the simple past (which equates to the Spanish preterit in Study 1 above) from the past perfect (e.g. *He had shouted*) and from other moods (e.g. with *could* or *would*). It is furthermore non-distinguishable from the past participle adjectival form. For this reason, and because the COCA is an untagged corpus, an extraction of 100 instances of *shouted*, for example, can contain many instances of 1sg "*I (had) shouted*", 2sg "*you (would have) shouted*", 3sg "*he (could have) shouted*", etc. In order to arrive at a dataset comparable to the Spanish dataset in Study 1, each of the 100 initially-extracted instances was coded for person and number, with a separate code for past participles as adjectives, and only the 3sg instances of any tense and mood were ultimately used as tokens for this study. It should be noted that in previous studies, unlike the current study, passives and adjectival passives were also included in the data, though the way that they were coded varied somewhat. The method used in the present study did at times result in very small token counts for some verbs, a fact that should give way to another fruitful line of research to investigate how the usage patterns of superficially identical forms in their different grammatical roles interact with one another and influence cue strength during processing. That is, however, outside of the scope of the present study. A larger scale study of the sort conducted for Spanish was not conducted here because it was unnecessary. Gahl et al. (2004) have already done cross-corpora comparisons for English and found high levels of consistency. Instead, this study was conducted with the intention of arriving at a multivariate model of verb bias in English through analysis of complements and their co-occurring linguistic factors. A description of the coding follows in the next section.

Hypotheses and Coding of Tokens

All of the selected 3sg tokens were coded for complement type to determine the verb subcategorization frequency for each verb in this corpus. The coding schema for complement type followed the same methods described in Study 1 above. Complement type codes were later collapsed into just three categories for final analysis, as well: DO, SC and Other.

Once again the complement type also served as the dependent variable for the multivariate analysis using Goldvarb X (Sankoff, Tagliamonte & Smith, 2005). This is, to my knowledge, the first time that complement type is being used as a dependent variable for a multivariate model of verb bias in English. Coding for this analysis followed a nearly identical procedure as described in Study 1 above. All tokens were coded for clause type, animacy of the subject, animacy of the direct object (when present), form of the subject, form of the direct object (when present), presence of an indirect object, presence of additional structural material and semantic class. The factor groups Presence of Preverbal Clitic and Word Order and the following codes within factor groups were not carried over from the methods in Study 1 because they do not represent allowable forms in English: null subjects in the Form of Subject factor group, clitic pronouns in the Form of Object factor group, and doubled objects in the Position of Direct Object factor group. A new factor group was also added which would not have been relevant to the Spanish study: expressed *that* complementizer.

Expressed complementizer. For tokens containing sentential complements, an additional factor group was added to code for the presence (30) or absence (31) of an overt *that* complementizer.

(30) Meredith **assumed** *that* her parents would notice her accomplishments.

COCA, ASSUMED-274

(31) He **assured** us Ø they contained fresh water.

COCA, ASSURED-276

In English, the received wisdom is that complementizer deletion is optional and has no influence on meaning, but previous research has found that certain verbs, such as *think*, rarely occur with the complementizer, while others, such as *understand*, occur with a complementizer in the vast majority of cases (Tagliamonte & Smith, 2005:301; Torres Cacoullos & Walker, 2009), suggesting that some other constraint besides meaning makes the complementizer not truly optional in all cases. Still, overall rates of complementizer deletion in oral data tend to be very high (86% in Thompson & Mulac, 1991:244; 85% in Tagliamonte & Smith, 2005:300; 84% in Torres Cacoullos & Walker, 2009:16; 79% in Kolbe, 2008:112; and 90% in Elsness, 1984:521) and somewhat less in more formal, written registers (Elsness, 1984:521). In previous processing work on verb bias, the presence or absence of the overt complementizer has been tested as a part of the experimental manipulation of the stimuli. In that work, the presence of an overt complementizer in a sentence complement construction resulted in no difference in reading times between sentences with DO bias as opposed to SC bias verbs, indicating that the overt expression of a complementizer can aid in overcoming the difficulty caused by an incorrect prediction of complement type based on verb bias information (Wilson & Garnsey, 2009). This factor was not included in the multivariate analysis, but is reported in more detail in Chapter 4. It was coded in order to quantify the rates of occurrence of the temporary ambiguity tested by psycholinguistic processing research on verb bias.

Analysis

Verb bias

Despite low token counts for several verbs, a rough estimate of verb bias based on relative frequency of complement types was calculated for these data according to the same method employed in Study 1 and in the bulk of previous verb bias research. Here again the bias was determined on the basis of one complement type (DO or SC) being twice as frequent as the other and with a difference of at least 15% between the relative frequencies of the two. The results of those calculations, alongside the Garnsey, Lotocky, Pearlmutter and Myers (1997) norms are shown in Table 3-4 in the results section that follows. Table 3-5 lists the bias results for those verbs which were not studied previously by Garnsey and colleagues.

Multvariate analysis

Due in part to the low token counts mentioned above, and also due to the fact that many of these verbs do not tend to take sentence complements, a number of the verbs selected were excluded from further analysis of factors predicting subcategorization frame. The verbs which were inappropriate for inclusion in this portion of the study are listed below:

> ACCLAIMED, DENOUNCED, DESCRIBED, DETECTED, DISCUSSED, EXAMINED, EXCLAIMED, EXPRESSED, JUSTIFIED, MENTIONED, MURMURED, NEGOTIATED, NOTIFIED, OUTLINED, PERMITTED, POINTED AT, PREFERRED, PRESENTED, PROHIBITED, PROJECTED, PROMOTED, PRONOUNCED, SUPPOSED, TRIED.

After a preliminary analysis, the following independent variables were selected for as significant in the multifactorial model of English verb bias, the results of which are shown in Table 3-6 below: animacy of the subject, presence of an indirect object, verb class.

Results

Verb bias

Out of the 80 English verbs selected for analysis, 46% (n=37) of them were found to have a DO bias, 21% (n=17) were found to have an SC bias, 26% (n=21) were identified as EQUI bias, and 4%(n=3) had no bias. Two other "verbs", *supposed* and *acclaimed*, had no instances in the 100 tokens extracted of use of the lexical item as a true verb. All tokens of these verbs were uses of the past participle form as an adjective either modifying a noun directly (e.g. *the acclaimed director*) or as a predicate adjective (e.g. *He was supposed to meet her at six*). The overall distribution of these biases across this list of verbs is quite similar to those observed in the previous work. Garnsey. Lotocky, Pearlmutter, and Myers (1997) observed 45% DO bias, 32% SC bias, 2% EQUI bias and 21% no bias. This high rate of similarity across the two studies is echoed by individual verb-by-verb comparisons of the verb bias estimates in each study. Thirty-one of the verbs included in this study were also studied by

Garnsey. Lotocky, Pearlmutter and Myers (1997). Side-by-side results from this study and the Garnsey. Lotocky, Pearlmutter, and Myers (1997) study before it are present in Table 3-4 below. Of those verbs, 14 of them (45%) demonstrated the same subcategorization bias in the corpus data presented here as in the previous elicitation data. Among the remaining verbs, only 3 (10%) of them reversed bias: *protested* and *warned* showed SC biases in the corpus data when DO biases had been assigned to them according to the previous norming study and *imagined* demonstrated a DO bias in this corpus study, while it was classified as SC bias in the norming study. The remaining 45% of the verbs studied switched biases, but 13 of them (42%) had either an EQUI bias or no bias in one study and an SC or DO bias in the other, and 1 verb (3%), *doubted*, was classified as having no bias in the present study, but an EQUI bias in Garnsey. Lotocky, Pearlmutter, and Myers' (1997) work. This result points to a shift in the relative frequency of completions across corpora, but not a complete reversal in tendencies from one corpus to another. These results, like the Spanish results above, confirm a high level of cross-corpora consistency between this and the foregoing study and validate the results of both studies as well as the processing studies based on these verb bias classifications.

Results for those verbs which are new to this study, but which were chosen because their translation equivalents have been studied in Spanish (Dussias et al., 2010) are shown in Table 3-5. Among those 49 new verbs studied, it is observed that 13 (27%) of them appear categorically with DO constructions only, and an additional 5 (10%) were nearly categorical, occurring with DO constructions over 90% of the time. It should be noted that the original norming study conducted by Garnsey, Lotocky, Pearlmutter, and Myers (1997) was directed specifically at investigating usage patterns of *sentence-complement-taking* verbs. While one can imagine potential grammatical sentence complement constructions using some of the verbs in Table 3-5, in practice it appears that the majority of these verbs do not make use of the sentence complement much or at all. This might explain why they were not included in the previous English norms, despite their high usage frequency in some cases.

Table 3-4 Study 2: English verb biases compared with the results from Garnsey, Lotocky, Pearlmutter, & Myers (1997)

[on next page]

	STUDY 2						Garnsey et al. (1997)					
English verb	Bias	Rate of DO	Rate of SC	Rate of Other	n	COCA frequency/ million	Bias	Rate of DO	Rate of SC	Rate of Other	Match the Garnsey et al. (1997) findings?	Reversal?
advocated	DO BIAS	0.57	0.07	0.36	44	6	DO BIAS	0.87	0.05	0.08	yes	-
announced	EQUI BIAS	0.45	0.53	0.02	58	61	EQUI BIAS	0.50	0.49	0.01	yes	-
believed	SC BIAS	0	0.91	0.09	32	75	SC BIAS	0.14	0.50	0.36	yes	-
comprehended	DO BIAS	0.82	0.18	0	22	1	DO BIAS	0.94	0.04	0.02	yes	-
concealed	DO BIAS	1	0	0	17	7	DO BIAS	0.96	0.01	0.03	yes	-
confessed	SC BIAS	0.09	0.27	0.64	69	7	SC BIAS	0.20	0.49	0.31	yes	-
decided	SC BIAS	0	0.23	0.77	47	128	SC BIAS	0.02	0.15	0.83	yes	-
guaranteed	EQUI BIAS	0.57	0.43	0	7	14	EQUI BIAS	0.46	0.50	0.04	yes	-
promised	EQUI BIAS	0.29	0.19	0.52	42	38	EQUI BIAS	0.13	0.15	0.72	yes	-
pronounced	DO BIAS	0.54	0	0.46	24	1228	DO BIAS	0.84	0.15	0.01	yes	-
realized	SC BIAS	0.24	0.76	0	17	71	SC BIAS	0.19	0.80	0.01	yes	-
remembered	DO BIAS	0.59	0.17	0.24	29	43	DO BIAS	0.89	0.11	0	yes	-
suspected	SC BIAS	0.25	0.75	0	4	23	SC BIAS	0.30	0.68	0.02	yes	-
wished	SC BIAS	0.10	0.65	0.25	52	20	SC BIAS	0.01	0.79	0.20	yes	-
imagined	DO BIAS	0.61	0.32	0.07	28	28	SC BIAS	0.02	0.95	0.03	NO	***yes***
protested	SC BIAS	0.14	0.29	0.57	35	7	DO BIAS	0.60	0.11	0.29	NO	***yes***
warned	SC BIAS	0.18	0.53	0.29	57	27	DO BIAS	0.76	0.11	0.13	NO	***yes***
anticipated	DO BIAS	0.80	0.20	0	15	14	EQUI BIAS	0.13	0.12	0.75	NO	no
assumed	EQUI BIAS	0.47	0.47	0.06	15	30	SC BIAS	0.10	0.90	0	NO	no
confided	SC BIAS	0.10	0.35	0.55	83	3	EQUI BIAS	0.07	0.13	0.80	NO	no
declared	DO BIAS	0.56	0.24	0.20	50	32	EQUI BIAS	0.45	0.51	0.04	NO	no
doubted	NO BIAS	0.35	0.65	0	48	5	EQUI BIAS	0.42	0.56	0.02	NO	no
dreamed	EQUI BIAS	0.06	0.18	0.76	51	12	SC BIAS	0.02	0.24	0.74	NO	no
feared	SC BIAS	0.13	0.63	0.24	46	1685	EQUI BIAS	0.41	0.48	0.11	NO	no
guessed	SC BIAS	0.22	0.58	0.20	40	8	NO BIAS	0.46	0.25	0.29	NO	no
indicated	NO BIAS	0.35	0.65	0	26	51	SC BIAS	0.27	0.70	0.03	NO	no
learned	EQUI BIAS	0.33	0.33	0.33	6	119	DO BIAS	0.60	0.19	0.21	NO	no
mentioned	DO BIAS	0.63	0.06	0.31	16	57	EQUI BIAS	0.43	0.54	0.03	NO	no
noted	SC BIAS	0.19	0.69	0.12	32	68	NO BIAS	0.57	0.41	0.02	NO	no
predicted	DO BIAS	0.67	0.25	0.08	12	24	EQUI BIAS	0.48	0.52	0	NO	no
proposed	EQUI BIAS	0.43	0.43	0.14	7	58	DO BIAS	0.46	0.16	0.38	NO	no

Table 3-5 Study 2: English verb biases for verbs not previously studied

	STUDY 2					
English verb	**Bias**	**Rate of DO**	**Rate of SC**	**Rate of Other**	**n**	**Frequency/ million in COCA**
admired	DO BIAS	1	0	0	50	10
adored	DO BIAS	1	0	0	48	3
advertised/published	DO BIAS	0.04	0.76	0.20	25	5
analyzed	DO BIAS	1	0	0	5	15
approved	DO BIAS	0.93	0	0.07	18	32
authorized	DO BIAS	0.96	0	0.04	24	9
celebrated	DO BIAS	0.96	0	0.04	24	16
communicated	DO BIAS	0.38	0.08	0.54	26	419
considered	DO BIAS	0.60	0.20	0.2	5	121
denounced	DO BIAS	1	0	0	36	5
described	DO BIAS	1	0	0	6	85
detected	DO BIAS	1	0	0	3	12
discussed	DO BIAS	1	0	0	5	40
examined	DO BIAS	1	0	0	10	33
expressed	DO BIAS	0.92	0	0.08	12	40

English verb	Bias	Rate of DO	Rate of SC	Rate of Other	n	Frequency/ million in COCA
justified	DO BIAS	0.64	0.09	0.27	13	11
negotiated	DO BIAS	0.68	0	0.32	19	11
notified	DO BIAS	1	0	0	26	5
outlined/formulated	DO BIAS	0.92	0	0.08	26	965
permitted	DO BIAS	1	0	0	20	15
preferred	DO BIAS	0.57	0	0.43	7	23
presented/explained	DO BIAS	1	0	0	2	63
prohibited	DO BIAS	1	0	0	10	7
promoted	DO BIAS	1	0	0	17	14
proved/tried	DO BIAS	0.10	0	0.9	42	174
reiterated	DO BIAS	0.72	0.21	0.07	57	3
required	DO BIAS	0.80	0.2	0	5	97
certified	EQUI BIAS	0.50	0.50	0	4	12
clarified	EQUI BIAS	0.29	0.29	0.42	31	3
deduced	EQUI BIAS	0.34	0.45	0.21	29	1
demonstrated	EQUI BIAS	0.46	0.50	0.04	28	30
determined	EQUI BIAS	0.56	0.44	0	9	56
exclaimed	EQUI BIAS	0	0	1	79	6
judged	EQUI BIAS	0.42	0.29	0.29	11	1197
murmured	EQUI BIAS	0.06	0.01	0.93	87	7
pointed, marked	EQUI BIAS	0	0	1	66	5
proclaimed	EQUI BIAS	0.33	0.19	0.48	69	694
projected	EQUI BIAS	0.50	0.50	0	2	15
reported	EQUI BIAS	0.44	0.56	0	9	140
respected	EQUI BIAS	0.50	0.50	0	8	16
specified	EQUI BIAS	0.50	0.50	0	8	9
dictated	NO BIAS	0.58	0.38	0.04	24	4
assured	SC BIAS	0	0.69	0.31	45	16
cited	SC BIAS	0.33	0.66	0	3	26
interpreted	SC BIAS	0.08	0.84	0.08	13	12
recommended	SC BIAS	0.18	0.74	0.09	11	29
told	SC BIAS	0.11	0.47	0.42	45	417
acclaimed	-	-	-	-	0	4
supposed	-	-	-	-	0	84

Multivariate analysis

This analysis finds that overall direct object constructions are slightly more common than sentence complement constructions in this corpus of English, as evidenced by an input value of 0.491. Three factor groups were found to be statistically significant predictors of sentence complement continuations: animacy of the subject, presence of an indirect object and verb class. Human subjects were found to slightly favor SC complements with a factor weight of 0.53, while groups of humans as subjects strongly disfavor SC complements with a factor weight of 0.28. The presence of an indirect object in a clause strongly favors SC complements with a factor weight of 0.97, while an absent indirect object slightly disfavors SC complements with a factor weight of 0.45. Finally, in the case of verb class, utterative verbs slightly disfavor SC complements with a factor weight of 0.45.

Table 3-6 Factors contributing to the selection of a sentential complement in English

Factor Group		**Factor Weight**	**% SC**	**% Data**
Animacy				
Human		0.53	387/776 (49.9%)	82.6%
Group		0.28	59/164 (36.0%)	17.4%
	Range:	0.25		
Presence of an indirect object				
Present		0.97	48/126 (38.1%)	88.6%
No IO		0.45	468/984 (47.6%)	11.4%
	Range:	0.52		
*Verb Class**				
Utterative		0.45	136/325 (41.8%)	29.3%
Other		0.52	380/785 (48.4%)	70.7%
	Range:	0.07		
Form of Subject				
Lexical		[0.52]	154/345 (44.6%)	31.8%
Proper		[0.49]	184/396 (46.5%)	36.5%
Reduced		[0.49]	164/180 (91%)	31.8%
	Range:	--		
N=516/1110		Overall Rate= 46.5%		
Log likelihood: -716.126		Input: 0.491		[non-significant factor]

*Other includes all other verb types listed in the coding schema.

Factors included in the analysis but not selected as significant: word order, presence of additional structural material.

Study 2: Summary

In English, as in the Spanish study above, collective animates as subjects favor direct objects while individual animates are the opposite, favoring sentential complements. This provides evidence that in English, as in Spanish, comprehenders can begin positing meaning and structure for the sentence even before they reach the verb. Also, the presence of indirect objects in a clause strongly favors sentence complement constructions, perhaps more in line with the assumption that sentence complements convey thoughts or utterances, which are often directed *to* or *at someone* (i.e.; an indirect object). Verb class was also significant in this analysis, but the tendency for utterative verbs to disfavor SC complements in English is weak. These results do not provide particularly useful insights to address inconsistencies across studies of English the way the Spanish results did, but given the high rate of cross-study consistency in verb bias, such explanations may not be needed.

In keeping with the comparisons made above, in this model of verb bias in English, as in the Dietrich and Balukas (2012: 268) work on Spanish, tendencies of different subject forms emerge. Proper names and pronoun forms in this study share the same factor weight (0.49), slightly disfavoring the use of sentential complements, while lexical NPs slightly favor sentential complements (0.52).

CROSS-LINGUISTIC COMPARISONS: WHAT ARE THE DIMENSIONS OF EQUIVALENCY?

Can verbs *really* have different biases in different languages?

When the results of these two studies are compared, there is a fairly high rate of cross-linguistic consistency. That is, translation pairs in Spanish and English often have the same verb bias in both languages. The comparison is represented graphically in Table 3-7 below. To summarize, 56% of the verbs studied (n=44) have the same bias in both the English and Spanish corpora studied here. An additional 36% of them (n=28) have a DO or SC bias in one language and an EQUI bias or no bias in the other, representing a relative shift, but not a complete reversal of subcategorization tendencies between languages. Only 8% (n=6) of verbs had opposite biases in the two languages. Those verbs were mostly DO bias in Spanish and SC bias in English: *adivinó/guessed, apuntó/noted, citó/cited, confió/confided, interpretó/interpreted;* one exception, *se acordó/remembered*, is SC biased in Spanish, but has a DO bias in English. The overall rates of cross-linguistic difference are distributed similarly in this study as in the previous comparative work conducted by Dussias et al. (2010), where 49% of all verbs had different biases across the two languages (compared to 44% in this study), and only 7 verbs had opposite biases cross-linguistically. However, the verbs which showed different biases in the two languages were different across studies. The only result which is replicated between this comparison and that of Dussias and colleagues (2010) is the verb *se acordó/remembered*. *Aseguró/insured* and *advirtió/warned*, which had opposite biases according to the Dussias study have the same, SC bias in both languages in the present study. *Asumió/assumed*, while showing a strong DO bias in Spanish, had an EQUI bias in the English corpus in the present study. Similarly, *indicó/indicated* has a strong SC bias in Spanish, but demonstrates no bias in English in the present study. *Calculó/figured* and *afirmó/asserted* were not studied in the current English study, so no comparison could be made in this case.

The comparison across languages in the present study, based on corpus data, as well as the previous cross-linguistic comparison conducted by Dussias et al. (2010), based on verb norming studies, as well as the comparison of the results of both studies, points towards a likely role for meaning in determining structure. That is, verbs with similar meanings across languages do often favor the same kinds of syntactic structures. That a full third of verbs demonstrate different relative verb biases cross-linguistically, though not opposite biases, further supports a high rate of cross-linguistic consistency, while also highlighting the need for a careful evaluation of the extraction and coding methods employed and the verb bias calculation method used (relative or absolute). The few verbs which do show different verb biases in different languages have some clear differences in both their structural requirements (e.g. *se acordó* must always appear with the clitic) and translational meaning mappings (*se acordó* translates to 'remembered', while *acordó* means 'agreed'), further supporting prior calls for the incorporation of verb sense and meaning into research on this topic (Hare, McRae, Elman, 2003; 2004), as well as providing additional evidence for the intertwining of structure and meaning in the grammar (e.g. Levin, 1993; Goldberg, 1995).

Table 3-7 Cross-linguistic comparison of biases (Study 1 vs. Study 2)

STUDY 1					**STUDY 2**						
Spanish verb	**Bias**	**Rate of DO**	**Rate of SC**	**Rate of Other**	**English verb**	**Bias**	**Rate of DO**	**Rate of SC**	**Rate of Other**	**Same bias in both languages?**	**Reversal?**
admiró	DO BIAS	0.9	0.1	0	admired	DO BIAS	1	0	0	yes	-
adoró	DO BIAS	0.92	0	0.08	adored	DO BIAS	1	0	0	yes	-
analizó	DO BIAS	0.68	0.04	0.28	analyzed	DO BIAS	1	0	0	yes	-
aprobó	DO BIAS	0.54	0	0.46	approved	DO BIAS	0.93	0	0.07	yes	-
autorizó	DO BIAS	0.52	0.04	0.44	authorized	DO BIAS	0.96	0	0.04	yes	-
celebró	DO BIAS	0.6	0	0.4	celebrated	DO BIAS	0.96	0	0.04	yes	-
denunció	DO BIAS	0.88	0.08	0.04	denounced	DO BIAS	1	0	0	yes	-
describió	DO BIAS	0.78	0	0.2	described	DO BIAS	1	0	0	yes	-
detectó	DO BIAS	0.78	0.2	0.02	detected	DO BIAS	1	0	0	yes	-
discutió	DO BIAS	0.6	0.06	0.34	discussed	DO BIAS	1	0	0	yes	-
enunció	DO BIAS	0.85	0.3	0.12	outlined/formulated	DO BIAS	0.92	0	0.08	yes	-
examinó	DO BIAS	0.94	0	0.06	examined	DO BIAS	1	0	0	yes	-
expresó	DO BIAS	0.66	0.12	0.22	expressed	DO BIAS	0.92	0	0.08	yes	-
expuso	DO BIAS	0.54	0.04	0.42	presented/explained	DO BIAS	1	0	0	yes	-
imaginó	DO BIAS	0.62	0.26	0.12	imagined	DO BIAS	0.61	0.32	0.07	yes	-
justificó	DO BIAS	0.88	0.02	0.1	justified	DO BIAS	0.64	0.09	0.27	yes	-
mencionó	DO BIAS	0.58	0.18	0.24	mentioned	DO BIAS	0.63	0.06	0.31	yes	-
negoció	DO BIAS	0.72	0	0.28	negotiated	DO BIAS	0.68	0	0.32	yes	-
ocultó	DO BIAS	0.96	0	0.04	concealed	DO BIAS	1	0	0	yes	-
prefirió	DO BIAS	0.22	0	0.78	preferred	DO BIAS	0.57	0	0.43	yes	-
probó	DO BIAS	0.72	0.06	0.22	proved/tried	DO BIAS	0.10	0	0.9	yes	-
prohibió	DO BIAS	0.58	0.12	0.30	prohibited	DO BIAS	1	0	0	yes	-
promovió	DO BIAS	1	0	0	promoted	DO BIAS	1	0	0	yes	-
pronunció	DO BIAS	0.78	0	0.22	pronounced	DO BIAS	0.54	0	0.46	yes	-
publicó	DO BIAS	0.96	0.04	0	advertised/published	DO BIAS	0.04	0.76	0.20	yes	-
reiteró	DO BIAS	0.54	0.36	0.10	reiterated	DO BIAS	0.72	0.21	0.07	yes	-
requirió	DO BIAS	0.7	0.02	0.28	required	DO BIAS	0.80	0.2	0	yes	-
anunció	EQUI BIAS	0.32	0.36	0.32	announced	EQUI BIAS	0.45	0.53	0.02	yes	-
certificó	EQUI BIAS	0.27	0.27	0.44	certified	EQUI BIAS	0.50	0.50	0	yes	-
dedujo	EQUI BIAS	0.36	0.46	0.18	deduced	EQUI BIAS	0.34	0.45	0.21	yes	-
demostró	EQUI BIAS	0.38	0.36	0.26	demonstrated	EQUI BIAS	0.46	0.50	0.04	yes	-
determinó	EQUI BIAS	0.42	0.46	0.12	determined	EQUI BIAS	0.56	0.44	0	yes	-
especificó	EQUI BIAS	0.22	0.34	0.44	specified	EQUI BIAS	0.50	0.50	0	yes	-
exclamó	EQUI BIAS	0	0	1	exclaimed	EQUI BIAS	0	0	1	yes	-
murmuró	EQUI BIAS	0.10	0.02	0.88	murmured	EQUI BIAS	0.06	0.01	0.93	yes	-
prometió	EQUI BIAS	0.20	0.28	0.52	promised	EQUI BIAS	0.29	0.19	0.52	yes	-
señaló	EQUI BIAS	0.32	0.40	0.28	pointed, marked	EQUI BIAS	0	0	1	yes	-
advirtió	SC BIAS	0.14	0.38	0.48	warned	SC BIAS	0.18	0.53	0.29	yes	-

Spanish verb	Bias	Rate of DO	Rate of SC	Rate of Other	English verb	Bias	Rate of DO	Rate of SC	Rate of Other	Same bias in both languages?	Reversal?
aseguró	SC BIAS	0.12	0.42	0.46	assured	SC BIAS	0	0.69	0.31	yes	-
confesó	SC BIAS	0.14	0.36	0.5	confessed	SC BIAS	0.09	0.27	0.64	yes	-
creyó	SC BIAS	0.18	0.44	0.38	believed	SC BIAS	0	0.91	0.09	yes	-
se dio cuenta	SC BIAS	0	0.78	0.22	realized	SC BIAS	0.24	0.76	0	yes	-
sospechó	SC BIAS	0.64	0.28	0.08	suspected	SC BIAS	0.25	0.75	0	yes	-
temió	SC BIAS	0.24	0.58	0.18	feared	SC BIAS	0.13	0.63	0.24	yes	-
aprendió	DO BIAS	0.34	0	0.66	learned	EQUI BIAS	0.33	0.33	0.33	no	no
asumió	DO BIAS	0.64	0.04	0.32	assumed	EQUI BIAS	0.47	0.47	0.06	no	no
dictó	DO BIAS	0.8	0.02	0.18	dictated	NO BIAS	0.58	0.38	0.04	no	no
garantizó	DO BIAS	0.70	0.28	0.02	guaranteed	EQUI BIAS	0.57	0.43	0	no	no
juzgó	DO BIAS	0.42	0.12	0.46	judged	EQUI BIAS	0.42	0.29	0.29	no	no
proclamó	DO BIAS	0.62	0.8	0.3	proclaimed	EQUI BIAS	0.33	0.19	0.48	no	no
propuso	DO BIAS	0.38	0.1	0.52	proposed	EQUI BIAS	0.43	0.43	0.14	no	no
proyectó	DO BIAS	0.82	0.02	0.16	projected	EQUI BIAS	0.50	0.50	0	no	no
reportó	DO BIAS	0.48	0.3	0.22	reported	EQUI BIAS	0.44	0.56	0	no	no
respetó	DO BIAS	0.98	0	0.02	respected	EQUI BIAS	0.50	0.50	0	no	no
abogó	EQUI BIAS	0	0	1	advocated	DO BIAS	0.57	0.07	0.36	no	no
anticipó	EQUI BIAS	0.36	0.48	0.16	anticipated	DO BIAS	0.80	0.20	0	no	no
comprendió	EQUI BIAS	0.44	0.48	0.08	comprehended	DO BIAS	0.82	0.18	0	no	no
comunicó	EQUI BIAS	0.32	0.22	0.45	communicated	DO BIAS	0.38	0.08	0.54	no	no
consideró	EQUI BIAS	0.38	0.32	0.3	considered	DO BIAS	0.60	0.20	0.2	no	no
contó	EQUI BIAS	0.4	0.26	0.34	told	SC BIAS	0.11	0.47	0.42	no	no
decidió	EQUI BIAS	0.12	0.16	0.72	decided	SC BIAS	0	0.23	0.77	no	no
declaró	EQUI BIAS	0.2	0.22	0.58	declared	DO BIAS	0.56	0.24	0.20	no	no
deseó	EQUI BIAS	0.28	0.22	0.5	wished	SC BIAS	0.10	0.65	0.25	no	no
notificó	EQUI BIAS	0.23	0.35	0.42	notified	DO BIAS	1	0	0	no	no
permitió	EQUI BIAS	0.14	0.18	0.68	permitted	DO BIAS	1	0	0	no	no
protestó	EQUI BIAS	0.04	0	0.96	protested	SC BIAS	0.14	0.29	0.57	no	no
recomendó	EQUI BIAS	0.42	0.28	0.30	recommended	SC BIAS	0.18	0.74	0.09	no	no
predijo	NO BIAS	0.50	0.30	0.20	predicted	DO BIAS	0.67	0.25	0.08	no	no
aclaró	SC BIAS	0.12	0.68	0.2	clarified	EQUI BIAS	0.29	0.29	0.42	no	no
dudó	SC BIAS	0.06	0.14	0.8	doubted	NO BIAS	0.35	0.65	0	no	no
indicó	SC BIAS	0.2	0.52	0.28	indicated	NO BIAS	0.35	0.65	0	no	no
soñó	SC BIAS	0.12	0.42	0.46	dreamed	EQUI BIAS	0.06	0.18	0.76	no	no
adivinó	DO BIAS	0.54	0.16	0.3	guessed	SC BIAS	0.22	0.58	0.20	no	yes
apuntó	DO BIAS	0.32	0.04	0.64	noted	SC BIAS	0.19	0.69	0.12	no	yes
citó	DO BIAS	0.36	0.04	0.6	cited	SC BIAS	0.33	0.66	0	no	yes
confió	DO BIAS	0.3	0.06	0.64	confided	SC BIAS	0.10	0.35	0.55	no	yes
interpretó	DO BIAS	0.86	0.04	0.1	interpreted	SC BIAS	0.08	0.84	0.08	no	yes
se acordó	SC BIAS	0.1	0.22	0.68	remembered	DO BIAS	0.59	0.17	0.24	no	yes

What about the factors that co-occur with particular complements?

The multivariate analyses of factors co-occuring with SC complements in English and Spanish in these two corpus studies reveal that while the same structural and semantic factors are selected as significant in both languages, the structures which those factors favor do not always match. Shared significant factors across languages help to unify our understanding of verb bias and constructions. Both semantic considerations such as animacy of subjects and verb class, and factors with structural implications, such as the presence of an indirect object, pattern similarly cross-linguistically. In Spanish, indirect objects are often represented as pre-verbal clitics alone or doubled with their lexical anaphor. In English, they either appear immediately after the verb and before the direct object or sentential complement if one follows, or they are marked by a preposition. Either way this role is represented structurally, indirect objects in both languages generally create unambiguous contexts by providing early cues to structure and meaning in a sentence. In fact, the presence of an indirect object in English seems to account for much of the lack of ambiguity in natural speech that verb bias is used to test in processing research (see Chapter 4: Materials and Predictions for more on this topic). Taken together, these factors provide stronger evidence that meaning in language is constructed and comprehended incrementally, and that verb bias is likely part of a larger structural template which has its start in the preverbal subjects of clauses and is refined through the presentation of other verbal arguments throughout the sentence.

Conclusion

This chapter included corpus studies of verb bias in Spanish and English which build strong evidence of the biases of a large collection of cognate and non-cognate verbs in the two languages. It demonstrates that cross-linguistically, the meanings associated with particular verbs tend to represent themselves in structurally similar ways in many cases, but, crucially, not in all. In so doing, it echoes prior calls for closer consideration of semantic concerns in what has ostensibly been defined as a syntactic cue (*verb bias*). The first attempt at a multivariate model for each of these languages provides some cues to certain intra- and inter-linguistic tendencies of sentence-complement-taking verbs and provides further evidence that structural considerations alone may be insufficient for understanding how verb bias develops and what role it plays in language processing. Furthermore, by providing evidence of the strong influence certain semantic and structural characteristics of early clausal elements can have on later complement structure, this work provides support for usage-based approaches to grammar and acquisition, whereby structural templates can give support for the acquisition and processing of verbs. In addition to providing important information and insights regarding verbal complement structures, this chapter draws attention to some other valuable considerations. First, it provides consistent evidence from across varying corpora and data collection techniques which show that the results of such studies are generalizable to a larger context of language use. Second, despite said generalizability, there are a few important differences noted here between studies, especially between the previous norming study of Spanish and the current corpus-based approach. Those differences, namely caused by the natural limitations barring preverbal clitics in sentence completion tasks, remind us that in the search for models of grammar that account for the biggest picture, language- and task-specific considerations should not be overlooked.

Chapter 4 | Testing verb bias as a cue to L2 sentence processing using stimuli from a natural language corpus

Experimental laboratory research on language–including language processing–is often criticized for being too far removed from the naturally occurring ways in which people use language, implying that such data is not reliable for understanding human language mechanisms. Even those researchers who find validity in experimental language research find themselves conceding that the sentences that we ask participants to read are often contrived, and the contexts in which they read them are often awkward or uncomfortable. For this reason, one goal of the present study is to conduct processing research using materials which have been carefully informed by and selected from corpus data to investigate questions which have previously been investigated only in the highly artificial context of the traditional language processing study.

The research questions to be addressed in this study are an extension of those asked in Chapter 2 of this dissertation. Using *verb bias*, the present study tests whether highly proficient, late second language learners of English use frequency based cues to resolve temporary ambiguities during online processing of written English. The temporary ambiguity in focus here is that of a direct object/sentential complement ambiguity, whereby a noun phrase following certain verbs has the potential to be either (1) the direct object of that verb or (2) the subject of an upcoming clausal complement.

Camille comprehended the text…
(1) … once she grasped the meanings of the unknown words.
(2) … had been written long ago.

Previous experimental research on this topic, including Chapter 2 of this dissertation, has revealed that both monolinguals (Garnsey, Pearlmutter, Myers, & Lotocky, 1997; Wilson & Garnsey, 2009) and bilinguals (Dussias & Cramer, 2006; Dussias & Cramer Scaltz, 2008; Li, Lu & Garnsey, 2013) can be sensitive to verb bias cues during processing, but in the case of processing in one's second language and using cues from that language, the mechanisms and experiences by which these sensitivities are developed remain elusive. Differences have been found across and within studies that point to the influence of immersion experience (Chapter 2 of this dissertation) and L2 proficiency (Dussias & Cramer, 2006; Dussias & Cramer Scaltz, 2008) as factors that contribute to different processing patterns in different groups of L2 learners. The cross-linguistic factor of cognate status has not been examined as carefully, but could indeed also play an important role in the disambiguation strategies that L2 learners use during processing. Though L1 transfer of verb bias information has not been instantiated in previous work on this topic, it is crucial to note that previous work has included a mix of both cognate and non-cognate verbs which were not controlled as a factor nor analyzed independently of one another. The present study uses cognate verbs only in order to elucidate the role of cognates in shaping processing strategies in bilinguals. In order to respond to these lingering questions in a meaningful way, this study asks whether two groups of highly proficient L2 speakers of English, one immersed in their native language and one immersed in their L2, use verb bias information in English in a matter that resembles native readers while reading stimuli which more closely resemble the kinds of sentences these participants encounter in their daily, "real-life" encounters with these words. The goal of the present study is to explore the previously presented findings further by asking whether increased activation of the shared codes from cognates results in the influence of L1 verb bias information during L2 sentence processing.

BACKGROUND AND HYPOTHESES

The extant theories of sentence processing should still apply to and account for processing patterns observed in more naturalistic reading stimuli. These theories fall into two different umbrella categories: interactive, exposure-based theories (e.g. Bates & MacWhinney, 1982; MacDonald & Seidenberg, 1994), which propose that people comprehend language using multiple sources of frequency and distribution information they derive from the input they receive, and serial, modular theories (e.g., Frazier, 1979), which propose that people comprehend language first based on universal constraints of syntactic simplicity and lexico-semantic plausibility information. When studying bilinguals, these theories generate three different predictions for processing. Bilingual speakers parsing in the L2 might rely on universal heuristics, they might rely on frequency information from the L2, or they might transfer what they know about the L1 to aid L2 processing. Evidence from studies of verb bias has been found to support both of the first two proposals. In Chapter 2 of this dissertation (Experiment 2), the non-immersed Spain bilingual group showed a strong and consistent preference for the simpler DO structures regardless of verb bias information in either language, which would point towards a universally-derived, syntax-first approach to ambiguity resolution. But the US bilinguals in that same experiment, as well as in Experiment 1 (Chapter 2) and in several previous studies of bilinguals (Frenk-Mestre & Pynte, 1997; Dussias & Cramer, 2006; Dussias & Cramer Scaltz, 2008; Lee, Lu & Garnsey, 2013), patterned nearly identically to native, monolingual speakers of English, providing support for an exposure-based processing account in which second language learners rely on frequency-derived information *from their L2*. Native-like processing routines have also been instantiated in other experimental work based on other processing cues for L2 speakers (e.g., Dussias, Valdés Kroff, Guzzardo Tamargo, & Gerfen, 2013; Foucart & Frenck-Mestre, 2011; Hoover & Dwivedi, 1998; Hopp, 2013; Jackson & Dussias, 2009; Pliatsikas & Marinis, 2013; Witzel et al., 2012).

In studies of verb bias as a cue to processing, L1 transfer has not been observed, but this may not mean that transfer of processing routines is impossible (Dussias, Dietrich & Villegas, to appear). In fact, it has been observed in many studies of other kinds of processing cues (e.g. relative clause attachment: Frenk-Mestre, 1999; 2002; wh-gaps: Juffs, 2005; grammatical gender: Kotz, 2009; Morales, Paolieri, Dussias, Valdés Kroff, Gerfen, & Bajo, submitted; Sabourin & Stowe, 2008; Weber & Paris, 2004). In studies where L1 transfer is found, cognates are often pointed out as the trigger for that transfer due to their shared semantic representation (Jared & Kroll, 2001). Such activation is observed during sentence comprehension (e.g., Elston-Güttler, 2000; Schwartz & Kroll, 2006; Van Hell, 1998) and despite the presence of cues related to the accentedness of speech (e.g., Lagrou, Hartsuiker, & Duyck, 2011), language-specific features of orthography (e.g., van Assche, Duyck, Hartsuiker, & Diependaele, 2009), and informative sentence contexts (e.g., Libben & Titone, 2009; Schwartz & Kroll, 2006). Reliance on L1 transfer seems also to be moderated by factors relating to proficiency (Dussias, 2001; Frenk-Mestre, 1999; 2002; Jackson, 2008; Kotz, 2009; Su, 2001) and immersion experience (e.g., Dussias, Valdés Kroff, Guzzardo Tamargo, & Gerfen, 2013; Foucart & Frenck-Mestre, 2011; Hoover & Dwivedi, 1998; Hopp, 2013; Jackson & Dussias, 2009; Pliatsikas & Marinis, 2013; Witzel et al., 2012) among other things (e.g. cognitive and computational resources: Hopp, 2010; McDonald, 2006; speed of lexical access: Hopp, 2012).

As previously stated, verb bias in particular has not been the subject of much scrutiny in this regard, but if L1 transfer of verb bias information were occurring during online sentence processing, one would expect that it would be most evident during the processing of cognates. Recent evidence demonstrates that lexical entries from the non-target L1 become highly activated while bilinguals comprehend sentences in their L2, although this effect is true only for words that have a shared semantic representation (i.e., cognates). For example, Schwartz and Kroll (2006) conducted a study using cognates and interlingual homographs (words that are orthographically similar between languages but have different meanings) to determine whether the word recognition processes of two groups of Spanish-English bilinguals (differing in levels of proficiency) were affected by low- and high- constraint sentence contexts (e.g., *When we entered the dining hall we saw the piano in the corner of the room*, low constraint; *Before playing, the composer first wiped the keys of the piano at the beginning of the concert*, high constraint). For both bilingual groups, the findings revealed a significant interaction between sentence context and cognate status in the direction that cognate facilitation only occurred in low constraint sentences (converging evidence is also found in van Hell, 1998, and Elston-Güttler, 2000). These findings point to an important facts regarding bilingual language processing. The mere presence of language cues in a sentence (i.e., reading a sentence entirely in the second language) is not sufficient to constrain non-selectivity of the non-target (L1) language, at least in the case of cognates. Therefore, though as-yet unsubstantiated, it is plausible that highly proficient Spanish-English bilinguals use L1 verb-bias information when resolving syntactically ambiguous sentences more readily when they process cognate verbs. For this reason, this study was conducted using participants from the same populations but with stimuli containing only cognate verbs in order to build on the previous research and determine whether transfer of L1 processing routines related to verb subcategorization can be induced under certain circumstances.

METHOD

Participants

Data were collected from three groups of participants: 37 Spanish-English bilinguals immersed in their L1 in Granada, Spain, 35 Spanish-English bilinguals immersed in their L2 environment in the US and 36 English monolinguals. All of these groups were taken from the same populations as those included in Chapter 2 of this dissertation. In fact, the groups included some of the same individual participants from the experiments in Chapter 2[6]. Those participants were allowed to return because a period of at least 3 months, and as much as two years in some cases, had passed between studies. The Spain bilinguals were students or recent graduates of the Universidad de Granada, many from programs in English literature and philology, who had only limited travel or study abroad experience in English-speaking countries and were immersed in a Spanish-speaking environment at the time of testing. The US bilingual participants were students and staff affiliated with a large US university who had lived in the US for an extended period and who were immersed in English at the time of testing. A third group of 36 English monolinguals was also tested to serve as the native controls and set the target for native-like processing which could be expected from the other groups (if achieved). The English monolinguals were students and staff affiliated with the same US institution as the US bilingual group, but who were functionally monolingual, having never studied more than a basic level of a foreign language (the equivalent of 3 college semesters) and never lived or studied in a country where a language other than English was spoken. Track loss and equipment malfunction resulted in incomplete data collection, and therefore, exclusion, of one participant from each of the three groups. Additionally, two Spain bilinguals and one US bilingual were later discovered to be simultaneous Catalán-Spanish bilinguals, which also resulted in their exclusion. Finally, one US bilingual who performed very poorly on the Spanish picture naming task (described in more detail below) was excluded due to the possibility that she has entered a phase of L1

[6] Nine monolinguals, 13 US bilinguals, and 12 Spain bilinguals from the previous study (Chapter 2) returned to participate in this study.

attrition. This resulted in 34 monolinguals, 30 US bilinguals and 34 Spain bilinguals ultimately being included in the final analyses.

In order to guarantee balanced proficiency and different language experiences across the groups, all participants completed a series of secondary measures of language proficiency and experience in addition to the primary experiment. These tasks included: the same self-assessment Language History Questionnaire (LHQ) as described in Chapter 2, a bilingual Boston Naming Vocabulary Test (BNT) (Kaplan, Goodglass, & Weintraub, 1983) in English and Spanish, a lexical decision task (LDT) in English, and grammar and reading tests in English and Spanish. Monolinguals completed all of the same tasks as the bilingual groups but in English only.

Language History Questionnaire (LHQ). As in the previous study, prior to beginning the experiment, participants completed an online LHQ to assess their proficiency in both English and Spanish proficiency in the four principal areas of proficiency (speaking, listening, reading, and writing). The LHQ, adapted from Marian, Blumenfeld and Kushanskaya (2007), included 23 questions open-ended and Likert scale questions about participants' history with both languages, their language learning experiences, and their daily exposure to and use of both of their languages (see Appendix A). Prior research has demonstrated that self-rating LHQ techniques are accurate assessment tools for evaluating language proficiency (Birdsong, 1992; Oscarson, 1997).

Boston Naming Vocabulary Test (BNT). This task was nearly identical to the equivalent task described in Chapter 2, but this time the bilingual participants named the first half of the list (30 words) in English and the second 30 words in Spanish. The words in the BNT have been controlled for word frequency so that as the test progresses, frequency decreases, and in turn difficulty increases. This task evaluates lexical access, vocabulary size and naming performance in a more fine-grained language proficiency measure than the LHQ self-ratings and has been highly correlated with other experimental measures of language proficiency in bilinguals, such as language self-assessments like the LHQ (Kohnert, Hernández, & Bates; 1998).

During the BNT, participants are first asked to name 30 outline drawings of objects and animals in English, such as Figure 4-1 'acorn'. In the second portion of the BNT, participants are asked to name a different series of 30 outline drawings of object and animals, but this time in Spanish, such as Figure 4-2 '*rinoceronte'* "rhinoceros". A complete list of images and correct responses for both the English and Spanish portions of this task is included in Appendix G. As participants named the images, their voices were recorded using a microphone and digital recorder for later scoring. Prior to beginning each section of the task, participants were shown 10 images two practice naming and ensure proper equipment function. The same 10 images were shown for the English and Spanish practice sessions and participants always completed the practice before each segment of the BNT.

Figure 4-1 'acorn'

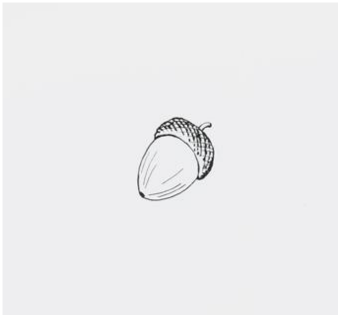
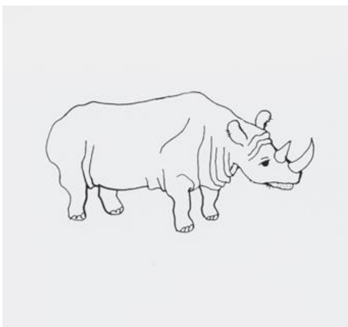


Figure 4-2 '*rinoceronte*' ("rhinoceros")



Lexical decision task (LDT). The LDT used for this experiment was developed for another study being conducted in the same laboratory. It was selected because it was shorter and contained a more carefully controlled list of words than the task used in Experiment 1 of Chapter 2, but it followed a very similar procedure. Participants were shown strings of letters on a computer screen and were asked to decide whether the string corresponded to a word in English by indicating their answers using a button box. This button box was connected to the computer and measured reaction times (not analyzed here) in addition to recording participant responses. Participants responded to 100 letter strings, half requiring a 'yes' response, such as in (3) below, and half requiring a 'no' response, such as (4) (see Appendix H for complete list of stimuli). Nonce words were created by changing a single letter in a real English word. The words and non-words in this task were matched for length and the words were selected such that half of them are cognates with Spanish and half are not. Prior to beginning the scored portion of the task, participants were shown 10 practice trials, 5 words and 5 non-words, and were encouraged to ask clarification questions before beginning the task. The presentation program used (E-Prime 2.0, Psychology Software Tools, Pittsburgh, PA) recorded accuracy data which was used for later scoring. For each participant four scores were determined: correctly identified words, incorrectly identified words, correctly identified non-words and incorrectly identified non-words, also known as false alarms. False alarms are scored when the participant identifies a non-word letter sequence as a real word of English.

(3) YES response: love
(4) NO response: syrug

Grammar and reading tests. The grammar sections of the Michigan Test of English Language Proficiency (MTELP©)[7] and the Advanced Test of the Diplomas de Español como Lengua Extranjera (DELE) (Appendix F) were again used to assess grammar skills and reading competency a multiple-choice format. Each test contains 50 multiple-choice items designed to evaluate grammar, vocabulary, and reading competence in isolated sentences and a longer text, more detailed descriptions of which can be found in Chapter 2.

Table 4-1 Language proficiency information by participant group

	Monolinguals *Mean (SD)*	US Bilinguals *Mean (SD)*	Spain Bilinguals *Mean (SD)*	ANOVA* (all groups) *F1*	ANOVA‡ (bilinguals only) *F1*
n	34	30	34	-	-
males	20	12	18	-	-
age	20.6 (3.2)	28.5 (6.7)	24.8 (3.4)	$F_1(2) = 22.272^{\dagger}$	$F_1(1) = 7.812, p = 0.007^{\S}$
Years in a English-speaking country	20.6 (3.8)	4.2 (4.4)	0.8 (0.9)	$F_1(2) = 57.873^{\dagger}$	$F_1(1) = 19.550, p < 0.001^{\S}$
English Age of Acquisition	0.8 (0.9)	9.2 (5.3)	7.9 (2.9)	$F_1(2) = 54.441^{\dagger}$	$F_1(1) = 1.535, p = 0.220$
English Age of Fluency	4.0 (2.0)	16.7 (7.4)	16.9 (3.8)	$F_1(2) = 75.359^{\dagger}$	$F_1(1) = 0.020, p = 0.889$
Self-rating - Proficiency	9.8 (0.4)	7.7 (1.4)	7.5 (1.3)	$F_1(2) = 56.617^{\dagger}$	$F_1(1) = 0.652, p = 0.422$
Self-rating - Understanding	9.8 (0.5)	8.2 (1.0)	7.8 (1.4)	$F_1(2) = 35.355^{\dagger}$	$F_1(1) = 1.830, p = 0.181$
Self-rating - Reading	9.8 (0.5)	8.2 (1.0)	8.2 (1.3)	$F_1(2) = 25.529^{\dagger}$	$F_1(1) = 0.005, p = 0.943$
% current L1 exposure	-	44.2 (19.9)	73.1 (14.7)	-	$F_1(1) = 44.309, p < 0.001^{\S}$
% current L2 exposure	-	57.6 (19.4)	29.0 (14.5)	-	$F_1(1) = 45.408, p < 0.001^{\S}$
% of time participant would choose to read in L1	-	37.3 (24.0)	56.8 (23.1)	-	$F_1(1) = 10.868, p = 0.002^{\S}$
% of time participant would choose to read in L2	-	64.0 (20.7)	42.9 (18.9)	-	$F_1(1) = 18.088, p < 0.001^{\S}$
% of time participant would choose to speak L1 with person fluent in both	-	67.0 (24.9)	55.3 (24.2)	-	$F_1(1) = 3.613, p = 0.062$
% of time participant would choose to speak L2 with person fluent in both	-	34.6 (26.8)	44.6 (20.6)	-	$F_1(1) = 2.842, p = 0.097$
How often are you rated as non-native? (0-10, never-always)	0.3(1.7)	7.4 (3.0)	6.3 (3.2)	$F_1(2) = 63.138^{\dagger}$	$F_1(1) = 2.116, p = 0.151$
MTELP score (out of 50)	46.3 (2.3)	35.7 (8.5)	35.8 (7.9)	$F_1(2) = 26.055^{\dagger}$	$F_1(1) = 0.002, p = 0.962$
DELE score (out of 50)	-	42.2 (3.8)	44.5 (3.9)	-	$F_1(1) = 5.587, p = 0.021^{\S}$
English BNT score (out of 30)	25.2 (2.6)	16.8 (4.4)	14.1 (4.2)	$F_1(2) = 76.218^{\dagger}$	$F_1(1) = 6.209, p = 0.015^{\S}$
Spanish BNT score (out of 30)	-	24.8 (3.8)	25.4 (2.8)	-	$F_1(1) = 0.445, p = 0.507$
LDT Accuracy (out of 100)	93.6 (3.3)	86.9 (6.6)	86.4 (6.7)	$F_1(2) = 16.105^{\dagger}$	$F_1(1) = 0.113, p = .738$
Comprehension question accuracy (%)	92.2 (0.3)	88.6 (5.4)	87.2 (5.2)	$F_1(2) = 10.649^{\dagger}$	$F_1(1) = 1.107, p = 0.297$

*A one-way analysis of variance was conducted to compare the mean performance on each of these tasks and ratings between the three groups.

†p < 0.001

‡ A subsequent one-way ANOVA was conducted to compare the mean performance on each of these tasks and ratings between the bilingual groups only.

§The difference in means between the US and Spain bilingual groups is significant at a level of 0.05

The average scores on all of these tasks for each group are shown in Table 4-1 above. These results indicate that the bilingual groups report having begun to study English at the same age on average, as well as reaching fluency at the same average age in their late teens. The results also indicate that these groups are closely matched on their self-assessment of

[7] Use of this test has been permitted under an agreement with the creator, but reproduction of any portion of this test here or in the Appendices is prohibited by copyright protections.

their L2 skills for listening, reading and writing, as well as on their scores on several objective measures of English proficiency, which include the LDT and the English grammar test. Significant differences were found between the bilingual groups' English BNT scores and their self-reported preference for reading in their L1 and L2. The US bilinguals named more pictures correctly and indicated a preference for reading in their L2, while the Spain bilinguals would prefer to read in their L1. Importantly, these two groups also have significant differences in their reported length of immersion in English, as well as the average amount of time they spend exposed to each of their languages on a daily basis. The US bilinguals have spent significantly more time immersed in English throughout the course of their lifetime and were also, at the time of testing, exposed to more English in their daily lives than the Spain bilinguals.

Materials and Predictions

The conditions for this study are identical to those included in the previous self-paced reading and eye-tracking studies presented in Chapter 2 of this dissertation. The critical sentences contained noun phrase/sentential complement ambiguities, illustrated in (5) through (8). The verbs were embedded in temporarily ambiguous direct object (DO) [(Condition 1) and (Condition 3)] and sentential complement (SC) [(Condition 2) and (Condition 4)] continuations (underlined below):

(5) *Condition 1*
Sophie comprehended her maid <u>**when** the news broke about her divorce</u>.

(6) *Condition 2*
Sophie comprehended her maid <u>**was** the most protected woman in all of Scotland.</u>

(7) *Condition 3*
Sophie suspected her maid <u>**when** the news broke about her divorce</u>.

(8) *Condition 4*
Sophie suspected her maid <u>**was** the most protected woman in all of Scotland</u>.

Because the goal of this study was to investigate the role of verb bias in the processing of more naturalistic–as opposed to laboratory prepared–stimuli, the selection of materials for this study was based on and selected from the corpus data described in Chapter 3 of this dissertation, along with previous work conducted on verb bias in English (Garnsey, Lotocky, Pearlmutter, & Myers, 1997) and Spanish (Dussias et al., 2010). The goal was to select verbs which have been rigorously compared across languages in order to create stimuli which would have clearly distinct predictions based on models of language processing. As additional goals, the stimuli selection sought to have equal numbers of lexical verbs in each condition, as well as to control for cognate status. In the Chapter 2 stimuli there were more different bias verbs than same bias verbs included in the stimuli, which resulted in same bias verbs being repeated more times throughout the course of the experiment. Also, there was a mix of both cognate and non-cognate verbs, which could blurry processing strategies given that cognates occupy a special co-activated status in the bilingual lexicon (e.g. Costa, Caramazza, & Sebastian-Galles, 2000; Djikstra, Grainger, & van Heuven, 1999). Furthermore, to answer to criticisms of psycholinguistic research as being unnatural or far removed from the way most people encounter and interact with language most of the time, the stimuli were constructed based on naturally produced language found in a corpus of American English, the Corpus of Contemporary American English (COCA) (Davies, 2008-). To select which English verbs to include in the study, the biases of English verbs as determined by Garnsey and colleagues (1997) were compared with the results of a corpus study of verb bias of the Spanish translation equivalents of those verbs (Study 1, Chapter 3). From this comparison, verbs with the same (SC) bias in both languages and verbs with different biases (DO in English, SC or EQUI in Spanish) were identified from the list, which was further narrowed by taking care to focus only on those verbs whose Spanish bias in the corpus study matched the results found in a previous norming study (Dussias et al., 2010). This resulted in only 3 sets of cognates verbs which had the same bias in English and Spanish, so those verbs were selected as the verbs to be used for the same bias conditions: *confessed, indicated,* and *suspected*. In order to ensure balanced repetition of all verbs in the stimuli, 3 of the 4 cognate verbs which had different biases in English and Spanish, but the same bias across the current Spanish corpus study and the previous Spanish norming study were selected for use in the different-bias conditions: *protested*, *proposed* and *comprehended*.[8]

Once these verbs were identified, sentences containing them were extracted from the COCA to serve as the basis for the experimental stimuli. Though the original intent was to have all stimuli be directly extracted from the corpus and included in the experiment as they were originally produced, the limitations of processing research and necessary structure of experimental stimuli made it impossible to do that. First, the actual existence of temporarily ambiguous structures such as those used for verb bias processing research is not overwhelmingly common, at only 52.7% (590/1119) of the sentences analyzed in Study 2, Chapter 3 of this dissertation. Most importantly, out of the 519 sentential complements coded in that study, only 30 of them contained a potentially ambiguous noun phrase, and out of 560 temporarily ambiguous sentences with DO constructions, only 2 of them used 'that' as a demonstrative in such a way as to potentially cause confusion between

[8] Later discovery of a clerical error revealed that *indicó* 'indicated' was not consistent across studies, and in fact was found to have a DO bias in the previous Dussias et al. (2010) study. After initial analyses revealed unexpected results, biases for the verbs were double-checked across all previous studies and the error was discovered. For this reason, stimuli containing this verb were later excluded from the analysis presented in this chapter. Similarly, Study 2 in Chapter 3 was conducted after the stimuli were selected for this experiment. In that study, inconsistencies were revealed among biases for *protested* and *proposed* in the American English corpus data as compared to the Garnsey, Lotocky, Pearlmutter, and Myers (1997) norming study. *Protested* showed an SC preference in the corpus data and *proposed* was categorized as EQUI bias based on the corpus data. For this reason, stimuli containing these verbs were also excluded from the final analyses presented in this chapter.

demonstrative 'that' and an overt complementizer. It would appear that in the face of a potential ambiguity such as the direct object/sentential complement ambiguity studied here that people choose to produce sentences which include the optional complementizer *that*, perhaps to circumvent confusion. Where possible, stimuli were selected which contained such an ambiguity, but in other cases, a sentence was selected which included the complementizer. The complementizer was then deleted for use in the materials. Secondly, in order to make meaningful comparisons between reading times for different conditions, the sentences must be controlled such that the structure and lexical items before the critical region must be identical but for the experimental manipulation, in this case the verb, which has either a DO or SC bias. In order to do this, but to maintain the commitment to naturalistic stimuli, each quartet of stimuli was developed from an original extraction from the corpus. That is, for each verb, 5 sentences were extracted from the COCA where that verb occurred with a DO continuation and 5 sentences were extracted where that verb occurred with an SC continuation. This resulted in 60 original corpus extractions which served as the baseline for each of the 60 quartets of stimuli such as seen in examples (5) – (8) above (p. 76). In that quartet, example (1) was extracted directly from the COCA. Because proper noun subjects were found to be overwhelmingly the most common subject form among these verbs in both languages, occurring 42.5% (1656/3901) of the time with *all* tokens from Chapter 3 (across languages), all subjects in the stimuli were changed to common U.S. American given names (unless, in the case of the example, the subject was already a fairly common name). Each presentation of a particular verb contained a different subject and post-verbal noun. All post-verbal nouns were highly plausible as direct objects of the verbs they followed. Participants were exposed to all conditions an equal number of times, but only saw each sentence frame in one of the conditions. Experimental materials were constructed in such a way that the syntactic ambiguity could only be resolved when readers saw the text following the post-verbal NP (e.g., *'was the'* or *'when the'* in the examples above). This region is emboldened in Conditions 1 through 4 above and will be referred to here as the disambiguating region.

For presentation to participants, stimuli were counterbalanced across four separate lists of 60 sentences each, such that in each list a participant saw each verb repeated five times in each of its two possible conditions, one condition where bias and continuation were congruent and one condition where they were incongruent. Stimuli were furthermore distributed in such a way that all lists were sure to include both original corpus extractions and experimenter-created sentences. A complete listing of all experimental stimuli, including instructions, practice sentences and fillers, is included in Appendix I.

Each of the four stimuli lists included a total of 108 fillers or distractor sentences in addition to the critical experimental conditions. These fillers were the same across all lists. A portion of the fillers (n=63) were direct extractions from the corpus which were modified only to have similarly common American given names as subjects, as was done for the experimental stimuli. This was done to create a more naturalistic reading context throughout the experiment, as compared with other psycholinguistic studies (including those in Chapter 2 of this dissertation) which use experimenter-created stimuli from other experiments as the fillers or distractors for a given experiment. These sentences included verbs which had no bias or were EQUI bias in English as well as in their Spanish translation equivalents: *announced, considered, demanded, determined, estimated, informed,* and *predicted*. Each of these verbs was repeated in 10 different filler sentences to match the number of times verbs were repeated in the experimental stimuli. The sentences in which these verbs were embedded included 23 sentence complement constructions with an overt *that* complementizer (9), 22 direct object constructions with some additional intervening material (10), 2 sentences containing the verbs in adverbial adjuncts (11), 1 sentence using *if* as the complementizer (12), 1 sentence with an infinitival complement (13), 2 sentences using the verb in passive voice (14) and 12 sentences containing object relative clauses (15):

(9) Gregory estimated that the changes would cause housing prices to drop.
(10) Hillary demanded an unconditional apology for the November attack.
(11) Adam, when informed about the test, decided to withdraw his application.
(12) Justin determined if any of the manuals contained a sample of children with disabilities.
(13) Christine demanded to know everything her boyfriend had lied about.
(14) Karen demonstrated a financial model that was estimated without the influence of additional factors.
(15) Michelle bought the clock that announced the hour with a loud buzzing sound.

Because an initial pilot with a naïve participant who was not trained in linguistics or psycholinguistic experimentation revealed that the participant noticed the repetition of the experimental verbs in what he described as their "uncommon uses," additional distractors were added to the final version of the experiment as presented to the participants included in this study.[9] The added fillers were selected from among the fillers from the experiments in Chapter 2 of this dissertation, but again altered so that all subjects were common American given names. They included: (16) 9 sentences containing subject relative clauses with the relative pronoun 'that', and 36 sentences containing temporarily ambiguous relative clauses lacking relative pronouns but requiring either (17) high or (18) low attachment based on gender information in the subject and object. Following the addition of these fillers, when participants were debriefed following the experiment they generally noted the varying high and low attachment of relative clauses such as in examples (17) and (18) below.

(16) The tattoos that Dominic displayed were as ugly as they could be.

[9] This participant's data were not included in the analyses presented here.

(17) Liam welcomed the brother of the nun who always walked with a cane after injuring his leg.
(18) Britney laughed at the grandfather of the girl who had a torn skirt.

The predictions for this experiment are as follows. If the highly proficient L2 speakers in this study use verb bias information from their L2 during processing, it is predicted that sentences containing continuations consistent with the verbs' English biases will be read faster than those with inconsistent continuations at critical regions. That is, sentences with DO bias verbs (5 and 6) should pose difficulty for participants at the disambiguating region only in (6), the condition which contains an inconsistency between verb bias and sentence continuation. For sentences with SC bias verbs, as in examples (7 and 8), participants should encounter difficulty at the disambiguating region only in (7), due to the inconsistency between verb bias and sentence continuation. Because in (8) verb bias and sentence continuation are consistent, participants are not expected to show processing difficulties. This would result in a graph of reading times similar to that shown in Figure 4-3 below (p. 81). This pattern was observed in both the monolingual and US bilingual participants in the previous eye-tracking study, Experiment 2 in Chapter 2 of this dissertation.

If participants are using universal strategies and are not sensitive to usage frequency information, as proposed by syntax-first accounts of processing, participants would treat (5) and (7) the same and read them faster than sentences (6) and (8) because of their simpler, DO. This would result in a graph of reading times similar to that shown in Figure 4-4 below. A similar pattern was observed in the Spain bilingual participants in Experiment 2, Chapter 2 of this dissertation.

An important third hypothesis which has not been instantiated in previous work on second language processing is the L1 transfer hypothesis. To investigate this hypothesis, all experimental sentences in this study were created such that the Spanish translation equivalents of all verbs were SC or EQUI bias. Thus, with the access of L1 verb bias information during L2 sentence processing, (5) and (7) should be difficult for participants to process because the continuations do not match the verb bias of the verb's Spanish translation equivalent. In contrast, (6) and (8) should be easy to process because the sentence continuation matches the expectations indicated by the Spanish verb bias. This would result in a graph of reading times similar to that shown in Figure 4-5 below.

Figure 4-3 Hypothetical results if L2 lexical information were used

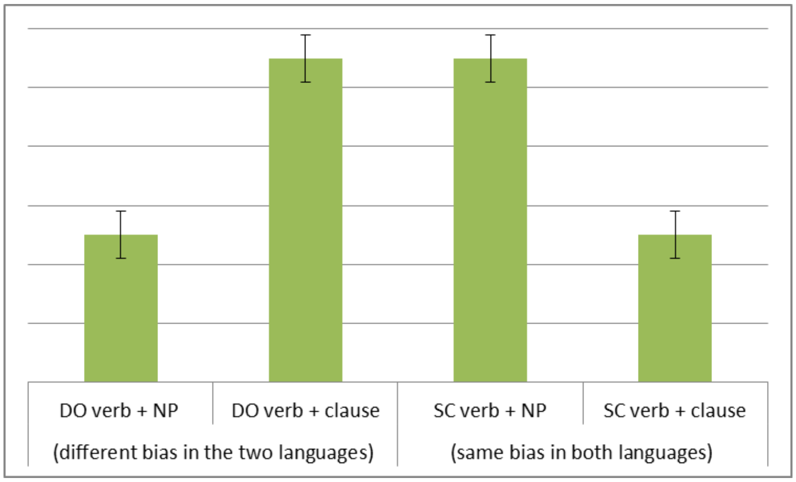


Figure 4-4 Hypothetical results if a syntax-first approach to processing were used

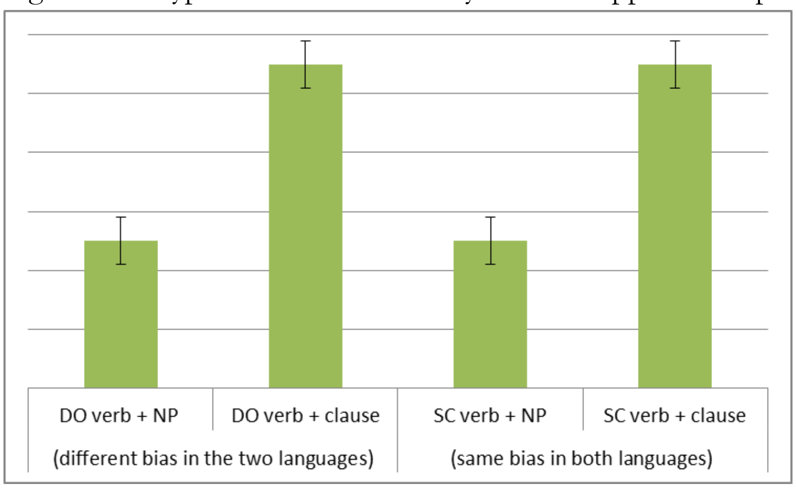
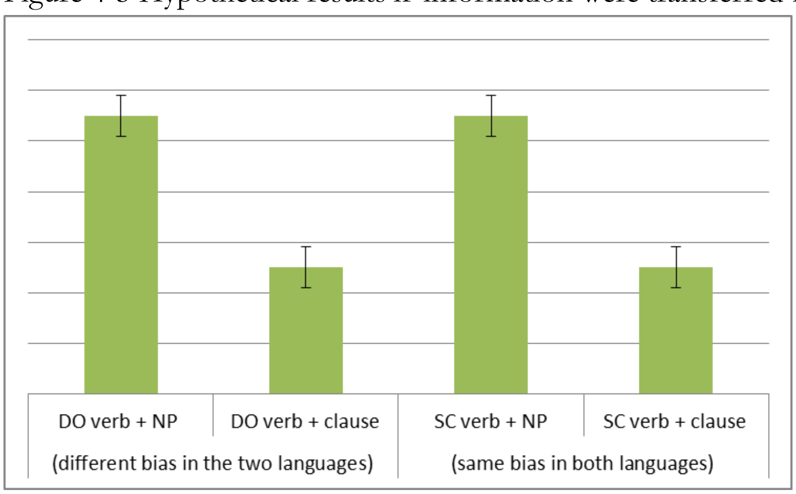


Figure 4-5 Hypothetical results if information were transferred from the L1



Procedure

Participants' reading data were collected using Eyelink 1000 desktop-mounted eye-trackers. Participants were seated in front of a PC computer in a sound-attenuated room. A chin rest was used to stabilize their head movements. They were informed that for each trial, they would see a sentence on the screen which had been taken from a newspaper, book or magazine which they should read naturally to themselves (not aloud) "like you're reading a newspaper" in order to answer a simple question about it afterwards. All experimental trials were presented on a single line of text. Some fillers extended onto a second line. When participants were finished reading each sentence, they were instructed to press a button on a game controller to trigger the presentation of a comprehension question following each sentence. They then used that game controller to answer the question: a press of the left rear button indicated a 'yes' answer, a press of the right rear button indicated 'no.' Before beginning the actual experiment, participants were given seven practice sentences to familiarize them with the task. This served to ensure proper calibration of the eye-tracker while also giving participants the opportunity to ask clarification questions and be sure they understood the procedure.

RESULTS AND DISCUSSION

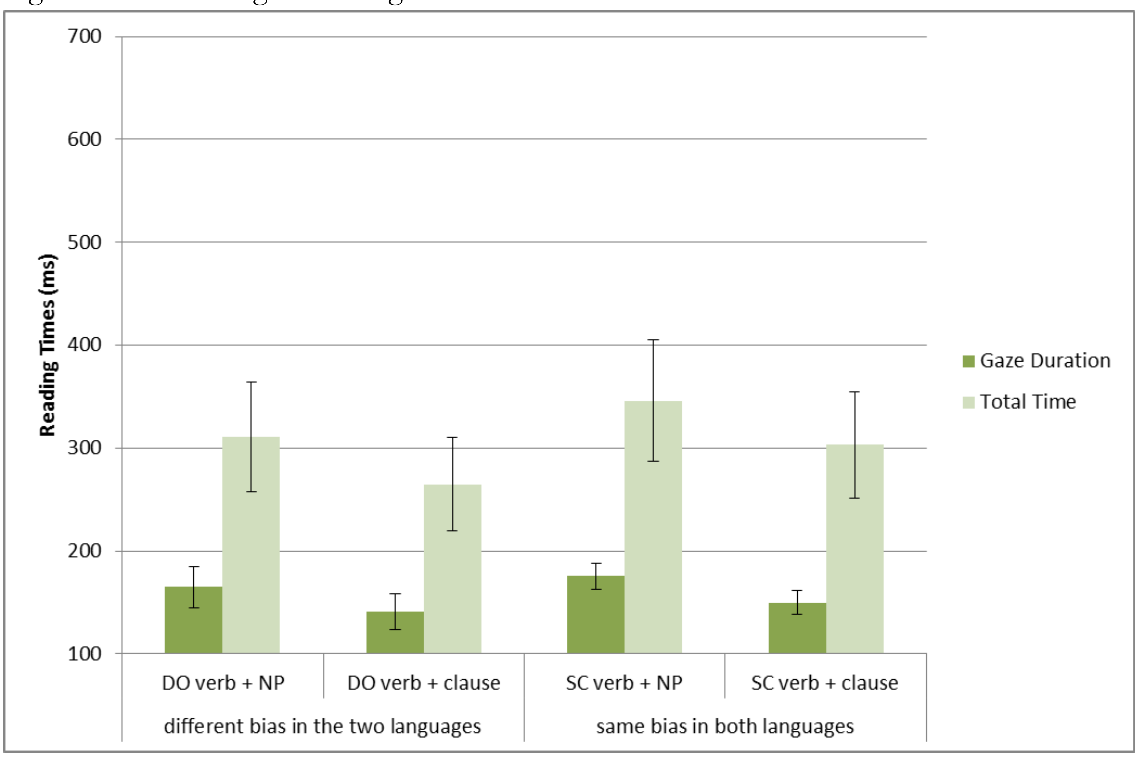
The analysis presented here will focus on two measurements on each region of analysis: gaze duration (also called first pass duration) and total time. Gaze duration is defined as the sum of all left-to-right eye-fixations on the critical region before leaving it the first time it is read. Total time is defined as time the sum of all fixation durations on the critical region at any time, including all re-reading. These measures were chosen to evaluate both early (gaze) and late (total times) processes (Clifton, Staub, & Rayner, 2007; Rayner, 1998; Rayner, Sereno, Morris, Schmauder, & Clifton, 1989). The analyses were conducted on the word that represents the disambiguating region: word 5 in bold in examples (5) – (8) above (p. 76). This is the word that immediately follows the ambiguous noun phrase. It is called the disambiguating region because it represents the first point in the sentence in which participants are able to verify whether the preceding noun phrase is intended as a direct object of the preceding verb or as the subject of a subordinated sentence complement clause.

A two-way repeated measure analysis of variance (ANOVA) was conducted on all data from all groups to evaluate the effect of verb bias and continuation type on each of the extracted reading measures. Verb bias (direct object (DO) versus sentential complement (SC)) and continuation type (noun phrase continuation versus clause continuation) were the within-subjects factors. Group (monolingual, US bilingual and Spain bilingual) was the between-subjects factor. To ensure that participants were paying attention to and understood the stimuli, the proportions of correct responses to the comprehension questions were also calculated. Mean accuracy on these is given in Table 4-1 above under "Comprehension question accuracy (%)" (p. 75). Because overall accuracy was extremely high across groups, reading measures for both correctly and incorrectly responded stimuli were included in all analyses. This somewhat unconventional approach was taken because the results were the same as when incorrect responses were excluded, but inclusion of these items added power.

Analysis of all trials

The average times for all trials for the analyzed reading measures are presented by group in Figures 4-6, 4-7 and 4-8 below.

Figure 4-6 Monolingual reading times for all trials

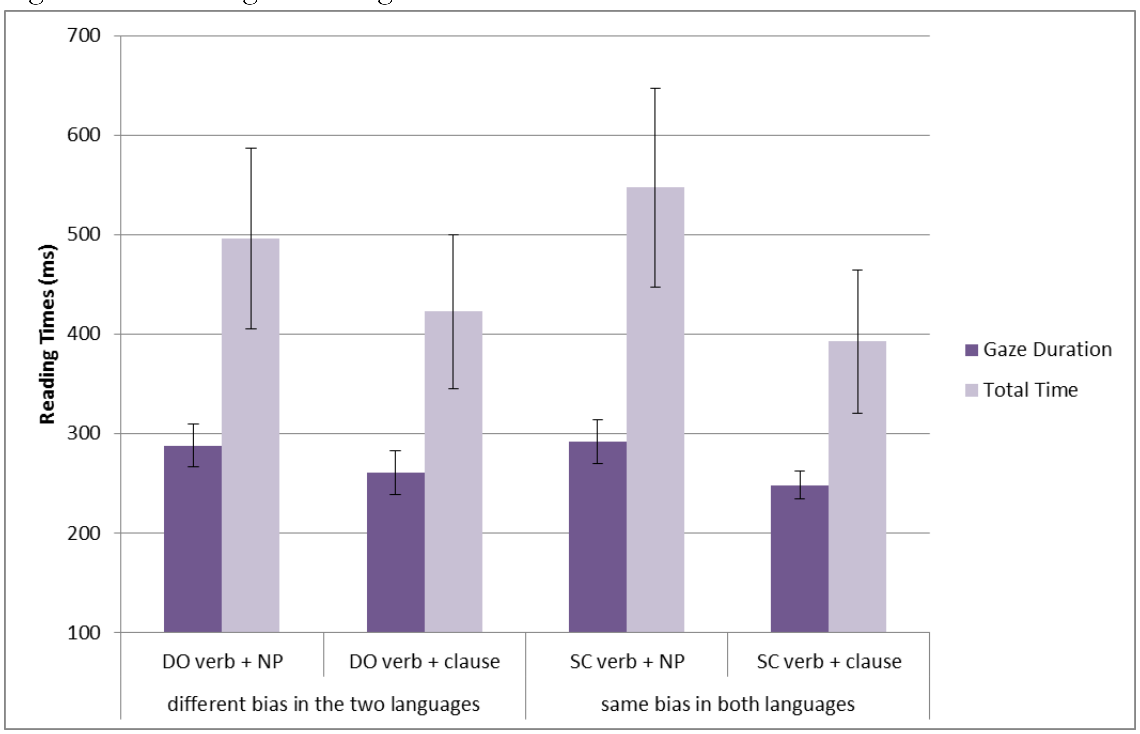


The preliminary analysis yielded an unpredicted result. Repeated measures ANOVAs on all reading measures revealed no significant effect of bias (gaze: $F_1(1,95)=0.004$, $p=0.948$; total time: $F_1(1,95)=3.165$, $p=0.078$), no significant interaction between bias and continuation[10], but a significant main effect of continuation (gaze: $F_1(1,96)=8.572$, $p=0.004$; total time: $F_1(1,95)=22.550$, $p<0.001$). The main effect of continuation was such that sentences having

[10] A full ANOVA table that includes the F and p values for each of the interactions (all not significant) in this model is presented in Appendix J.

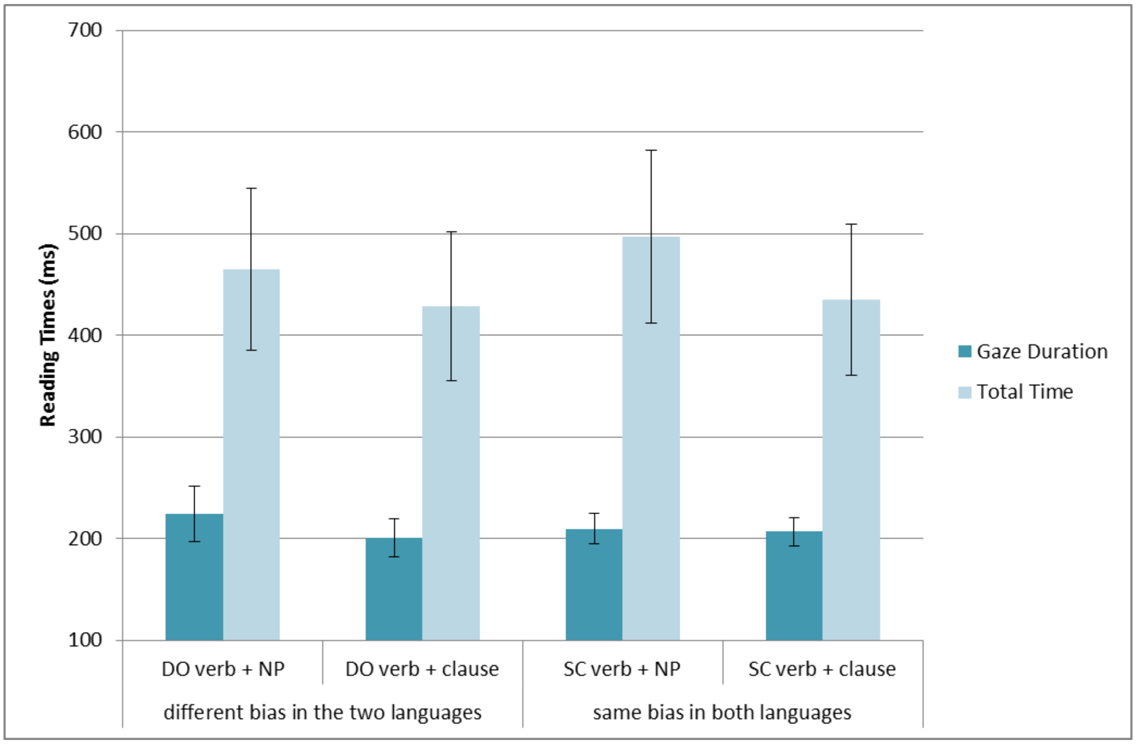
SC completions (gaze: m=201.34 ms; total time: m=374.48 ms) were read faster on average at the disambiguating region than sentences have DO completions (gaze: m=225.75 ms; total time: m=443.68 ms). Such a pattern would point to the L1 transfer hypothesis in bilingual groups, but the initial ANOVA showed no group interactions which would indicate that the monolingual group (who have no L1 to transfer) were employing a different pattern. A subsequent repeated measures ANOVA of the monolingual group only confirmed this. No main effect of bias was found among this group in gaze, $F_1(1,33)=0.858$, $p=0.361$, although a significant effect was observed in total time, $F_1(1,33)=4.270$, $p=0.047$, but a main effect of continuation was found in both gaze, $F_1(1,33)=4.135$, $p=0.050$, and total time, $F_1(1,33)=4.722$, $p=0.037$. There was also no significant interaction between bias and continuation in either gaze, $F_1(1,33)=0.006$, $p=0.941$, or total time, $F_1(1,33)=0.005$, $p=0.42$.

Figure 4-7 US Bilingual reading times for all trials



Such a strong and consistent effect of continuation across groups and conditions might point to some aspect of the stimuli which would make sentence complement continuations in these materials faster to process despite being a syntactically more complex and globally less common structure. To address this concern, a series of lexical properties of the disambiguating word were examined.

Figure 4-8 Spain Bilingual reading times for all trials



Lexical characteristics of the disambiguating word

Using data from the English Lexicon Project (ELP, Balota et al., 2007), the following lexical properties were determined for each of the eleven words which appeared as disambiguating words in the stimuli list: word length, log frequency of the word in the ELP, orthographic neighborhood density, phonological neighborhood density, bigram count, number of phonemes, number of syllables, mean reaction times on a LDT, mean accuracy on a LDT, mean reaction times on a word naming task and mean accuracy on a word naming task. In addition to the ELP characteristics, the frequency with which each word appeared through the entire stimuli set and for each presentation list individually were also calculated. Properties of the individual words can be found in Appendix K. All of the disambiguating words were non-cognates in English and Spanish. T-tests were conducted to compare averages for each of these lexical properties between DO and SC completions. Those averages and the results of the t-tests are shown in Table 4-2 below.

Table 4-2 Comparisons of lexical properties of disambiguating words in DO and SC continuations

condition		N	Mean (SD)	*T*	*df*	*p*
word length	SC	6	4.5 (1.22)			
	DO	5	4 (1.22)	0.674	9	0.517
ELP Log Frequency	SC	6	13.53 (0.71)			
	DO	5	13.24 (1.05)	0.554	9	0.593
Overall occurences	SC	6	20 (17.84)			
	DO	5	23.8 (40.1)	0.21	9	0.838
Occurences - File 1	SC	6	5.3 (5.01)			
	DO	5	5.6 (8.26)	0.066	9	0.949
Occurences - File 2	SC	6	4.83 (4.22)			
	DO	5	6 (11.20)	0.238	9	0.817
Occurences - File 3	SC	6	5.5 (4.89)			
	DO	5	5.8 (8.7)	0.072	9	0.944
Occurences - File 4	SC	6	4.83 (4.22)			
	DO	5	6 (11.2)	0.238	9	0.817
Orthographic Neighborhood	SC	6	9.83 (8.42)			
	DO	5	6.6 (5.86)	0.722	9	0.489
Phonological Neighborhood	SC	6	25 (12.13)			
	DO	5	10 (9.72)	*2.227*	*9*	*0.053*
Bigram Sum	SC	6	2142 (454)			
	DO	5	4009 (1075)	***3.889***	***9***	***0.004***
# of phonemes	SC	6	3 (0)			
	DO	5	3.6 (0.89)	1.622	9	0.131
# of syllables	SC	6	1 (0)			
	DO	5	1.2 (0.45)	1.108	9	0.297
LDT - Mean RT	SC	6	615.43 (22.36)			
	DO	5	621.99 (33.01)	0.393	9	0.704
LDT - Mean Accuracy	SC	6	0.975 (0.02)			
	DO	5	0.96 (0.05)	0.749	9	0.473
Naming - Mean RT	SC	6	614.51 (73.76)			
	DO	5	596.10 (27.42)	0.525	9	0.612
Naming - Mean Accuracy	SC	6	0.99 (0.02)			
	DO	5	0.99 (0.02)	0.239	9	0.816

Only two lexical properties were found to be significantly different across the two continuations in this study: phonological neighborhood density and bigram count. Phonological neighborhood density is defined as the number of words that are formed by changing a single phoneme in the target word while maintaining the identity and position of the other phonemes (Balota et al., 2007). In the case of phonological neighborhood density, SC disambiguators (m=25) had significantly denser phonological neighborhoods on average than DO disambiguators (m=10). But while some evidence finds that words with denser phonological neighborhoods are recognized and named more quickly (e.g. Yates et al., 2004; Yates, 2005), other evidence suggests that, in isolation, at least, words with denser phonological neighborhoods are recognized more slowly than those with lesser density (e.g. Chin, Vaid, Boas & Bortfeld, 2011).

The significant difference in bigram count presents similar doubts. A bigram is a sequence of two letters. Bigram frequency is defined as the sum of the frequencies of all of the bigrams in a given word, e.g. for CAT, the frequency of the bigram CA plus the frequency of the bigram AT (Balota et al., 2007). The SC disambiguators (m=2141) have significantly less frequent bigrams on average than the DO disambiguators (m=4009) used in the stimuli for this study. As with phonological neighborhood density, it is not yet well understood what facilitative (or not) role bigrams play in word recognition and processing (e.g. Conrad, Carreiras, Tamm & Jacobs, 2009). Therefore, while the disambiguating words in the stimuli for this study are not perfectly matched on all of their lexical properties (a side-effect of the effort to use naturalistic stimuli extracted from corpora, rather than created solely with this experimental manipulation in mind), the differences that exist do not predict the results either.

Analysis of the first trial only

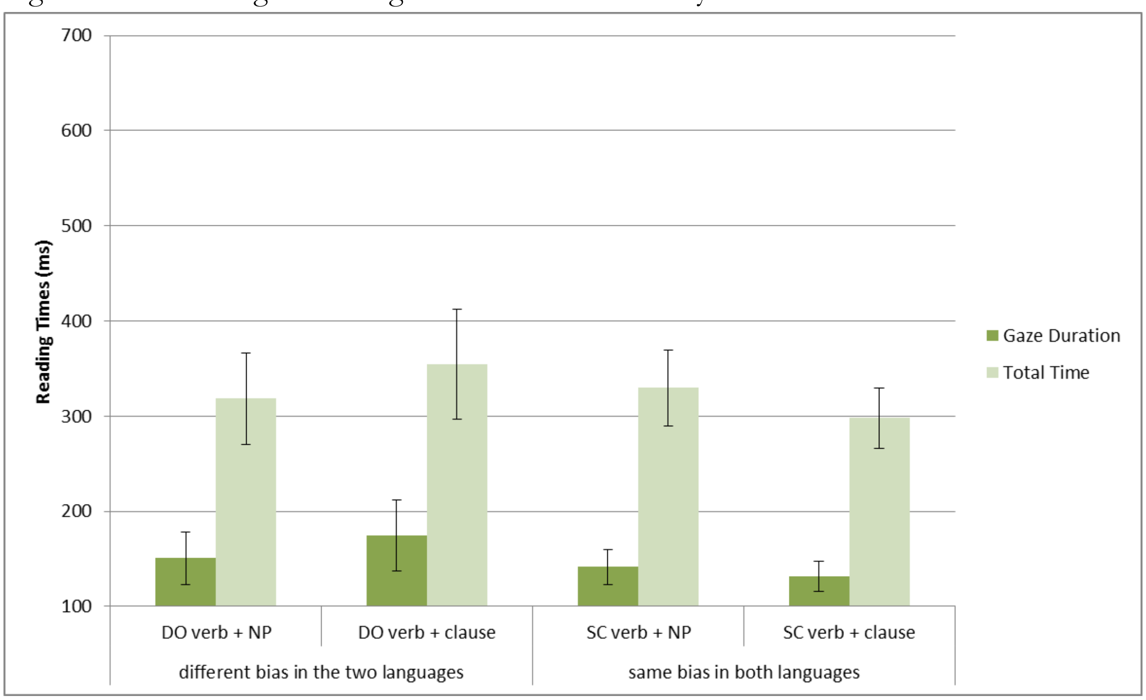
Another consideration lies in the frequent repetitions of the verbs and structures in this study. Although each sentence that a participant saw was wholly unique to that participant, recall that the verbs used in the study were repeated 10 times each, with five repetitions occurring in DO continuations and five repetitions occurring in SC continuations. SC continuations, which are the syntactically more complex completion of the two, are also less frequent overall in both English and Spanish (Chapter 3 of this dissertation). Syntactic priming (also called structural priming or syntactic persistence) is defined as both the tendency of a speaker to repeat a syntactic structure they have processed (Bock, 1986; Pickering & Branigan, 1998) or to process more quickly a structure which is similar to one recently processed (Branigan, Pickering, Stewart, & McLean, 2000; Pickering & Garrod, 2004). Syntactic priming effects persist across modalities, written and spoken, for language that is both comprehended and produced (Bock, Dell, Chang & Onishi, 2007). Significant evidence in first and second language processing research indicates that while syntactic priming happens for all manner of linguistic structures, the effects of priming are generally observed to be much stronger for less frequent structures (e.g. Bernolet & Hartsuiker, 2010; Ferreira, 2003; Jaegger & Snider, 2007) or more complex structures (e.g. McDonough, 2006; Behney, 2008). This priming effect provides an explanation for the unpredicted facilitation of SC observed in the analysis of all trials.

To better test whether syntactic priming does, in fact, account for the results of the previous analysis, a second analysis was conducted. For each participant, the first presentation of each verb in each of its two possible conditions was extracted. The average reading times for first trials only are depicted by group in Figures 4-9, 4-10, and 4-11 below. This reduced data set was then submitted to the same two-way repeated measures ANOVA used above. The ANOVA conducted on gaze revealed no significant results in any of the comparisons[11], likely due to a large loss in power following the exclusion of a large number of trials. A repeated measures ANOVA of total time revealed no effect of bias, $F_1(1,95)=0.148$, $p=0.701$, but did reveal, once again, a main effect of continuation, $F_1(1,95)=4.164$, $p=0.044$,. A near-significant interaction of continuation and group was also observed, $F_1(1,95)=3.071$, $p=0.051$, indicating that perhaps the groups are not behaving entirely the same. For this reason, and because the three different predictions do not each have entirely different expected patterns for each condition, a discussion of the trends in processing patterns will be presented by group in the sections to follow.

Monolinguals

In gaze duration, monolingual participants read DO bias verbs followed by a DO continuation faster on average (m=150.59) than when those same verbs were followed by clause continuations (m=174.15). They read SC bias verbs followed by clause continuations faster on average (m=131.46) than when those same verbs were followed by DO continuations (m=141.53).

Figure 4-9 Monolingual reading times for first trials only



[11] bias: $F_1(1,95)=0.469$, $p=0.495$
bias*group: $F_1(1,95)=0.476$, $p=0.623$
continuation: $F_1(1,95)=0.320$, $p=0.573$
continuation*group: $F_1(1,95)=0.697$, $p=0.500$
bias*continuation: $F_1(1,95)=0.202$, $p=0.654$
bias*continuation*group: $F_1(1,95)=0.144$, $p=0.866$

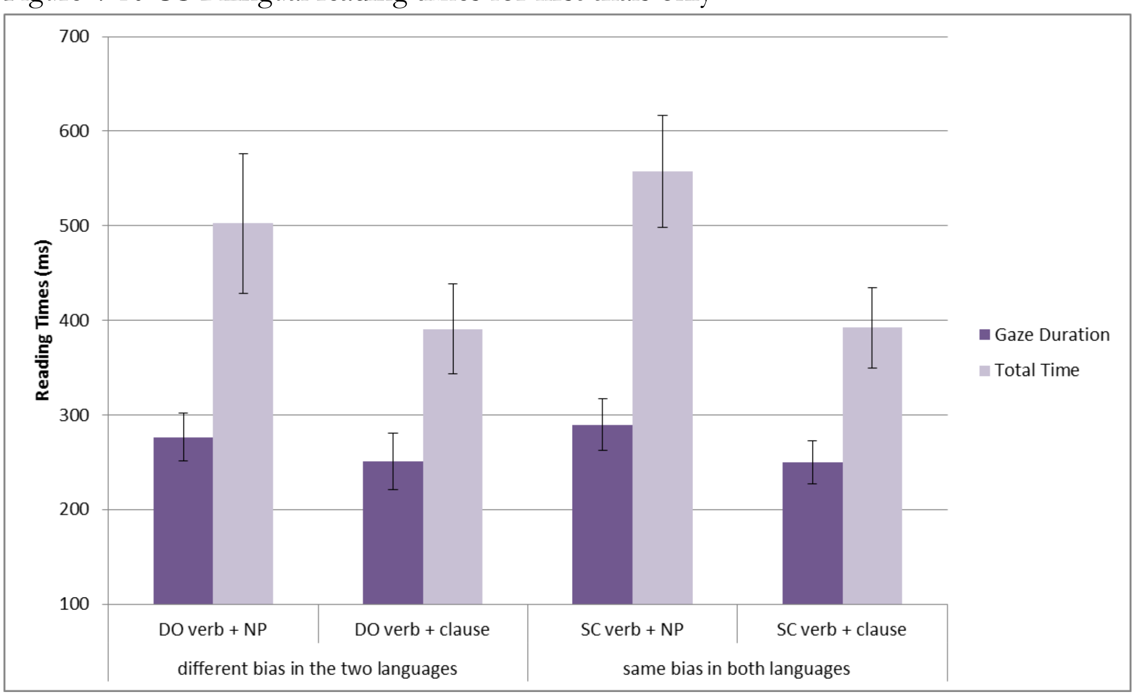
The pattern is the same in total times. Monolinguals demonstrated faster reading times on DO bias verbs followed by a DO continuation (m=318.29) than when DO bias verbs were followed by clause continuations (m=354.62). Similarly, sentences with SC bias verbs followed by clause continuations (m=298.02) were read faster on average than SC bias verbs followed by direct objects (m=329.56).

These differences are not statistically significant, but do reveal a trend towards reading sentences faster when the verb's bias and the sentence continuation are congruent and reading sentences slower when they are incongruent. This would indicate that these participants are sensitive to verb bias information the first time they read these verbs, but that the frequent repetition of the verbs in more complex, less frequent SC structures throughout the course of the experiment speeds up processing of those structures, resulting in the faster average reading times of SC structures when all repetitions of the verbs were included in the original analysis.

US bilinguals

The US bilingual participants show a distinctly different pattern from the monolinguals. In gaze duration, US bilingual participants read DO bias verbs followed by a DO continuation slower on average (m=276.40) than when those same verbs were followed by clause (m=250.90). They also read SC bias verbs followed by clause continuations faster on average (m=249.87) than when those same verbs were followed by DO continuations (m=289.73).

Figure 4-10 US Bilingual reading times for first trials only



The pattern is the same in total times. US bilinguals demonstrated faster reading times on clause continuations after both DO bias verbs (m=390.77) and SC bias verbs (m=502.47) and slower readings on direct object continuations after both DO bias (m=392.03) and SC bias (m=557.52) verbs.

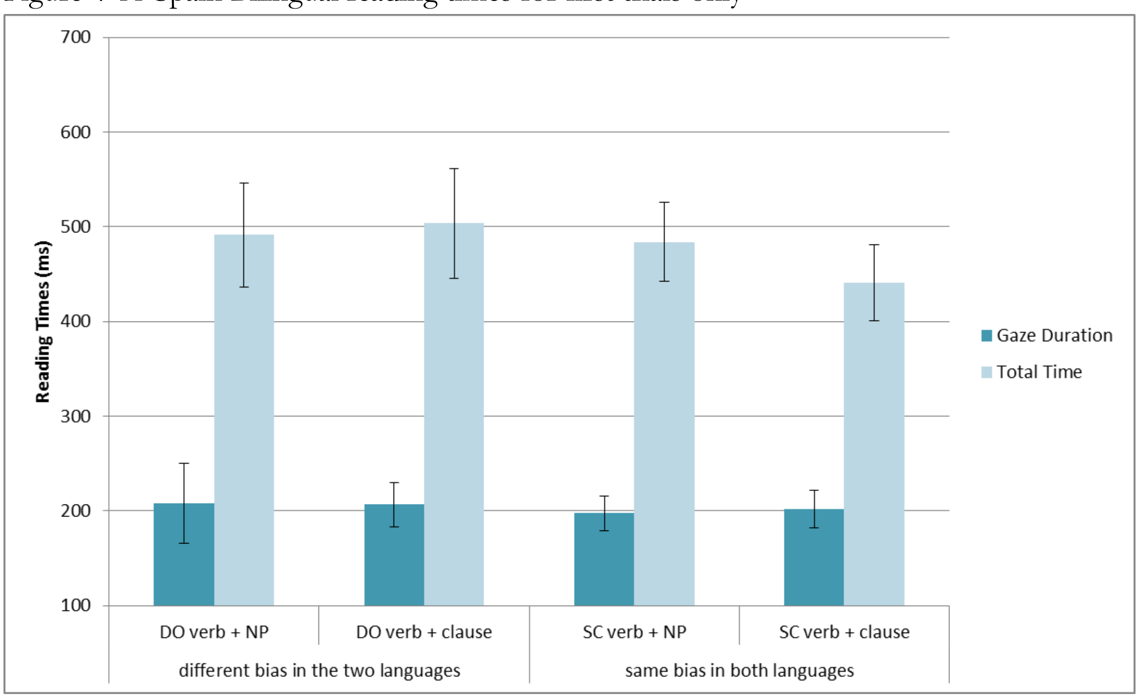
Because these reading times reflect only the first trial of each verb in each continuation type, the repetition effects found in the previous section cannot apply here. This trend would indicate, then, that US bilinguals may be transferring verb bias information from their L1 to aid in ambiguity resolution for sentences read in their L2.

Spain Bilinguals

In gaze duration, the Spain bilinguals still show no clear pattern even after removing the verb repetitions. DO verbs followed by DO continuations (m=208.38) and followed by SC continuations (m=206.62) were read at approximately the same speed. SC verbs followed by DO continuations (m=195.57) and followed by SC continuations (m=202.03) were also read at approximately the same speed.

The same is true of their total times, as well. DO verbs followed by DO continuations (m=491.29) and followed by SC continuations (m=503.47) were read at approximately the same speed. SC verbs followed by SC continuation (m=440.97) were read somewhat faster than DO continuations (m=483.94). No clear pattern can be drawn from the Spain bilinguals' reading times.

Figure 4-11 Spain Bilingual reading times for first trials only



Analysis excluding returning participants

The previous analyses of the first trials only demonstrated that syntactic persistence of uncommon, complex structures is, in fact, a strong force in the way that people process language. Such priming has been proposed to have implications for fluency and alignment among interlocutors, as well as serve as a form of implicit learning through which people learn how meaning is associated with certain syntactic configurations (Chang, Dell, Bock & Griffin, 2000; Ferreira & Bock, 2007; Torres Cacoullos & Travis, 2011). The analysis of first trials only showed that syntactic priming does appear to increase fluency in processing because the SC continuations were read faster. Alignment, in this context, is irrelevant because participants are reading these sentences in isolation, without an interlocutor. The last claim about implicit learning could have additional implications for the present study. Implicit learning is a process that happens independently of conscious efforts to learn, and produces a tacit knowledge about structure which can be used covertly to solve problems and make decisions, even in novel situations (Reber, 1989). The strong persistence of syntactic priming effects across many trials and days is consistent with a learning as opposed to memory effect (Bock & Griffin, 2000; Savage, Lieven, Thiekston & Tomasello, 2009). This means that experience with syntactic structures, especially infrequent or dispreferred ones, can result in learning of those structures, which facilitates processing of those structures in the future (Chang, Dell, Bock, 2007). For this reason, the choice was made to conduct a final analysis which excluded those participants who had prior exposure to the DO and SC structures investigated here by virtue of having participated in the previous study (Chapter 2).

The average reading times for the first trials of each verb, after excluding individuals who had participated in the prior study, are depicted by group in Figures 4-12, 4-13, and 4-14 below. This reduced data set was then submitted to the same two-way repeated measures ANOVA used in the previous analyses. The ANOVA conducted on gaze revealed no significant main effects[12], but did reveal a significant interaction of bias and group, $F_1(1,63)=4.586$, $p=0.014$, which supports that the individual groups are displaying different patterns. A repeated measures ANOVA of total time revealed no main effects[13], but revealed a significant interaction of continuation and group, $F_1(1,63)=3.625$, $p=0.032$, indicating that the groups are not behaving in the same manner. For this reason, and because the three different predictions do not each have entirely different expected patterns for each

[12] bias: $F_1(1,63)=0.484$, $p=0.489$
continuation: $F_1(1,63)=0.045$, $p=0.832$
bias*continuation: $F_1(1,63)=0.899$, $p=0.347$

[13] bias: $F_1(1,63)=0.024$, $p=0.878$
continuation: $F_1(1,63)=3.860$, $p=0.054$
bias*continuation: $F_1(1,63)=1.756$, $p=0.190$

condition, a discussion of the trends in processing patterns will be presented by group in the sections to follow.

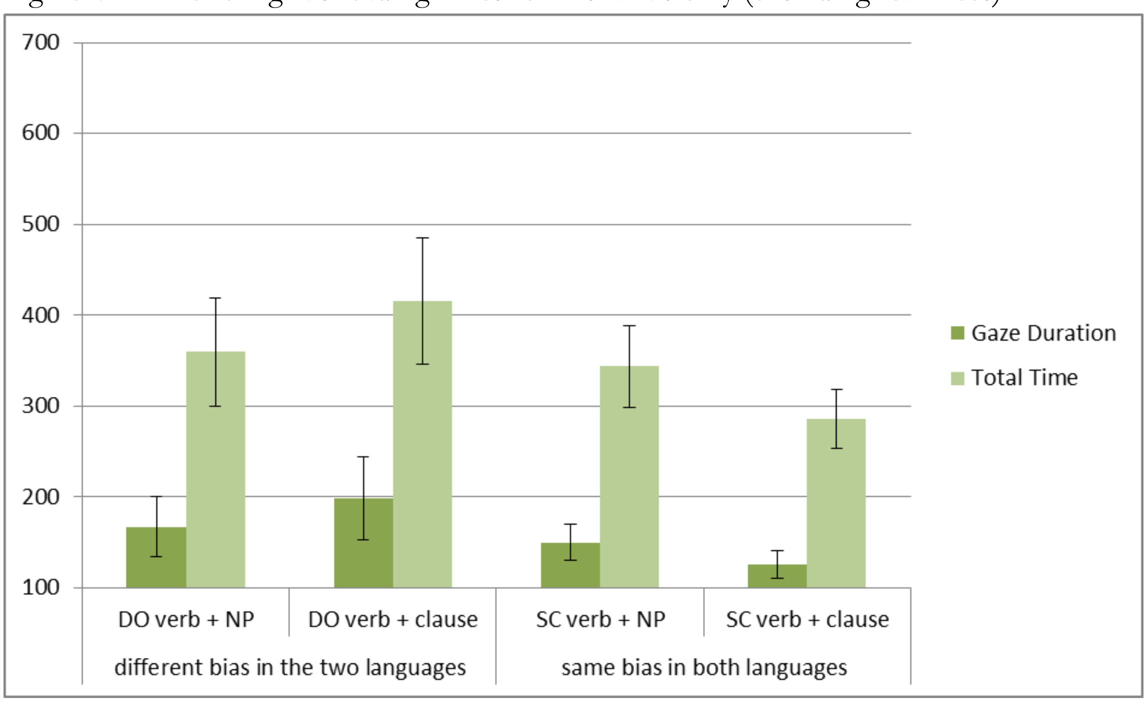
Monolinguals

The analyses of gaze duration for only those monolinguals who had not participated in the prior verb bias experiment described in Chapter 2 revealed a similar pattern as was observed in the previous analysis, but with greater differences. DO bias verbs followed by direct objects (m=167.00) were read faster than when followed by clauses (m=198.96) and SC bias verbs followed by clauses (m=125.23) were read faster than when followed by direct objects (m=149.94).

The patterns for total times were also similar. Sentences with DO bias verbs followed by direct objects (m=359.46) were read faster than when followed by clauses (m=415.65) and SC bias verbs followed by clauses (m=285.462) were read faster than when followed by direct objects (m=343.519).

This once again indicates that in the absence of stronger structural priming effects and the cumulative effects of implicit learning of these structures, monolingual native speakers of English use verb bias information to disambiguate temporary direct object/sentence complement ambiguities.

Figure 4-12 Monolinguals reading times for first trials only (excluding returnees)

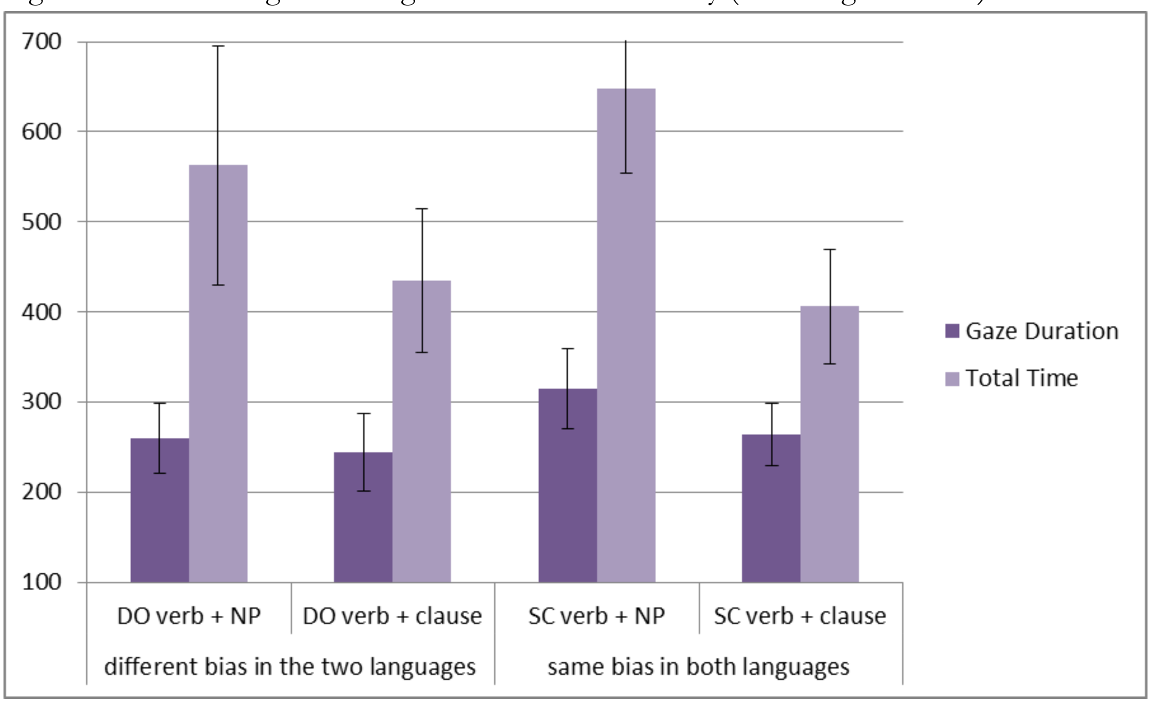


US Bilinguals

The trends for the US bilingual group also persisted in this analysis as observed in the previous analysis of all trials, but with greater differences between conditions. US bilingual participants read DO bias verbs followed by a DO continuation slower on average (m=259.71) than when those same verbs were followed by clause (m=244.47). They also read SC bias verbs followed by clause continuations faster on average (m=263.53) than when those same verbs were followed by DO continuations (m=315.27).

The pattern is the same in total times. US bilinguals demonstrated faster reading times on clause continuations after both DO bias verbs (m=434.65) and SC bias verbs (m=406.27) and slower readings on direct object continuations after both DO bias (m=562.71) and SC bias (m=648.24) verbs.

Figure 4-13 US Bilingual reading times for first trials only (excluding returnees)



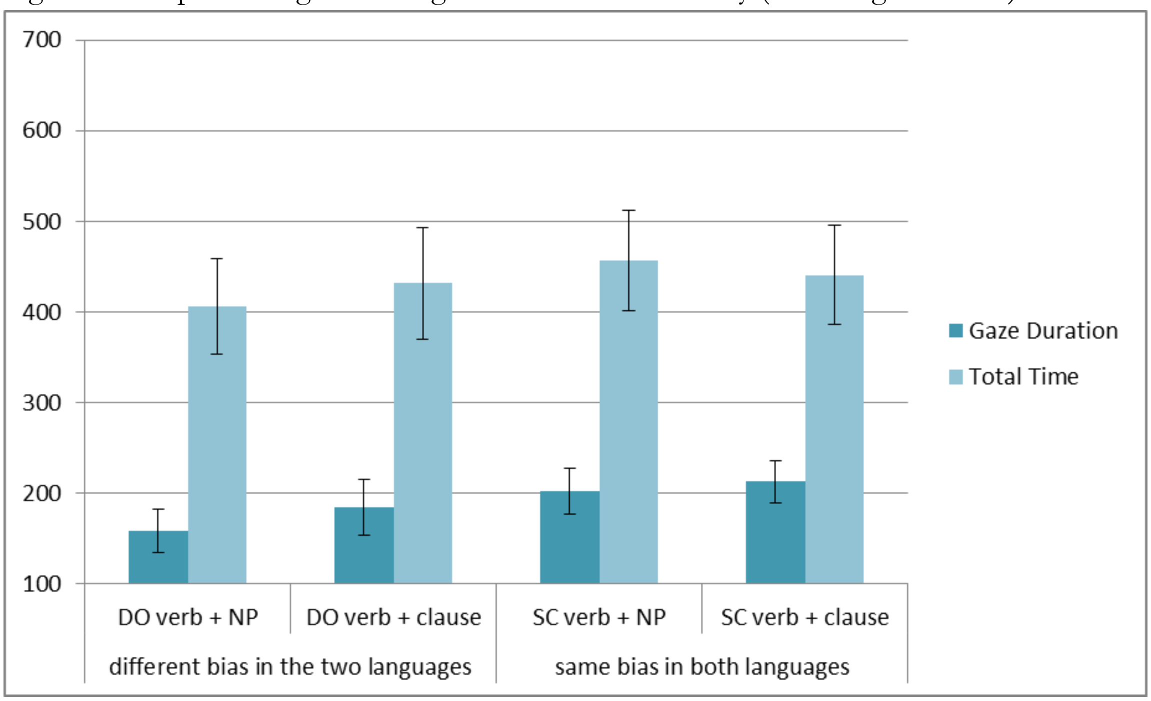
Spain Bilinguals

The Spain bilinguals start to show a clearer, though still weak, trend when returning participants were excluded from the averages. In measures of gaze duration, direct object continuations (m=158.65) were read faster than sentence complement continuations (m=183.91) when preceded by DO bias verbs. Direct object continuations (m=202.24) were also read faster than sentence complement continuations (m=212.65) when preceded by SC bias verbs.

In total times the pattern still remains unclear. After DO bias verbs, direct object continuations (m=406.17) were read faster than sentence complement continuations (m=431.39). After SC bias verbs, however, sentence complement continuations (m=440.413) were read faster than direct object completions (m=456.804).

Though very tentative, the removal of returning participants does point towards a pattern in gaze duration that looks more like previous findings that non-immersed bilinguals use universal simplicity heuristics to resolve temporary ambiguities. In total times, that pattern does not persist. These differences, of course, are not significant, likely due at least in part to a lack of statistical power.

Figure 4-14 Spain Bilingual reading times for first trials only (excluding returnees)



General Discussion

The lack of power and statistical significance of the final analysis demands that conclusions drawn from these data be tentative, but the tendencies do merit note. When asking whether bilinguals are able to use the same frequency-based cues employed by monolinguals to resolve temporary ambiguities, the current study does not provide evidence to support this conclusion, though previous studies show that bilinguals are capable of doing this, at least under certain conditions. This study, however, provides suggestive evidence that L1 transfer, previously uninstantiated in processing studies of verb bias, may be possible when cognate verbs are present. The US bilingual group favors sentential complement continuations regardless of English verb bias in this experiment, but it is important to recall that the translation equivalents of all verbs in this experiment are sentence complement biased in Spanish. This suggests that even highly proficient, immersed learners are susceptible to L1 transfer when cognates are present. The Spain bilinguals show inconsistent patterns in the analyses presented here. The differences in reading times across conditions are neither large nor consistent enough to draw any strong conclusions from that data alone.

The differences between the initial analysis of this data, including all trials and the analysis of only the first presentation of each verb in each condition also have repercussions for theories of syntactic priming. The frequent repetition within the experiment of sentence complement completions without overt complementizers seems to have primed a structure that is uncommon (Chapter 3) and syntactically more complex. Furthermore, not only is this structure syntactically complex and less common overall, but within the experiment it was repeated as many times with a verb which would disprefer a clausal complement (a DO bias verb) as it was with a verb that would prefer one (a SC bias verb), which reinforces the priming effect on uncommon structurues his finding thus confirms results observed in previous work indicating that cumulative syntactic priming is stronger for less common (e.g. Bernolet & Hartsuiker, 2010; Ferreira, 2003; Jaegger & Snider, 2008) and more complex syntactic structures (e.g. McDonough, 2006; Behney, 2008). For this reason, the experiment-internal repetition of sentence complement continuations over time likely facilitated the processing of these less common structures.

The differences between analyses that included and did not include returning participants also have implications for theories of implicit learning. Removal of returning participants revealed patterns what their inclusion had been obscuring. Though months had passed between participation in the study from Chapter 2 and the present study, these participants' processing of sentence complements was apparently further facilitated by their past experience with these structures. This provides further evidence to support the claim that syntactic priming is not merely an ephemeral facilitation or alignment strategy, but rather a form of implicit learning which enables participants to map meaning to structure, which is especially useful for learning how to process complex structures and rare structures that participants do not encounter often. This result also provides support for usage-based theories of grammar which, propose that "grammar is the cognitive organization of one's experience with language" (Bybee, 2006:3) and exemplar models under which every token of one's linguistic experience is classified and organize (e.g. Pierrehumbert, 2001; 2002).

The impact that repetition has, even months or years after initial exposure, on the outcome of this experiment draws attention to the need to consider these effects at the junctures of stimuli development and participant recruitment when conducting psycholinguistic studies.

Chapter 5 | Conclusion

In this thesis I examined verb bias using production data from Spanish and English mixed-genre corpora and comprehension data from experimental psycholinguistic studies of English monolinguals and highly proficient Spanish-English bilinguals. I investigated the cross-linguistic tendencies of structural information which is encoded lexically as verb subcategorization bias and tested intra- and extra-linguistic factors which contribute the ability to make use of this information during online sentence comprehension. In the introduction to this dissertation, I asked several questions. Below, I summarize the answer to those questions and the data provided by this dissertation in support of those answers.

Based on naturalistic data, what are the biases of commonly used Spanish verbs? How do the biases determined from corpus data compare with those found in previous verb norming studies?

In Chapter 3, I presented corpus studies of verb bias for 188 Spanish verbs and 80 English verbs which showed a very high level of cross-study continuity in the determination of verb biases based on a relative measure. In Study 1 of that chapter, 56% of the Spanish verbs studied had the same bias in the present data as was determined in a previous norming study, while only 2% of verbs demonstrated opposite biases in the two studies. The remaining 42% of verbs had different biases according to the relative measure, but demonstrated the same tendencies in both studies. In Study 2 of that chapter, 45% of the English verbs studied had the same bias in the present data as was determined in a previous norming study, while only 10% of verbs demonstrated opposite biases in the two studies. The remaining 45% of verbs had different biases according to the relative measure used in this work, but again demonstrated the same tendencies across studies. These results, in keeping with previous cross-corpora comparisons of English verb bias, indicate a high level of continuity across studies of verb bias in different dialects, genres, and data collection methods. They do, however, also point out the need for careful considerations of the measures (absolute or relative) which are used to determine a verb's bias.

The comparison of biases cross-linguistically between English and Spanish indicate that while it is possible for verbs to have different biases in two languages, it is often the case that verbs which share meaning often share a tendency to favor the same types of structures (44% of the time in the comparison conducted in Chapter 3). That semantic meaning apparently plays a role in determining structural preferences further reinforces the importance of considering verb sense when conducting corpus and psycholinguistic studies of verb bias.

What linguistic factors co-occur with the selection of a verb's particular complement in both Spanish and English?

In Chapter 3, the multivariate analysis of linguistic factors co-occurring with sentence complements in Spanish finds that expressed subjects, individual human subjects, the presence of an indirect object, and verbs used to express utterances favor sentence complement completions, while collective subjects and sensory verbs co-occur with direct object completions. In English, the same analysis again finds that individual subjects favor sentence complements while groups disfavor them, and that the presence of an indirect object favors sentence complement completion. In contrast with Spanish, English utterative verbs slightly disfavor sentence complement continuations as a class. The significance of these factors supports usage-based theories of grammar by providing strong, testable evidence of constructions which can serve as aids to acquisition of verb meanings and cues to processing.

Can bilinguals use probabilistic cues (i.e., verb bias information) specific to the L2 to parse sentences in the L2?

In response to this question, I presented evidence in Chapter 2, Experiments 1 and 2, which demonstrates that highly proficient second language learners with a long history of immersion in their second language are able to use English verb bias information as a cue to parsing temporary ambiguities in English. The US bilingual groups, who averaged approximately 6 years in an English-speaking country in Experiment 1 and approximately 5 years in Experiment 2, showed sensitivity to English verb bias information which was evidenced, critically, by the facilitation of processing of the more complex sentence complement structures when preceded by a verb which had a sentence complement bias as compared to verbs which had direct object biases. This effect was observed in total time only, a later measure, which is a later effect than is generally observed in monolingual groups here and elsewhere, but the relatively slower processing by speakers in their L2 (a more laborious task) does not reject the hypothesis that second language learners use fundamentally similar processes in both their first and second languages.

If it is the case that L2 speakers do not demonstrate strategies like native speakers of the target language, is it because they transfer verb information from the L1? Does this (L1 transfer) happen more readily when L2 speakers are processing cognates?

This dissertation provides some evidence that L1 transfer of probabilistic processing cues can occur. In three cases throughout this dissertation I present examples of L2 speakers who do not demonstrate native-like processing strategies in their target language. In Chapters 2 and 4, the Spain bilingual groups fail to parse ambiguities like native speakers, instead seeming to favor syntactic simplicity heuristics to aid processing; in Chapter 4, the US bilingual group also showed non-native-like parsing routines. In the case of the Spain bilinguals, there is no evidence of transfer, which is discussed in more detail below (p. 100).

To better understand the role of cognates in the use of L1 transfer in bilingual processing, the findings of the experimental work presented in Chapters 2 and 4 merit closer attention. On the surface, they seem, perhaps, contradictory. Participants in the two groups were recruited from the same populations at the same universities. They match closely on several different measures of language proficiency. The processing patterns of the monolingual English speakers and the non-immersed, Spain bilinguals seem consistent across the studies in both chapters. And yet, in the pilot experiment in Chapter 2, the highly proficient, immersed US bilinguals show native-like processing strategies using English L2 verb bias information. The equivalent group in the second experiment, in Chapter 4, shows a clear L1 transfer strategy, instead. One potential explanation for the difference in these groups is that they are not, in fact, well matched on measures of proficiency. While not all of the measures of proficiency were used for all groups, the LHQ document used in all three experiments was exactly the same. Additionally, Chapters 2 and 4 used the same English (MTELP) and Spanish (DELE) grammar tests and the same 30 pictures for the English portion of the BNT picture naming tasks. So as to better understand the implications of the results across these two studies, a one-way ANOVA was conducted on each of the proficiency measures comparing the two US bilingual groups—the pilot bilingual group from Chapter 2, Experiment 2 (n=23) and the group from the second experiment, in Chapter 4, excluding the returnees from the pilot experiment (n=17). The results of that comparison are shown in Table 5.1 below.

Table 5-1 Side-by-side comparison of US Bilingual groups from the pilot and second experiments

	Chapter 2 - Pilot experiment *Mean (SD)*	**Chapter 4 - Second experiment** *Mean (SD)*	**ANOVA** *F*
n	23	17	-
males	12	4	-
age	28.6(5.9)	26.6(6.7)	$F(1,38)=1.020$, $p=0.319$
Years in a English-speaking country	4.9(3.8)	3.6(5.2)	F(1,38)=0.895, p=0.350
English Age of Acquisition	8.7(3.7)	8.7(6.4)	F(1,38)=0.002, p=0.966
English Age of Fluency	18.9(6.6)	14.8(8.1)	F(1,38)=3.078, p=0.087
Self-rating - Proficiency	7.4(1.3)	7.9(1.1)	F(1,38)=1.863, p=0.180
Self-rating - Understanding	8.0(1.1)	8.2(1.0)	F(1,38)=0.286, p=0.597
Self-rating - Reading	8.3(1.0)	7.9(0.9)	F(1,38)=1.910, p=0.175
% current L1 exposure	45.4(16.3)	46.6(23.8)	F(1,38)=0.033, p=0.856
% current L2 exposure	51.4(20.2)	57.8(22.8)	F(1,38)=0.880, p=0.354
% of time participant would choose to read in L1	43.2(22.9)	35.6(27.3)	F(1,38)=0.923, p=0.343
% of time participant would choose to read in L2	51.4(24.5)	67.4(20.9)	F(1,38)=4.245, p=0.046§
% of time participant would choose to speak L1 with person fluent in both	66.9(25.2)	63.5(28.3)	F(1,38)=0.154, p=0.697
% of time participant would choose to speak L2 with person fluent in both	31.2(25.2)	40.0(30.5)	F(1,38)=1.004, p=0.323
How often are you rated as non-native? (0-10, never-always)	8.4(2.9)	6.4(3.2)	F(1,38)=4.055, p=0.051
MTELP score (out of 50)	37.2(7.2)	33.6(8.8)	F(1,38)=1.944, p=0.172
DELE score (out of 50)	44.0(4.5)	40.8(3.5)	F(1,38)=5.736, p=0.022§
English BNT score (out of 30)	20.2(3.4)	15.4(3.3)	F(1,38)=16.603, p<0.001§

§The difference in means between the two groups is significant at a level of 0.05

The analyses indicate that participants are, in fact, differ in some of their linguistic abilities, though perhaps the dimensions on which they differ are not crucial for the current study. Three measures showed significant differences between the two US bilingual groups. Those were: the percentage of time the participant would choose to read in the L2 (if the text were translated from a third, unknown language), the DELE Spanish grammar test score and the English picture naming score. It should be noted that both groups were highly on these last two measures, especially in the case of the DELE, where both groups performed at a rate of 80% accuracy or better. As regards the first, while the percentage of time the participant would choose to read in the L2 is different between the two samples, the significance is marginal ($p=0.046$), and the corresponding percentage of time the participant would choose to read in the L1 is not significantly different. For this reason, it may not be of great relevance when considering the larger context of these comparisons. The other two factors are not as easily disregarded. A significant difference in BNT scores would indicate, in this case, that the participants in the second experiment had a lower average proficiency in English when compared with the participants in the pilot experiment. However, the MTELP scores, another objective measure of L2 proficiency, were not significantly different between groups. This measure is arguably the most relevant for this study because the participants were reading complex sentences in English, and the MTELP, as an English grammar test, measures their comprehension skills as relates to a formal register of written English. The subjective, self-rating measures of L2 proficiency were not different across groups, either. I interpret this to mean that the two groups are similar enough to draw comparisons across studies. Similarly, the significant difference in DELE scores might indicate that the participants in the second experiment also had lower average proficiency in Spanish when compared with the participants in the pilot. When considering this result in light of the significant difference in choice to read in the L2, which indicates that the bilinguals in the second experiment feel far more comfortable reading in their second language than the bilinguals in the pilot experiment, it is difficult to conclude that these differences account for the differences in processing strategies seen in the two studies. The English BNT scores alone might indicate that the bilinguals in the second experiment are less proficient, and thus more susceptible to L1 transfer effects than their slightly more proficient counterparts in the pilot study, but their lower DELE scores and relative preference for reading in their L2 would seem to make them potential candidates for L1 attrition, which would presumably counteract the likelihood of L1 transfer. Having found no sufficient explanation among language proficiency and immersion traits of the two samples which would account for the difference in strategies between the two studies, I conclude somewhat more confidently, though still cautiously, that the differences in the materials of the experiments, rather than the participants, provide the answer.

The materials in the second experiment in Chapter 4 contained exclusively cognate verbs, while the materials in the Chapter 2 pilot experiment contained an unbalanced mix of cognate verbs and non-cognate verbs which was not controlled across conditions. In

Chapter 4, each verb was repeated an equal number of times in each of its two possible conditions. In Chapter 2, verbs were repeated unequal numbers of times, though each verb occurred with equal frequency in each of the two possible syntactic frames. For this reason, while it is hard to determine the role of cognates in the pilot study, it is clear that the shared mental representation of cognates is playing an important role in the US bilinguals' processing strategies in the second study. Taken together, these results suggest that highly proficient second language learners are able to nearly approximate native processing routines when processing in their L2, but that, by virtue of their bilingualism and the existence of cognates in their two languages, transfer of L1 cues may never be completely avoidable. In fact, it is important to remember: the fundamental mechanisms by which bilinguals process language in their first and second languages are the same, and are the same which are used by monolinguals, as well. That being said, the presence of multiple languages within the same processing system and the relative slowness of late-acquired L2 processing when compared with adult L1 processing make it inapt to set monolingual native-likeness as the bar by which bilinguals are measured (see Dekydtspotter, Rex & Sprouse, 2006, for a more detailed argument in favor of this proposal).

In the case of the US bilingual group in Chapter 4, the pattern of processing is best explained by a transfer of L1 verb bias information to aid in the parsing of temporary ambiguities in the L2. Because the US bilingual groups in both chapters are closely matched in terms of age, immersion experience, and subjective and objective measures of language proficiency, the differences in the stimuli between the two studies best explains the different processing strategies shown in the two experiments. Unfortunately, other aspects of the stimuli preparation—namely frequent repetition of verbs—obscure and weaken the effect of L1 transfer by the US bilinguals observed in Chapter 4. Therefore, this dissertation presents tentative evidence that the presence of cognates, which share form and meaning in a bilingual's two languages, encourages the transfer of lexically encoded information, including structural preferences, during online processing.

An important question remains as to why neither sample of Spain bilinguals shows any evidence of L1 transfer while the US bilinguals do. On this point there is some debate. Most recently, within the field there is a call for a dialing back of the L1 transfer story, which is said to be over-applied to second language acquisition and processing research (Dussias, Dietrich & Villegas, to appear; Clahsen, personal communication). Though early work found repeated evidence of transfer (e.g., Gass, 1987; Harrington, 1987; Heilenman & McDonald, 1993; Hernández, Bates, & Avila, 1994; Liu, Bates, & Li, 1992; McDonald, 1987; McDonald & Heilenman, 1991; Sasaki, 1994; Wulfeck, Juárez, Bates, & Kilborn, 1986), more recent work has shown that the effects of L1 transfer are modulated either by L2 proficiency (Frenck-Mestre, 1999; Dussias, 2001; Su, 2001) and/or L2 immersion experience (Frenck-Mestre, 2002; Witzel et al., 2012), as well as the structural similarities of the L1 and the L2 (Foucart & Frenck-Mestre, 2011). In much of the previous work, however, proficiency and experience are confounded, or the conclusions about the role of immersion come *post hoc* or based on reviews of multiple studies (e.g. Frenck-Mestre, 2002) rather than on the test predictions of a study such as was conducted in this dissertation. In the present dissertation, the Spain bilingual groups in both eye-tracking experiments have had significantly less immersion experience in their L2 than their US bilingual counterparts. On measures of proficiency, in Chapter 2 the Spain bilinguals score lower on the MTELP English grammar test as well as the BNT English picture naming task, but in Chapter 4 they are better matched, and only score lower on the picture naming task when compared with their US bilingual counterparts. Though not perfectly addressed, the confound of proficiency and immersion experience is unproblematic in the present work because previous work which touts the role of these two factors in L1 transfer would predict that the less immersed and the less proficient group would show transfer where the higher proficiency, immersed group should not. This is the opposite of what happens here. In this dissertation, only the immersed group can use lexically encoded frequency information, sometimes from the L2, sometimes transferred from the L1, while the group with less immersion experience seems only to use simplicity heuristics. There may be several explanations for this.

First, the optional complementizer in sentence complement structure is only allowable in English. In Spanish, "*que*" is required as a complementizer to any clausal complement. There is some evidence that bilinguals can only make use of L1 transfer when the structures in the L2 are very similar to those found in the L1. In the work presented in the dissertation, the temporary ambiguity in question is one which can only present itself in the bilinguals' L2. In previous research on grammatical gender in bilinguals, Sabourin and Stowe (2008) only find native-like processing patterns for grammatical gender in bilinguals whose L1 had a similar structure as their L2. This presumably indicates that transfer only plays a role when systems are lexically and structurally similar. Still, subsequent work has found that when grammatical feature systems are different cross-linguistically, (e.g., Foucart & Frenck-Mestre, 2011) or when the grammatical features in question do not exist in the L1 (e.g., Gillon-Dowens, Vergara, Barber, & Carreiras, 2010; Gillon-Dowens, Guo, Guo, Barber, & Carreiras, 2011; Foucart & Frenck-Mestre, 2012), highly proficient L2 speakers can show sensitivity to these features which are very similar to the effects associated with native speaker processing. In the case of verb bias, highly proficient Korean-English bilinguals immersed in English at the time of testing have been shown to demonstrate sensitivity to L2 English verb bias information during processing, despite the fact that Korean V2 word order renders verb bias useless—because the structures are different in the L1 and L2—as a cue to prediction during processing. It may be that the lack of immersion experience of the Spain bilinguals makes them unable to recruit usage-based cues to processing because the structural ambiguity in the stimuli for these experiments is not licit in their dominant, native language.

A second explanation for the lack of L1 transfer in the Spain bilingual groups may come from research that contends that L1 and L2 processing are fundamentally different (e.g. Clahsen & Felser, 2006b; Marinis, Roberts, Felser, & Clahsen, 2005). Clahsen and Felser (2006b) propose the Shallow Structure Hypothesis, which argues that late second language learners have less detailed representations on which to base their parsing decision in their second language the child and adult native speakers of that language. A central component of the Shallow Structure Hypothesis is that L1 transfer is not as relevant to online processing as has been claimed in previous work. They point out that much of the evidence of L1 transfer comes from offline tasks such as questionnaires or production priming experiments, or from tasks which demonstrate transfer of phonological, orthographic, morpho-lexical and lexico-semantic information (Frenck-Mestre & Pynte, 1997; Hernandez et al., 2005; Marian & Spivey, 2003; Schuetz & Eberhard, 2004; Tan et al., 2003). The transfer of L1-specific syntactic processing preferences, which would include such cues as the verb bias information tested in the current dissertation, is not well instantiated in their view (Clahsen & Felser, 2006b:7), and has only been shown in one study of relative clause attachment (Frenck-Mestre, 1999). In other work on non-local dependencies, such as Marinis et al.'s (2005) study of wh- movement, no evidence of transfer was found. Marinis and colleagues (2005) found that native speakers of languages with (German, Greek) and without (Chinese, Japanese) overt wh- movement demonstrated the same processing patterns when processing in their L2 (English). Clahsen and Felser (2006b) take this as evidence that L1 transfer of processing routines is not possible. They propose, instead, that L2 processing places higher demands on cognitive resources than native language processing, and for this reason L2 parsers rely on simplicity heuristics to save resources (Clahsen & Felser, 2006b:8)

A second study of wh- movement using the same structures as Marinis et al. (2005) found that second language learners with extensive immersion experience (*9 years* on average) were able to process long distance dependencies in native-like ways (Platsiakis & Marinis, 2013). In light of the most recent findings, it seems to be increasingly the case that the strong version of the Shallow Structures Hypothesis may not apply (i.e. L2ers can never gain access to fine-grained structural information from their L1 or their L2) because there is evidence that native-like processing routines can be achieved. However, under a weaker version of the hypothesis, L2 parsers initially rely on syntactic simplicity universals to conserve cognitive resources, but once L2 speakers have had more naturalistic exposure to their second language in the form of immersion experience the demand on cognitive resources during L2 processing is lessened. At that point, second language learners are able to bring other sources of information into the parsing processing, including information from the L1. Thus, shallow structures are supplemented by more detailed representations through long-term immersion. This would explain why the Spain bilinguals in these experiments are unable to recruit structural frequency information of any kind in order to parse direct object/sentence complement ambiguities. They have simply not had enough immersion experience to do so.

If it is the case that L2 speakers do demonstrate similar processing patterns as L1 speakers, is proficiency or immersion experience the relevant factor in demonstrating those patterns?

This dissertation provides evidence that immersion is a powerful force in developing native-like processing routines in a second language. Across all bilingual groups in Chapters 2 and 4, subjective and objective measures of second language proficiency in a variety of skills were kept relatively constant. The key difference between the US and Spain groups (and, in fact, between the bilinguals and monolinguals, by extension) was the length of time those groups had been immersed in English at the time of participating in these experiments. While the Spain groups had little to no immersion experience, and were certainly not immersed in English at the time of their participation, the US groups had, on average, several years of immersion experience and were immersed at the time of their participation, also. The stark difference between the sensitivity to detailed probabilistic structure information shown by the US bilingual groups and the shallower reliance on simplicity heuristics by the Spain bilingual groups thus shows that linguistic experience itself, and not simply language proficiency on any one measure, is a key factor in reaching native-like levels of processing efficiency.

The questions answered by this dissertation breed several others. Future research would do well to consider more carefully the nature of immersion experience and to find better ways to measure immersion and proficiency as points on the same scale. Despite careful attempts to avoid it, the proficiency of the immersed and non-immersed groups in this dissertation was not perfectly matched and, in truth, that would have been very hard to do. And native-like processing routines could arguably be another measure of proficiency in one's second language, one which apparently can only be achieved through years of immersion experience. Furthermore, my own anecdotal knowledge of these participants is that the US bilingual groups are immersed in English in the sense that they live in an English-speaking country and attend an American, English-speaking university, but many of them live with spouses and children who are Spanish-speaking and have created local social networks comprised largely of immigrants like themselves. Though their contact with written and formal language at work and in school takes place largely in English, they still spend much of their time in contact with Spanish at home and in the community. This begs many questions about what constitutes immersion, how we measure that immersion on a gradient, and whether, perhaps, processing routines for spoken language and written language, or formal versus informal registers, might also be different.

That being said, putting together corpus data and experimental psycholinguistic results in the present dissertation, we find strong evidence that grammar—which includes our mental representations of verbs and the processing routines we develop based on that information—is usage-based and as such always open to adjustments as experience and exposure to a language or languages changes over time. This dissertation provides strong evidence that second language learners are capable of recruiting native-like strategies, including sensitivity to probabilistic cues to structural preferences, to aid during online processing of their second language. This furthermore provides evidence that language acquisition and processing in a second language is not fundamentally different from those processes in one's native language, even when the second language is acquired later in life. The evidence of L1 transfer by immersed bilinguals processing cognate verbs in their second language demonstrates that even second language learners at the highest levels of proficiency have access to information and cues from their native language, which they recruit (or succumb to) when shared representations facilitate access to that information. That native-like strategies were not observed in all bilingual groups in the experiments presented herein, despite extremely high levels of proficiency among all groups, shows that proficiency as measured by traditional classroom and experimental measures is not sufficient for the development of native-like strategies. Experience with and naturalistic, contextual exposure to one's second language is an essential component to reaching native-likeness in the automatic processes associated with sentence parsing. This also provides evidence that L1 transfer is not always the crutch on which learners in the early phases lean. Rather, simplicity heuristics serve an important function in the processing of complex sentences for less-exposed learners of a language, but the use of those heuristics for processing is not a permanent state for learners. It should instead be thought of as a developmental phase in learning.

The results reported in this dissertation represent the first step in incorporating naturalistic corpus data as an integral component in the creation of psycholinguistic processing experiments. This dissertation provides valuable and novel empirical evidence of how second language learners process direct object/sentence complement ambiguities using both probabilistic cues learned from language experience and universal syntactic simplicity heuristics. It provides a series of verb biases in Spanish and English which can be used in future research, as it has been used here, to conduct studies on bilingual processing as well as the role of verb bias in processing a language other than English (Spanish), which has not been previously investigated. This dissertation also provides a framework for future research which will inevitably be needed to better understand the nature and detail of usage-based grammar, the role of language experience in developing such a grammar, as well as how such a grammar is used by learners at various phases of language development, at the moment of online language comprehension.

References

Allopenna, Paul D., James S. Magnuson, & Michael K. Tanenhaus. (1998). Tracking the Time Course of Spoken Word Recognition Using Eye Movements: Evidence for Continuous Mapping Models. *Journal of Memory and Language*, *38*, 419-439.

Altmann, G. T. M., & Kamide. Y. (1999). Incremental interpretation at verbs: Restricting the domain of subsequent reference. *Cognition*, *73(3),* 247–264.

Altmann, G. T. M., & Steedman, M. (1988). Interaction with context during human sentence processing. *Cognition*, 30, 191–238.

Altmann, G. T. M., van Nice, K. Y., Garnham, A., & Henstra, J. A. (1998). Late Closure in Context. *Journal of Memory and Language, 38(4),* 459–484.

Assche, E. V., Duyck, W., Hartsuiker, R. J., & Diependaele, K. (2009). Does Bilingualism Change Cognate Effects in a Sentence Context. *Psychological Science*, *20(8),* 923–927.

Balota, D. A., Yap, M. J., Cortese, M. J., Hutchison, K. A., Kessler, B., Loftis, B. … & Treiman, R. (2007). The English Lexicon Project. *Behavior Research Methods*, *39(3),* 445-459.

Balukas, C.P. & Dietrich, A. J. (2011). A corpus study of usage frequencies in Spanish complement-taking verbs. Paper presented at the *41st Annual Linguistic Symposium on Romance Languages (LSRL 41)*, Ottawa, Canada.

Barto-Sisamount, K., Nicol, J., Witzel, . J & Witzel, N. (2009). Transfer Effects in Bilingual Sentence Processing. *Arizona Working Papers in SLA & Teaching 16*, 1-26.

Bates, E. (1989). *Functionalism and the Competition Model. The cross-linguistic study of sentence processing.* ed. by Elizabeth Bates. New York: Cambridge University Press.

Bates, E., & MacWhinney, B. (1982). Functionalist approaches to grammar. In E. Wanner & L. Gleitman (Eds.), *Language Acquisition: The State of the Art* (pp. 173–218). New York: Cambridge University Press.

Bates, E., MacWhinney, B., & Kliegl, R. (1984). Cue Validity and Interpretation in English, Italian and German. *Journal of Verbal Learning and Verbal Behavior, 1*, 127–150.

Behney, J. (2008). L2 syntactic priming of relative clauses: Implicit learning? Paper presentation at *Second Language Skill Development: A Crosslinguistic Perspective Symposium*, Michigan State University, East Lansing, MI. As cited in Schweiter, J. *Innovative Research and Practices in Second Language Acquisition and Bilingualism* (2013). Philadelphia: John Benjamins.

Bernolet, S., & Hartsuiker, R. J. (2010). Does verb bias modulate syntactic priming? *Cognition, 114,* 455–461.

Biber, D. (1995). *Dimensions of register variation: A cross-linguistic comparison.* New York: Cambridge University Press.

bilingual. (2014). Retrieved February 16, 2014, from Merrian-Webster.com: http://www.merriam-webster.com/dictionary/bilingual

Binder, K. S., Duffy, S.A., & Rayner, K. (2001). The effects of thematic fit and discourse context on syntactic ambiguity resolution. *Journal of Memory and Language, 44*, 297-324.

Birch, S., & Clifton, C. (1995). Focus, Accent and Argument Structure: Effects on Language Comprehension. *Language and Speech, 38(4),* 365–391.

Birdsong, D. (1992). Ultimate attainment in second language acquisition. *Language, 68*, 706-755.

Bley-Vroman, R. (1988). The Fundamental Character of Foreign Language Learning. In W. Rutherford & M. Sharwood Smith (Eds.), *Grammar and Second Language Teaching* (pp. 19–30). Rowley, MA: Newbury House.

Bley-Vroman, R. (1989). What is the logical problem of foreign language learning? In S. M. Gass & J. Schachter (Eds.), *Linguistic Perspectives on Second Language Acquisition* (pp. 41–68). New York: Cambridge University Press.

Bley-Vroman, R. (2009). The Evolving Context of the Fundamental Difference Hypothesis. *Studies in Second Language Acquisition, 31(02)*, 175.

Bley-Vroman, R. (1990). The Logical Problem of Foreign Language Learning. *Linguistic Analysis, 20(1-2),* 3–63.

Blodgett, A. (2004). The Interaction of Prosodic Phrasing, Verb Bias and Plausibility during Spoken Sentence Comprehension. Columbus, Ohio: The Ohio State University. Unpublished dissertation.

Bock, J.K. (1986). Syntactic persistence in language production. *Cognitive Psychology, 18*, 355–387.

Bock, J. K., Dell, G. S., Chang, F., & Onishi, K. H. (2007). Persistent structural priming from language comprehension to language production. *Cognition, 104(3),* 437-458.

Bock, K. & Griffin, Z. M. (2000). *Journal of Experimental Psychology: General, 129(2)*, 177-192.

Boland, J. E., Tanenhaus, M. K., Carlson, G., & Garnsey, S. M. (1989). Lexical Projection and the Interaction of Syntax and Semantics in Parsing. *Journal of Psycholinguistic Research, 18(6)*, 563–576.

Bowerman, M. (1982). Evaluating competing linguistic models with language acquisition data: Implications of developmental errors with causative verbs. *Quaderni di semantica, 3,* 5-66.

Branigan, H.P., Pickering, M.J., Stewart, A.J., & McLean, J.F. (2000). Syntactic priming in spoken production: Linguistic and temporal interference. *Memory and Cognition, 28(8)*, 1297–1302.

Brent, M. R., & Cartwright, T. A. (1996). Distributional regularity and phonotactic constraints are useful for segmentation. *Cognition, 61(1-2)*, 93–125.

Bresnan, J., & Kanerva, J. (1989). Locative inversion in Chichewa. *Linguistic Inquiry 20(1)*, 50.

Brown, G. D., & Watson, F. L. (1987). First in, first out: word learning age and spoken word frequency as predictors of word familiarity and word naming latency. *Memory & Cognition, 15(3)*, 208–16.

Budiu, R., & Anderson, C. (2004). Interpretation-based processing: a unified theory of semantic sentence comprehension. *Cognitive Science, 28(1)*, 1–44.

Bybee, J. (2006). From usage to grammar: the mind's response to repetition. *Language, 82*, 711-733.

Bybee, J. (2010). *Language, Usage and Cognition*. Cambridge: Cambridge University Press.

Caplan, D., & Waters, G. S. (1999). *Verbal working memory and sentence comprehension. The Behavioral and Brain Sciences, 22(1)*, 77–94.

Chafe, W. (1994). *Discourse, Consciousness, and Time: The Flow and Displacement of Conscious Experience in Speaking and Writing*. Chicago: The University of Chicago Press.

Chambers, C. G., & Cooke, H. (2009). Lexical competition during second-language listening: sentence context, but not proficiency, constrains interference from the native lexicon. *Journal of Experimental Psychology. Learning, Memory, and Cognition, 35(4)*, 1029–40.

Chang, F. R. (1980). Active memory processes in visual sentence comprehension: clause effects and pronominal reference. *Memory & Cognition, 8(1)*, 58–64.

Chang, F., Dell, G. S., & Bock, K. (2006). Becoming syntactic. *Psychological Review, 113(2)*, 234-272.

Chang, F., Dell, G. S., Bock, K., & Griffin, Z. M. (2000). Structural priming as implicit learning: A comparison of Models of Sentence Production. *Journal of Psycholinguistic Research, 29(2)*, 217-230.

Chater, N., & Manning, C. D. (2006). Probabilistic models of language processing and acquisition. *Trends in Cognitive Sciences, 10(7)*, 335–44.

Chersi, F., Thill, S., Ziemke, T., & Borghi, A. M. (2010). Sentence processing: linking language to motor chains. *Frontiers in Neurorobotics, 4(May)*, 1–9.

Chin, H., Vaid, J., Boas, D. A., & Bortfeld, H. (2011). Examining the Phonological Neighborhood Density Effect Using Near Infrared Spectroscopy. *Human Brain Mapping, 32(9)*, 1363-1370.

Chomsky, N. (1982). *Lectures on Government and Binding: The Pisa Lectures*. Dordrecht, Holland: Foris Publications.

Chomsky, N. (1995). *The Minimalist Program*. Cambridge: MIT Press.

Clahsen, H., & Felser, C. (2006a). How native-like is non-native language processing? *Trends in Cognitive Sciences, 10(12),* 564–70.

Clahsen, H., & Felser, C. (2006b). Grammatical processing in language learners. *Applied Psycholinguistics, 27(01)*, 3–42.

Clifton, C., & Frazier, L. (1989). Comprehending sentences with long-distance dependencies. In Michael K. Tanenhaus & G. N. Carlson (Eds.), *Linguistic Structure in Language Processing* (pp. 273–317). Dordrecht, Holland: Kluwer.

Clifton, C., Frazier, L., & Connine, C. (1984). Lexical Expectations in Sentence Comprehension. *Journal of Verbal Learning and Verbal Behavior, 23,* 696–708.

Clifton, C., Jr., Staub, A., & Rayner, K. (2007). Eye movements in reading words and sentences. In R. Van Gompel, M. Fisher, W. Murray, and R. L. Hill (Eds.), *Eye movement research: A window on mind and brain* (pp. 341-372). Oxford: Elsevier Ltd.

Conrad, M., Carreiras, M., Tamm, S., & Jacobs, A. M. (2009). Syllables and Bigrams: Orthographic Redundancy and Syllabic Units Affect Visual Word Recognition at Different Processing Levels. *Journal of Experimental Psychology: Human Perception and Performance, 23*, 296-326.

Costa, A., Caramazza, A., & Sebastian-Galles, N. (2000). The cognate facilitation effect: implications for models of lexical access. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 26(5)*, 1283-1296.

Croft, W. (2001). *Radical Construction Grammar: syntactic theory in typological perspective*. Oxford: Oxford University Press.

Cuetos, F. & Mitchell, D. C. (1988). Cross-linguistic differences in parsing: Restrictions on the use of Late Closure in Spanish. *Cognition, 30(1)*, 73-105.

Davies, M. (2002-) Corpus del Español: 100 million words, 1200s-1900s. Available online at http://www.corpusdelespanol.org.

Davies, M. (2008-). The Corpus of Contemporary American English: 450 million words, 1990-present. Available online at http://corpus.byu.edu/coca/.

Davis, A. (1996). Linking and the Hierarchical Lexicon. Unpublished doctoral dissertation. Stanford University.

DeLong, K.A., Urbach, T. P., & Kutas, M. (2005). Probabilistic word pre-activation during language comprehension inferred from electrical brain activity. *Nature Neuroscience, 8(8)*, 1117–21.

Dekydtspotter, L., Schwartz, B. D., & Sprouse, R. A. (2006). The Comparative Fallacy in L2 Processing Research. . In M. Grantham O'Brien, C. Shea, & J. Archibald (Eds.), *Proceedings of the 8th Generative Approaches to Second Language Acquisition conference (GASLA 2006): The Banff Conference* (pp. 33-40). Somerville, MA: Cascadilla Press.

Demiral, S. B., Schlesewsky, M., & Bornkessel-Schlesewsky, I. (2008). On the universality of language comprehension strategies: evidence from Turkish. *Cognition, 106(1)*, 484–500.

Devescovi, A., D'Amico, S., & Gentille, P. (1999). The development of sentence comprehension in Italian: a reaction time study. *First Language, 19(56)*, 129–163.

DeVincenzi, M. (1991). *Syntactic Parsing Strategies in Italian*. Dordrecht, The Netherlands: Kluwer Academic Publishers.

DeVincenzi, M. (1996). Syntactic analysis in sentence comprehension: Effects of dependency types and grammatical constraints. *Journal of Psycholinguistic Research, 25(1)*, 117-133.

Dietrich, A. J. & Balukas, C. P. (2012). A Corpus-Study of Verb Bias in Spanish. In M. Diaz-Campos & K. Geeslin (Eds.), *Selected Proceedings of the 14th Hispanic Linguistics Symposium.* Somerville, MA: Cascadilla Proceedings Project.

Dijkstra, A., Grainger, J., & Van Heuven, W. J. B. (1999). Recognition of cognates and interlingual homographs: The neglected role of phonology. *Journal of Memory and Language, 41*, 496-518.

Dooling, D. J., Segal, E., Danks, J. H., Dumas, J. S., Lachman, R., Mistler-Lachman, J. L., & State, K. (1972). Some Context Effects in the Speeded Comprehension of Sentences. *Journal of Experimental Psychology, 28(1)*, 56–62.

Dowty, D. (1991). Thematic proto-roles and argument selection. *Language, 67*, 547–619.

DuBois, J. W. (2003). Discourse and Grammar. In M.Tomasello (Ed.) *The New Psychology of Language: Cognitive and Functional Approaches to Language Structure*, Vol. 2 (pp. 47-87). London: Erlbaum.

Dussias, P. E. (2001). Sentence Parsing in fluent Spanish-English bilinguals. In J. Nicol (Ed.), *One Mind, Two languages: Bilingual Language Processing* (pp.159-176). Cambridge: Blackwell.

Dussias, P. E., & Cramer, T. R. (2006). The role of L1 verb bias on L2 sentence parsing. In D. Bamman, T. Magnitskaia, & C. Zaller (Eds.), *Proceedings of the 30th annual Boston University conference on language development, Vol 1,* (p. 166-177). Somerville, MA: Cascadilla Press.

Dussias, P. E., & Cramer Scaltz, T. R. (2008). Spanish-English L2 speakers' use of subcategorization bias information in the resolution of temporary ambiguity during second language reading. *Acta Psychologica, 128(3)*, 501–13.

Dussias, P. E., Dietrich, A. J., & Villegas, A., (to appear). Cross-language interactions during bilingual sentence processing. In J. Schwieter (Ed.). *The Cambridge Handbook of Bilingual Language Processing.* Cambridge: Cambridge University Press.

Dussias, P. E., Marful, A., Gerfen, C., & Bajo Molina, M. T. (2010). Usage frequencies of complement-taking verbs in Spanish and English: data from Spanish monolinguals and Spanish-English bilinguals. *Behavior Research Methods, 42(4)*, 1004–11.

Dussias, P. E., & Sagarra, N. (2007). The effect of exposure on syntactic parsing in Spanish–English bilinguals. *Bilingualism: Language and Cognition, 10(01)*, 101.

Dussias, P. E., Valdés Kroff, J. R., Guzzardo Tamargo, R. E., & Gerfen, C. (2013). When gender and looking go hand in hand. *Studies in Second Language Acquisition, 35(2)*, 353-387.

Duyck, W., Assche, E. V., Drieghe, D., & Hartsuiker, R. J. (2007). Visual word recognition by bilinguals in a sentence context: evidence for nonselective lexical access. *Journal of Experimental Psychology. Learning, Memory, and Cognition, 33(4)*, 663–79.

Elman, J. L., & McClelland, J. L. (1983). Speech Perception as a Cognitive Process: The Interactive Activation Model. In N. Lass (Ed.), *Speech and Language (Vol. 10)*. New York: Academic Press.

Elsness, J. (1984). That or zero? A look at the choice of object clause connective in a corpus of American English. *English Studies, 65*, 519-533.

Elston-Güttler, K. E. (2000). An enquiry into cross-language lexical-conceptual relationships and their effect on L2 lexical processing. Unpublished doctoral dissertation, University of Cambridge.

Farmer, T. A., Christiansen, M. H., & Monaghan, P. (2006). Phonological typicality influences on-line sentence comprehension. *Proceedings of the National Academy of Sciences of the United States of America, 103(32)*, 12203–8.

Federmeier, K. D. (2007). Thinking ahead: the role and roots of prediction in language comprehension. *Psychophysiology, 44(4)*, 491–505.

Feier, C. D., & Gerstman, L. J. (1980). Sentence comprehension abilities throughout the adult life span. *Journal of Gerontology, 35(5)*, 722–8.

Ferreira, F., & Clifton, C. (1986). The independence of syntactic processing. *Journal of Memory and Language, 25(3)*, 348-368.

Ferreira, F., & Henderson, J. M. (1990). Use of Verb Information in Syntactic Parsing : Evidence from Eye Movements and Word-by-Word Self-paced Reading. *Journal of Experimental Psychology: Learning, Memory and Cognition, 16(4)*, 555–568.

Ferreira, F., Henderson, J. M., Anes, M. D., Weeks, P. A., & McFarlane, D. K. (1993). Effects of Lexical Frequency and Syntactic Complexity in Spoken-Language Comprehension : Evidence from the Auditory Moving-Window Technique. *Journal of Experimental Psychology: Learning, Memory and Cognition, 22(2)*, 324–335.

Ferreira, V. S. (2003). The processing basis of syntactic persistence: We repeat what we learn. Paper presented at the *44th Annual Meeting of the Psychonomic Society*, Vancouver, Canada.

Ferreira, V. S. & Bock, K. (2006). The functions of structural priming. *Language and Cognitive Processes, 21 (7/8)*, 1011-1029.

Fillmore, C., Kay, P. & O'Connor, C. (1988). Regularity and Idiomaticity in Grammatical Constructions: The Case of let alone. *Language, 64,* 501–38.

Foss, D. J. (1969). Decision processes during sentence comprehension: Effects of lexical item difficulty and position upon decision times. *Journal of Verbal Learning and Verbal Behavior, 8(4),* 457–462.

Foss, D., & Jenkins, C. M. (1973). Some Effects of Context on the Comprehension of Ambiguous Sentences. *Journal of Verbal Learning and Verbal Behavior, 12*, 577–589.

Foucart, A., & Frenck-Mestre, C. (2011). Grammatical gender processing in L2: Electrophysiological evidence of the effect of L1–L2 syntactic similarity. *Bilingualism: Language and Cognition, 14*, 379–399.

Foucart, A., & Frenck-Mestre, C. (2012). Can late L2 learners acquire new grammatical features? Evidence from ERPs and eye-tracking. *Journal of Memory and Language, 66(1)*, 226-248.

Frank, S. L., & Bod, R. (2011). Insensitivity of the human sentence-processing system to hierarchical structure. *Psychological Science, 22(6)*, 829–34.

Frazier, L. (1979). On comprehending sentences: syntactic parsing strategies. University of Connecticut. Unpublished dissertation.

Frazier, L. (1995). Constraint satisfaction as a theory of sentence processing. *Journal of Psycholinguistic Research, 24(6),* 437-368.

Frazier, L., & Clifton, C. (1996). *Construal.* Cambridge, MA: MIT Press.

Frazier, L. & Fodor, J. A. (1978). The sausage machine: A new two-stage parsing model. *Cognition 6*, 291-325.

Frazier, L., & Rayner, K. (1982). Making and correcting errors during sentence comprehension: Eye movements in the analysis of structurally ambiguous sentences. *Cognitive Psychology, 14(2),* 178–210.

Frenck-Mestre, C. (1999). Examining second language reading: An on-line look. In Sorace, A. et al. (Eds.), *Proceedings of the GALA 1997 Conference on Language Acquisition* (pp.474-478), Edinburgh: Human Communications Research Center.

Frenck-Mestre, C. (2002). An on-line look at sentence processing in the second language, in R. R. Heredia & J. Altarriba (Eds.), *Bilingual sentence processing* (pp. 217-236). North-Holland: Elsevier.

Frenck-Mestre, C., & Pynte, J. (1997). Reading in Second and Native Languages. *The Quarterly Journal of Experimental Psychology Section A: Human Experimental Psychology, 50A(1),* 119–148.

Friedmann, N., & Gvion, A. (2003). Sentence comprehension and working memory limitation in aphasia: A dissociation between semantic-syntactic and phonological reactivation. *Brain and Language, 86(1),* 23–39.

Gahl, S. (2002). Lexical biases in aphasic sentence comprehension: An experimental and corpus linguistic study. *Aphasiology, 16(12)*, 1173–1198.

Gahl, S., & Garnsey, S. M. (2004). Knowledge of Grammar, Knowledge of Usage: Syntactic Probabilities Affect Pronunciation Variation. *Language, 80(4),* 748–775.

Gahl, S., & Garnsey, S. M. (2006). Knowledge of Grammar Includes Knowledge of Syntactic Probabilities. *Language, 82(2),* 405–410.

Gahl, S., Jurafsky, D. & Roland, D. (2004). Verb subcategorization frequencies: American English corpus data, methodological studies, and cross-corpus comparisons. *Behavior Research Methods, Instruments & Computers, 36(3)*, 432-443.

Garnsey, S. M., Lotocky, M., Pearlmutter, N., & Myers, E. (1997). Argument structure frequency biases for 100 sentece-complement-taking verbs. Unpublished Manuscript. University of Illinois at Urbana-Champaign.

Garnsey, S. M., Pearlmutter, N. J., Myers, E., & Lotocky, M. A. (1997). The Contributions of Verb Bias and Plausibility to the Comprehension of Temporarily Ambiguous Sentences. *Journal of Memory and Language, 37(1)*, 58–93.

Garnsey, S. M., Tanenhaus, M. K., & Chapman, R. M. (1989). *Journal of Psycholinguistic Research, 18(1)*, 51–60.

Gass, S. (1987). The resolution of conflicts among competing systems: A bidirectional perspective. *Applied Psycholinguistics, 8(4),* 329-350.

Gennari, S. P., & MacDonald, M. C. (2009). Linking production and comprehension: The case of relative clauses. *Cognition, 111*, 1-23.

Gerhand, S, & Barry, C. (1999). Age of acquisition, word frequency, and the role of phonology in the lexical decision task. *Memory & Cognition, 27(4)*, 592–602.

Gerhand, Simon, & Barry, C. (1998). Word frequency effects in oral reading are not merely age-of-acquisition effects in disguise. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 24(2)*, 267–283.

Gibson, E. (1998). Linguistic complexity: Locality of syntactic dependencies. *Cognition, 68,* 1-76.

Gibson, E., Pearlmutter, N., Canseco-Gonzalez, E., & Hickok, G. (1996). Recency preference in the human sentence processing mechanism. *Cognition, 59(1)*, 23–59.

Gibson, E., & Pearlmutter, N. J. (1998). Constraints on sentence comprehension. *Trends in Cognitive Sciences, 2(7)*, 262–8.

Gillon-Dowens, M., Guo, T., Guo, J., Barber, H., & Carreiras, M. (2011). Gender and number processing in Chinese learners of Spanish–Evidence from Event Related Potentials. *Neuropsychologia, 49(7)*, 1651-1659.

Gillon Dowens, M., Vergara, N., Barber, H. A. & Carreiras. M. (2010). Morphosyntactic processing in late second-language learners. *Journal of Cognitive Neuroscience, 22(8),* 1870–1887.

Glenberg, A. M., & Kaschak, M. P. (2002). Grounding language in action. *Psychonomic Bulletin & Review, 9(3)*, 558–65.

Goldberg, A.E. (1995). *Constructions: A construction grammar approach to argument structure*. Chicago: University of Chicago Press.

Goldberg, A. E. (2006). *Constructions at Work: The Nature of Generalization in Language*. Oxford: Oxford University Press.

Goldberg, A. E., Casenhiser, D. & Sethuraman, N. (2005). The Role of Prediction in Construction Learning. *Journal of Child Language, 32*, 407-426.

González López, V. (2008). Spanish Clitic Climbing. Unpublished doctoral dissertation. The Pennsylvania State University.

Griffin, Z. M., & Bock, K. (1998). Constraint, Word Frequency, and the Relationship between Lexical Processing Levels in Spoken Word Production. *Journal of Memory and Language, 38(3),* 313–338.

Grodner, D., Gibson, E., & Watson, D. (2005). The influence of contextual contrast on syntactic processing: evidence for strong-interaction in sentence comprehension. *Cognition, 95(3),* 275–96.

Hahne, A., & Friederici, A. D. (1999). Electrophysiological evidence for two steps in syntactic analysis. Early automatic and late controlled processes. *Journal of Cognitive Neuroscience, 11(2),* 194–205.

Hale, J. (2001). A Probabilistic Earley Parser as a Psycholinguistic Model. In *Proceedings of the Second Meeting of the North American Chapter of the Asssociation for Computational Linguistics.*

Hare, M., McRae, K., & Elman, J. L. (2003). Sense and structure: Meaning as a determinant of verb subcategorization preferences. *Journal of Memory and Language, 48(2)*, 281–303.

Hare, M., McRae, K. & Elman, J. L. (2004). Admitting that admitting sense into corpus analyses makes sense. *Language and Cognitive Processes, 19(2),* 181-224.

Harley, B., Howard, J., & Hart, D. (1995). Second Language Processing at Different Ages: Do Younger Learners Pay More Attention to Prosodic Cues to Sentence Structure? *Language Learning, 45(1),* 43–71.

Harrington, M. (1987). Processing transfer: Language-specific processing strategies as a source of interlanguage variation. *Applied Psycholinguistics, 8(4),* 351-377.

Hartsuiker, R. J., Pickering, M. J., & Veltkamp, E. (2004). Is Syntax Separate or Shared Between Languages ? Cross-linguistic Syntactic Priming in Spanish-English Bilinguals. *Psychological Science, 15(6)*, 409–414.

Heilenman, L. K., & McDonald, J. L. (1993). Processing strategies in L2 learners of French: The role of transfer. *Language Learning, 43(4),* 507-557.

Hendriks, P., van Rijn, H., & Valkenier, B. (2007). Learning to reason about speakers' alternatives in sentence comprehension: A computational account. *Lingua, 117(11),* 1879–1896.

Hernández, A. E., Bates, E. A., & Avila, L. X. (1994). On-line sentence interpretation in Spanish-English bilinguals: What does it mean to be "in between"?, *Applied Psycholinguistics, 15(4),* 417-446.

Hirotani, M., Frazier, L., & Rayner, K. (2006). Punctuation and intonation effects on clause and sentence wrap-up: Evidence from eye movements. *Journal of Memory and Language, 54(3),* 425–443.

Hoeks, J. C. J., Stowe, L. A., & Doedens, G. (2004). Seeing words in context: the interaction of lexical and sentence level information during reading. *Cognitive Brain Research, 19(1),* 59–73.

Hoover, M. L., & Dwivedi, V. D. (1998). Syntactic Processing by Skilled Bilinguals. *Language Learning, 48(1)*, 1–29.

Hopp, H. (2010). Ultimate attainment in L2 inflection: Performance similarities between non-native and native speakers. *Lingua, 120*, 901-931.

Hopp, H. (2012). The on-line integration of inflection in L2 processing: Predictive processing of German Gender. In A. K. Biller, E. Y. Chung, & A. E. Kimball (Eds.), *BUCLD 36: Proceedings of the 36th annual Boston University conference on language development* (pp. 226-241). Somerville, MA: Cascadilla Press.

Hopp, H. (2013). Grammatical gender in adult L2 acquisition: Relations between lexical and syntactic variability. *Second Language Research, 29(1),* 33-56.

Jackendoff, R. (2002). *Foundations of language*. Oxford: Oxford University Press.

Jackson, C. (2008). Proficiency level and the interaction of lexical and morphosyntactic information during L2 sentence processing. *Language Learning, 58(4)*, 875-909.

Jackson, C. N., & Dussias, P. E. (2009). Cross-linguistic differences and their impact on L2 sentence processing. *Bilingualism: Language and Cognition, 12(01),* 65.

Jaeger, T. F., & Snider, N. E. (2008). Implicit learning and syntactic persistence: Surprisal and cumulativity. In *Proceedings of the 29th annual Cognitive Science Society (CogSci09)* (pp. 1061–1066). Austin,Texas: Cognitive Science Society.

Jared, D. & Kroll, J. F. (2001). Do bilinguals activate phonological representations in one or both of their languages when naming words? *Journal of Memory and Language, 44,* 2-31.

Johnson, J. S., & Newport, E. L. (1989). Critical period effects in second language learning: the influence of maturational state on the acquisition of English as a second language. *Cognitive Psychology, 21(1),* 60–99.

Juffs, A. (2005). The influence of first language on the processing of wh-movement in English as a second language. *Second Language Research, 21,* 121-151.

Jurafsky, D. (2002). Probabilistic Modeling in Psycholinguistics : Linguistic Comprehension and Production. In R. Bod, J. Hay, & S. Jannedy (Eds.), *Probabilistic Linguistics*. Cambridge, Massachusetts: MIT Press.

Jurafsky, D. (1996). A Probabilistic Model of Lexical and Syntactic Access and Disambiguation. *Cognitive Science, 20(2),* 137–194.

Just, M. A., Carpenter, P. A. & Woolley, J. D. (1982). Paradigms and processes in reading comprehension. *Journal of Experimental Psychology: General, 111(2)*, 228.

Kaan, E., Dallas, A. C., & Wijnen, F. (2010). Syntactic predictions in second-language sentence processing. In J.-W. Zwart & M. de Vries (Eds.), *Structure preserved: Studies in syntax for Jan Koster* (pp. 208–213). Amsterdam: John Benjamins.

Kamide, Y., Altmann, G. T. M., & Haywood, S. L. (2003). The time-course of prediction in incremental sentence processing: Evidence from anticipatory eye movements. *Journal of Memory and Language, 49(1)*, 133–156.

Kaplan, E., Gooidglass, H., & Weintraub, S. (1983). *Boston Naming Test*. Philadelphia: Lea and Febiger.

Kaschak, M. P., Zwaan, R. A., Aveyard, M., & Yaxley, R. H. (2006). Perception of auditory motion affects language processing. *Cognitive Science, 30(2),* 733–44.

Kennison, S. M. (2001). Limitations on the use of verb information during sentence comprehension. *Psychonomic Bulletin & Review, 8(1),* 132–8.

Kennison, S. M. (2009). The use of verb information in parsing: different statistical analyses lead to contradictory conclusions. *Journal of Psycholinguistic Research, 38(4),* 363–78.

Kidd, E., Lieven, E., & Tomasello, M. (2006). Examining the role of lexical frequency in the acquisition and processing of sentential complements. *Cognitive Development, 21(2),* 93–107.

Kohnert, K. J.; Bates, E.; Hernández. A.E. (1999). Balancing Bilinguals: Lexical-Semantic Production and Cognitive Processing in Children Learning Spanish and English. *Journal of Speech, Language, and Hearing Research, 42,* 1400-1413.

Kolbe, D. (2008). Complement clauses in British English. Unpublished doctoral dissertation, University of Trier.

Kotz, S. A. (2009). A critical review of ERP and fMRI evidence on L2 syntactic processing. *Brain and Language, 109(2),* 68-74.

Kroll, J. F., Bobb, S. C., & Wodniecka, Z. (2006). Language selectivity is the exception, not the rule: Arguments against a fixed locus of language selection in bilingual speech. *Bilingualism, 9(02),* 119.

Kroll, J. F., Dussias, P. E., Bogulski, C. A., & Valdes-Kroff, J. (2012). Juggling two languages in one mind: What bilinguals tell us about language processing and its consequences for cognition. In B. Ross (Ed.), *The Psychology of Learning and Motivation, Volume 56* (pp. 229-262). San Diego: Academic Press.

Labov, W. (1969). Contraction, deletion, and inherent variability of the English copula. *Language, 45,* 715-762.

Labov, W. (1984). Field Methods of the Project in Linguistic Change and Variation. In J. Baugh & J. Scherzer (Eds.), *Language in Use* (pp. 28-52). Upper Saddle River, New Jersey: Prentice-Hall.

Lagrou, E., Hartsuiker, R.J., & Duyck, W. (2011). Knowledge of a second language influences auditory word recognition in the native language. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 37(4)*, 952-965.

Lapata, M., Keller, S., & Schulte Im Walde, S. (2001). Verb frame frequency as a predictor of verb bias. *Journal of Psycholinguistic Research, 30*, 419-435.

Laszlo, S., & Federmeier, K. D. (2009). A Beautiful Day in the Neighborhood: An Event-Related Potential Study of Lexical Relationships and Prediction in Context. *Journal of Memory and Language, 61(3)*, 326–338.

Lee, E. K., Lu, D. H. Y., & Garnsey, S. M. (2013). L1 word order and sensitivity to verb bias in L2 processing. *Bilingualism: Language and Cognition, 16(4)*, 761-775.

Lenneberg, E. H. (1967). Biological Foundations of Language. Cambridge, MA: Wiley.

Levin, B. (1993) *English Verb Classes and Alternations: A Preliminary Investigation,* University of Chicago Press, Chicago, IL.

Levy, R. (2008). Expectation-based syntactic comprehension. *Cognition, 106(3),* 1126–77.

Lewis, R. L., Vasishth, S., & Van Dyke, J. A. (2006). Computational principles of working memory in sentence comprehension. *Trends in Cognitive Sciences, 10(10),* 447–54.

Libben, M. R., & Titone, D. A. (2009). Bilingual lexical access in context: evidence from eye movements during reading. *Journal of Experimental Psychology. Learning, Memory, and Cognition, 35(2)*, 381–90.

Liu, H., Bates, E., & Li, P. (1992). Sentence interpretation in bilingual speakers of English and Chinese. *Applied Psycholinguistics, 13(4)*, 451-484.

Lucas, M. M. (1987). Ambiguous Words in Sentence Contexts. *Language and Speech, 30(1),* 25–45.

MacDonald, M. C. (1994). Probabilistic constraints and syntactic ambiguity resolution. *Language and Cognitive Processes, 9*, 157-201.

MacDonald, M. C. (2006). Constraint satisfaction accounts of lexical and sentence comprehension. In &. M. M. J. Traxler., *Handbook of Psycholinguistics, 2nd Edition* (pp. 581-611). London: Elsevier Inc.

MacDonald, M. C., and Thornton, R. (2009). When language comprehension reflects production constraints: Resolving ambiguities with the help of past experience. *Memory & Cognition, 37,* 1177-1186.

MacDonald, M. C., Pearlmutter, N. J., & Seidenberg, M. J. (1994). Syntactic ambiguity resolution as lexical ambiguity resolution. In L. Frazier, C.Clifton, Jr. and K. Rayner (Eds.), *Perspectives on Sentence Processing.* (pp. 123-153). Hillsdale, NJ: Erlbaum.

MacDonald, M. C., Pearlmutter, N. J., & Seidenberg, M. S. (1994). Lexical Nature of Syntactic Ambiguity Resolution. *Psychological Review, 101(4),* 676–703.

MacDonald, M.C., & Seidenberg, M.S. (2006). Constraint satisfaction accounts of lexical and sentence comprehension. In M. J. Traxler & M. A. Gernsbacher (Eds.), *Handbook of Psycholinguistics, 2nd Edition* (pp. 581-611). London: Elsevier Inc.

MacDonald, M. C., & Thornton, R. (2009). When language comprehension reflects production constraints: resolving ambiguities with the help of past experience. *Memory & Cognition, 37(8)*, 1177–86.

MacWhinney, B. (1987). The Competition Model. In B. MacWhinney (Ed.), *Mechanisms of Language Acquisition* (pp. 249–308). Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

MacWhinney, B. (2012). Keynote Address. Second Language Research Forum. Carnegie Mellon University, Pittsburgh, PA.

MacWhinney, B. (1998). Models of the Emergence of Language. *Annual Review of Psychology, 49,* 199–227.

MacWhinney, B. (2005). Extending the Competition Model. *International Journal of Bilingualism, 9(7),* 69–84.

MacWhinney, B., & Bates, E. (1984). Cue Validity and Sentence Interpretation in English, German, and Italian. *Journal of Verbal Learning and Verbal Behavior, 23,* 127–150.

Marian, V., Blumenfeld, H. K., & Kaushanskaya, M. (2007). Language Experience and Proficiency Questionnaire (LEAP-Q). *Journal of Speech Language and Hearing Research, 50(4),* 940-967.

Marian, V., & Spivey, M. (2003). Competing activation in bilingual language processing: Within- and between-language competition. *Bilingualism: Language and Cognition, 6(2),* 97–115.

Marinis, T., Roberts, L., Felser, C., & Clahsen, H. (2005). Gaps in second language sentence processing. *Studies in Second Language Acquisition, 27(1),* 53-78.

Marslen-Wilson, W. D. (1973). Linguistic Structure and Speech Shadowing at Very Short Latencies. *Nature, 244*, 522-523.

Marslen-Wilson, W. D. (1975). Sentence perception as an interactive parallel process. *Science, 189*, 226-228.

Mason, R. A., & Just, M. A. (2007). Lexical ambiguity in sentence comprehension. *Brain Research, 1146*, 115–27.

McClelland, J. L., & Rumelhart, D. E. (1981). An Interactive Activation Model of Context Effects in Letter Perception: Part 1. An Account of Basic Findings. *Psychological Review, 88(5),* 375–407.

McDonald, J. L. (1987). Sentence interpretation in bilingual speakers of English and Dutch. *Applied Psycholinguistics, 8(4)*, 379-413.

McDonald, J. L., & Heilenman, L. K. (1991). Determinants of cue strength in adult first and second language speakers of French. *Applied Psycholinguistics, 12(3)*, 313-348.

McDonough, K. (2006). Interaction and syntactic priming. *Studies in Second Language Acquisition, 28*, 179-207.

McRae, K., Spivey-Knowlton, M. J., & Tanenhaus, M. K. (1998). Modeling the Influence of Thematic Fit (and Other Constraints) in On-line Sentence Comprehension. *Journal of Memory and Language, 38(3)*, 283–312.

Merlo, P. (1994). A corpus-based analysis of verb continuation frequencies for syntactic processing. *Journal of Psycholinguistic Research, 23,* 435-447.

Misyak, J. B., Christiansen, M. H., & Tomblin, J. B. (2010). Sequential Expectations: The Role of Prediction-Based Learning in Language. *Topics in Cognitive Science, 2(1),* 138–153.

Mitchell, D. C. (1987). Lexical guidance in human parsing: Locus and processing characteristics. In M. Coltheart (Ed.), *Attention and performance XII* (pp. 601–618). Hillsdale, NJ: Erlbaum.

Mitchell, D. C., & Cuetos, F. (1991). The origins of parsing strategies. In C. Smith (Ed.), *Current Issues in Natural Language Processing* (pp. 1–12). Austin, Texas: University of Texas, Center for Cognitive Science.

Morales, L., Paolieri, D., Dussias, P. E., Valdés Kroff, J., Gerfen, C. & Bajo, M. T., (submitted). The gender congruency effect during bilingual spoken-word recognition. *Journal of Experimental of Psychology: Learning, Memory, and Cognition*.

Morrison, C. M., & Ellis, A. W. (1995). Roles of word frequency and age of acquisition in word naming and lexical decision. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21(1),* 116–133.

Murray, W. S. (2006). The nature and time course of pragmatic plausibility effects. *Journal of Psycholinguistic Research, 35(1),* 79–99.

Nash, R. (1997). *NTC's Dictionary of Spanish Cognates Thematically Organized*. New York: McGraw-Hill.

Nation, K., Marshall, C. M., & Altmann, G. T. M. (2003). Investigating individual differences in children's real-time sentence comprehension using language-mediated eye movements. *Journal of Experimental Child Psychology, 86(4),* 314–329.

Newmeyer, F. J. (2005). *Possible and probable language: A generative perspective on linguistic typology.* Oxford: Oxford University Press.

Newport, E. L. (1990). Maturational constraints on language learning. *Cognitive Science, 14(1),* 11–28.

Newport, E. L. (1988). Constraints on learning and their role in language acquisition: Studies of the acquisition of American Sign Language. *Language Sciences, 10(1),* 147–172.

Oscarson, M. (1997). Self-assessment of foreign and second language proficiency. In C. Clapham & P. Corson (Eds.), *Encyclopedia of Language and Education - Vol 7: Language testing and assessment* (pp. 175-187). Dordrecht, The Netherlands: Kluwer Academic Publishing.

Otten, M., Nieuwland, M. S., & Van Berkum, J. J. A. (2007). Great expectations: specific lexical anticipation influences the processing of spoken language. *BMC Neuroscience, 8,* 326–338.

Pickering M. J., & Branigan, H. P. (1998). The representation of verbs: Evidence from syntactic priming in language production. *Journal of Memory and Language, 39(4)*, 633–651.

Pickering, M.J., & Garrod, S. (2004). Toward a mechanistic psychology of dialogue. *Behavioral and Brain Sciences, 27(2),* 169–226.

Pierrehumbert, J. (2002) Word-specific phonetics. In *Laboratory Phonology VII* (pp.101-139). Mouton de Gruyter: Berlin.

Pierrehumbert, J. (2001) Why phonological constraints are so coarse-grained. In J. McQueen and A. Cutler (Eds.) *SWAP special issue, Language and Cognitive Processes, 16 (5/6),* 691-698.

Pinker, S. (1989). *Learnability and Cognition: The acquisition of verb-argument structure*. Cambridge, MA: Harvard University Press.

Pliatsikas, C., & Marinis, T. (2013). Processing empty categories in a second language: When naturalistic exposure fills the (intermediate) gap. *Bilingualism: Language and Cognition, 16(1),* 167-182.

Quirk, R., Greenbaum, S., Leech,G., and Svartvik, J. (1985). *A comprehensive grammar of contemporary English*. New York: Longman.

Rappaport Hovav, M. & Levin, B. (1998). Building Verb Meanings. In M. Butt & W. Geuder (Eds.), *The Projection of Arguments: Lexical and Compositional Factors* (pp. 97-134). , Stanford, CA: CSLI Publications.

Rayner, Keith. (1998). Eye Movements in Reading and Information Processing: 20 Years of Research. *Psychological Bulletin, 124(3),* 372-422.

Rayner, K., Carlson, K., & Frazier, L. (1983). The Interaction of Syntax and Semantics during Sentence Processing: Eye Movements in the Analysis of Semantically Biased Sentences. *Journal of Verbal Learning and Verbal Behavior, 3(22:3),* 358.

Rayner, K., & Frazier, L. (1987). Parsing temporarily ambiguous complements. *The Quarterly Journal of Experimental Psychology A: Human Experimental Psychology, 39(4, Sect A),* 657-673.

Rayner, K., & Pollatsek, A. (1989). *The Psychology of Reading*. Hillsdale, New Jersey: Lawrence Erlbaum and Associates, Inc.

Rayner, K., Sereno, S.C., Morris, R.K., Schmauder, A.R., & Clifton, C., Jr. (1989). Eye movements and on-line language comprehension processes. *Language and Cognitive Processes, 4(SI)*, 21-49.

REAL ACADEMIA ESPAÑOLA: Banco de datos (CORDE) [en línea]. Corpus diacrónico del español. <http://www.rae.es> [2014].

Reber, Arthur S. (1989). Implicit learning and tacit knowledge. *Journal of Experimental Psychology: General, 118(3),* 219-235.

Roberts, L., & Felser, C. (2011). Plausibility and recovery from garden paths in second language sentence processing. *Applied Psycholinguistics, 32(02),* 299–331.

Román, P. E., Ray, N. R., Contemori, C., Kaan, E., & Dussias, P. E. (2013). The Role of Verb Bias and Plausibility in the Resolution of Temporarily Ambiguous Sentences: An ERP Study with English Speakers. Poster presented at the *54th Annual Meeting of the Psychonomics Society*, Toronto, Canada.

Sabourin, L., & Stowe, L. A. (2008). Second language processing: When are first and second languages processed similarly? *Second Language Research, 24(3),* 397-430.

Saffran, J. R., Newport, E. L., & Aslin, R. N. (1996). Word Segmentation : The Role of Distributional Cues. *Journal of Memory and Language, (35),* 606–621.

Sankoff, D., Tagliamonte, S. & Smith, E. (2005). Goldvarb X: A variable rule application for Macintosh and Windows. Department of Linguistics, University of Toronto. Available online at http://individual.utoronto.ca/tagliamonte/goldvarb.htm.

Sasaki, Y. (1994). Paths of processing strategy transfers in learning Japanese and English as foreign languages. *Studies in Second Language Acquisition, 16(1),* 43-72.

Savage, C., Lieven, E., Theakston, A., & Tomasello, M. (2006). Structural Priming as Implicit Learning in Language Acquisition: The Persistence of Lexical and Structural Priming in 4-year-olds. *Language Learning and Development, 2(1)*, 27-49.

Schafer, A. J. (1997). Prosodic Parsing: The Role of Prosody in Sentence Comprehension. University of Massachusetts Amherst. Unpublished dissertation.

Schneider, W., Eschman, A., & Zuccolotto, A. (2002) *E-Prime Reference Guide*. Pittsburgh: Psychology Software Tools Inc.

Schwartz, A. I., & Kroll, J. F. (2006). Bilingual lexical activation in sentence context. *Journal of Memory and Language, 55,*197-212.

Schwartz, A. I., Kroll, J. F., & Diaz, M. (2007). Reading words in Spanish and English: Mapping orthography to phonology in two languages. *Language and Cognitive Processes, 22(1)*, 106–129.

Seidenberg, M. S., & McClelland, J. L. (1989). A distributed, developmental model of word recognition and naming. Psychological Review, 96(4), 523–68.

Sinclair Knight, L. (Series Ed.)(2000). *Collins Dictionary of Español-Inglés/English-Spanish (6th edition).* New York: Harper Collins.

Speer, S. R., & Clifton, C. (1998). Plausibility and argument structure in sentence comprehension. *Memory & Cognition, 26(5),* 965–78.

Spivey, M. J., Tanenhaus, M. K., Eberhard, K. M., & Sedivy, J. C. (2002). Eye movements and spoken language comprehension: effects of visual context on syntactic ambiguity resolution. *Cognitive Psychology, 45(4),* 447–81.

Stevenson, S. (1998). Parsing as Incremental Restructuring. In J. Fodor & F. Ferreira (Eds.), *Reanalysis in Sentence Processing* (pp. 327–362).

Su, I. R. (2001). Transfer of sentence processing strategies: A comparison of L2 learners of Chinese and English. *Applied Psycholinguistics, 22(1)*, 83-112.

Tagliamonte, S. A., & Smith, J. (2005). No momentary fancy! The zero complementizer in English dialects. *English Language and Linguistics, 9(2)*, 1-12.

Tanenhaus, M K, Carlson, G., & Trueswell, J. C. (1989). The Role of Thematic Structures in Interpretation and Parsing. *Language and Cognitive Processes, 4(3/4)*, 211–234.

Tanenhaus, M. K., Spivey-Knowlton, M. J., Eberhard, K. M., & Sedivy, J. C. (1995). Integration of Visual and Linguistic Information in Spoken Language Comprehension. *Science, 268 (5217)*, 1632-1634.

Thompson, S. A. & Hopper, P. J. (1980). Transitivity in Discourse and Grammar. *Language, 56(2),* 251-299.

Thompson, S. A. & Hopper, P. J. (2001). Transitivity, clause structure, and argument structure: Evidence form conversation. In Joan Bybee & Paul J. Hopper (eds.) *Frequency and the emergence of linguistic structure,* (pp. 27-59). Amsterdam/Philadelphia: John Benjamins.

Thompson, S. A., & Mulac, A. (1991). A quantitative perspective on the grammaticalization of epistemic parentheticals in English. In B. Heine & E. C. Traugott (Eds.), *Approaches to grammaticalization, volume II,* (pp. 313-329). Amsterdam: John Benjamins.

Tomasello, M. (1992). *First verbs: A case study of early grammatical development*. Cambridge: Cambridge University Press.

Torres Cacoullos, R. & Travis, C. (2011). Testing convergence vi acode-switching: Priming and the structure of variable subject expression. *International Journal of Bilingualism, 15(3),* 241-267.

Torres Cacoullos, R., & Travis, C. E. (2014). Introduction. Gauging convergence on the ground: Codeswitching in the community. International Journal of Bilingualism.

Torres Cacoullos, R., & Walker, J.A. (2009). On the persistence of grammar in discourse formulas: a variationist study of that. *Linguistics, 47(1)*,1-43.

Traxler, M. J. (2008). Lexically independent priming in online sentence comprehension. *Psychonomic Bulletin & Review, 15(1),* 149–155.

Traxler, M. J. (2002). Plausibility and subcategorization preference in children's processing of temporarily ambiguous sentences. *The Quarterly Journal of Experimental Psychology Section A: Human Experimental Psychology, 55(1),* 75–96.

Traxler, M. J, & Pickering, M. J. (1996). Plausibility and the Processing of Unbounded Dependencies: An Eye-Tracking Study. *Journal of Memory and Language, 35,* 454–475.

Trueswell, J. C., Tanenhaus, M. K., & Kello, C. (1993). Verb-specific constraints in sentence processing: separating effects of lexical preference from garden-paths. *Journal of Experimental Psychology. Learning, Memory, and Cognition, 19(3)*, 528–53.

Trueswell, J., & Gleitman, L. (2004). Children's Eye Movements during Listening: Developmental Evidence for a Constraint-Based Theory of Sentence Processing. In J. M. Henderson & F. Ferreira (Eds.), *Interface of Vision, Language & Action* (pp. 319–346). New York: Psychology Press.

Van Assche, E., Duyck, W., Hartsuiker, R.J., & Diependaele, K. (2009). Does bilingualism change native-language reading? Cognate effects in sentence context. *Psychological Science, 20,* 923-927.

van Hell, J. G. (1998). Cross-language processing and bilingual memory organization. Unpublished doctoral dissertation, University of Amsterdam.

van Hell, J. G., & de Groot, A. M. B. (2008). Sentence context modulates visual word recognition and translation in bilinguals. *Acta Psychologica, 128(3)*, 431–51.

Weber, A., & Paris, G. (2004). The origin of the linguistic gender effect in spoken-word recognition: Evidence from non-native listening. In K. Forbus, D. Gentner, & T. Regier (Eds.), *Proceedings of the twenty-sixth annual meeting of the Cognitive Science Society* (pp. 1446-1451). Mahwah, NJ: Lawrence Erlbaum.

Wells, J. B., Christiansen, M. H., Race, D. S., Acheson, D. J., & MacDonald, M. C. (2009). Experience and sentence processing: statistical learning and relative clause comprehension. *Cognitive Psychology, 58(2),* 250–71.

Wilson, M. P., & Garnsey, S. M. (2009). Making simple sentences hard: Verb bias effects in simple direct object sentences. *Journal of Experimental Psychology. Learning, Memory, and Cognition, 60(3)*, 368–392.

Witzel, J., Witzel, N., & Nicol, J. (2012). Deeper than shallow: Evidence for structure-based parsing biases in second-language sentence processing. *Applied Psycholinguistics, 33(2),* 419-456.

Wulfeck, B., Juarez, L., Bates, E. & Kilborn, K. (1986). Sentence interpretation strategies in healthy and aphasic bilingual adults. In J. Vaid (Ed.), *Language Processing in Bilinguals: Psycholinguistic and Neuropsychological Perspectives* (pp. 199-220). Hillsdale, NJ: Lawrence Erlbaum Associates.

Yang, C. D. (2004). Universal Grammar, statistics or both? *Trends in Cognitive Sciences, 8(10)*, 451–6.

Ye, Z., & Zhou, X. (2008). Involvement of cognitive control in sentence comprehension: evidence from ERPs. *Brain Research,* 103–15.

Zwaan, R, Madden, C. J., Yaxley, R. H., & Aveyard, M. (2004). Moving words: dynamic representations in language comprehension. *Cognitive Science, 28,* 611–619.

Zwaan, R. A., & Taylor, L. J. (2006). Seeing, acting, understanding: motor resonance in language comprehension. *Journal of Experimental Psychology. General, 135(1),* 1–11.

APPENDIX A

LANGUAGE HISTORY QUESTIONNAIRE

LANGUAGE EXPERIENCE AND PROFICIENCY QUESTIONNAIRE
Dussias Lab v.1

Last Name		First Name		Age	
Gender:	Male ☐ Female ☐	Date of Birth	mm / dd / yyyy	Today's Date	mm / dd / yyyy

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

1	2	3	4	5

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

1	2	3	4	5

(3) Please list what percentage of the time you are currently and on average exposed to each language.
(*Your percentage should add up to 100%*)

List language here					
List percentage here					

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

List language here					
List percentage here					

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

List language here					
List percentage here					

(6) Please name the cultures with which you identify. On a scale from zero to ten, please rate the extent to which you identify with each culture. (Examples of possible cultures are U.S American, Chinese, Hispanic, Jewish, …)

List cultures here					
	(select here)	(select here)	(select here)	(select here)	(select here)

(7) How many years of formal education do you have? ___.
Please check your highest education level (or the approximate US equivalent to a degree obtained in abother country):

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

(8) Date of immigration to the USA, if applicable: mm / dd / yyyy
If you have ever immigrated to another country, please provide name of country and date of immigration:

Name	1.	2.	3.	4.	5.
Date	1. mm / dd / yyyy	2. mm / dd / yyyy	3. mm / dd / yyyy	4. mm / dd / yyyy	5. mm / dd / yyyy

(9) Have you ever had a vision problem ☐, hearing impairment ☐, language disability ☐, or learning disability ☐?
If yes, please explain (including any corrections): ______.

LANGUAGE:

This is my (select) language.

All questions below refer to your knowledge of .

(1) Age when you…:

Began acquiring :	Became fluent in :	Began reading in :	Became fluent reading in :

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

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

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

Speaking	(select)	Understanding	(select)	Reading	(select)

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

Interacting with friends	(select)	Language tapes/self instruction	(select)
Interacting with family	(select)	Watching TV	(select)
Reading	(select)	Listening to the radio	(select)

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

Interacting with friends	(select)	Language lab/self instruction	(select)
Interacting with family	(select)	Watching TV	(select)
Reading	(select)	Listening to the radio	(select)

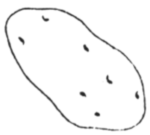
(6) In your perception, how much of a foreign accent do you have in ?
(select)

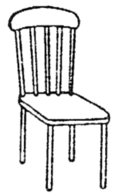
(7) Please rate how frequently others identify you as a non-native speaker based on your accent in :
(select)

APPENDIX B

PICTURE NAMING STIMULI WITH CORRECT RESPONSES (CHAPTER 2, EXP.1)

Practice A

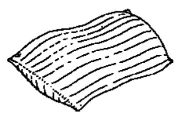

potato


chair


sock


ball

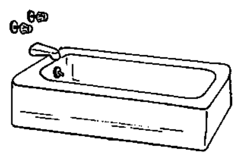

hair


pillow

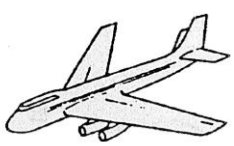

queen


glass

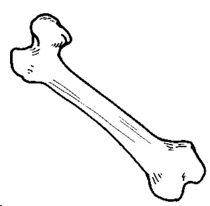

flower


(bath)tub

Block 1

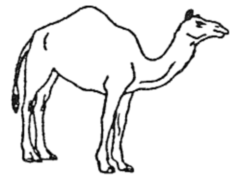

airplane

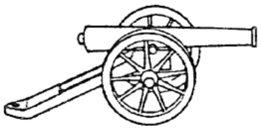

barrel

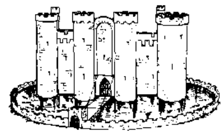

bone


brush

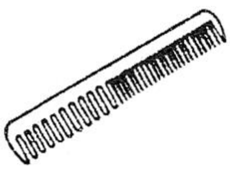

bus


camel

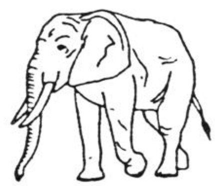

cannon


castle


clown


comb


key


elephant

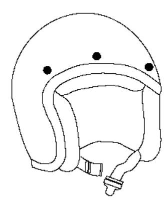

finger


flute

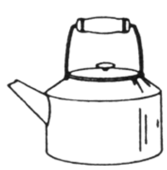

fork


giraffe


heart

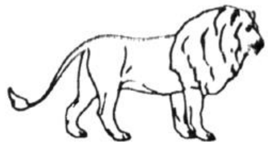

helmet


kangaroo


kettle


lamp

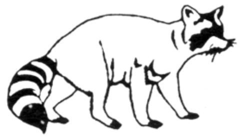

leaf

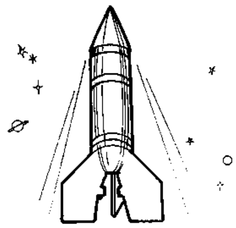

lion


moon


nail

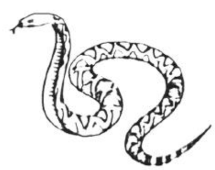

flag


raccoon


rocket


scissors

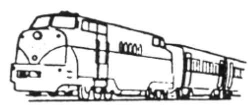

skirt


snake


spider


squirrel


onion

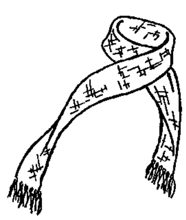

train


vase

Practice B


tear

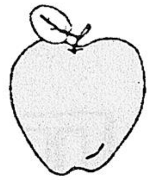

tail


scarf

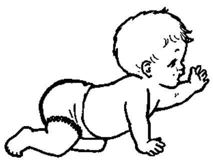

nose

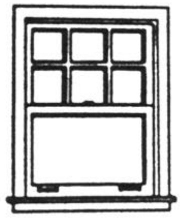

grapes


caterpillar

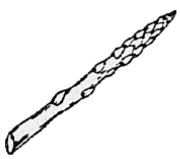

apple

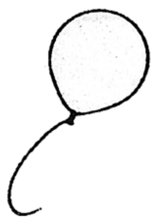

book


baby

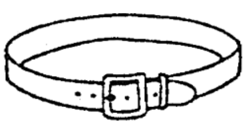

window

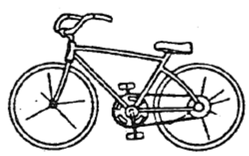
Block 2


asparagus

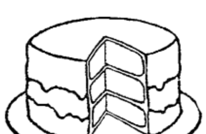

balloon

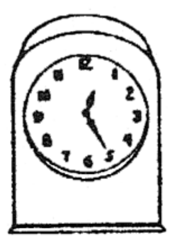

bee


belt


bicycle


bride


cake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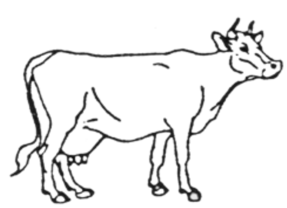
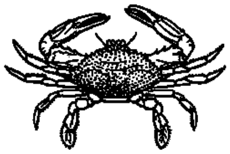
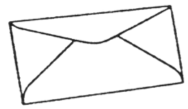
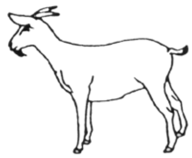

cow


crab


envelope

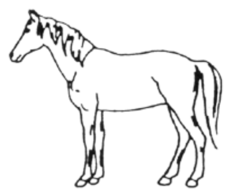

fly

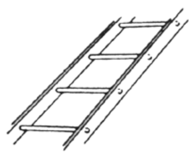

glasses


goat


guitar


hammer

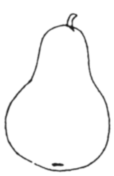

horse


ladder


lemon

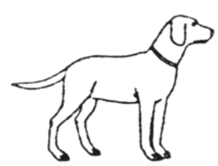

mountain


necklace

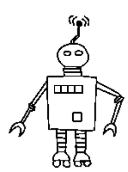

pear

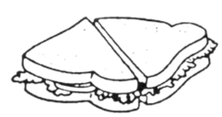

piano

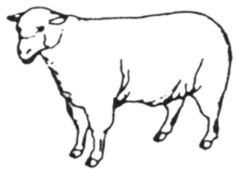
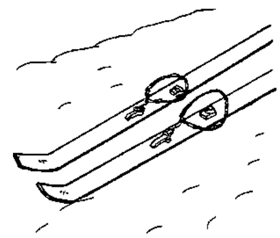

pig


dog


rabbit


robot


sandwich

 sheep  shirt  skis

 snail  spoon  tree

 tomato  violin

Appendix C

Lexical Decision Task stimuli with correct responses (Chapter 2)

Practice

short	word
love	word
chair	word
town	word
boss	word
zake	nonword
faste	nonword
noot	nonword
brike	nonword
gock	nonword

Block 1

balfs	nonword
bems	nonword
bidths	nonword
bont	nonword
bounce	word
breeze	word
broad	word
bull	word
chef	word
cise	nonword
cite	word
coob	nonword
cow	word
crime	word
cruise	word
crulls	nonword
cunks	nonword
damp	word
dauk	nonword
dayed	nonword
debt	word
dosts	nonword
drab	word
dread	word
duns	nonword
fake	word
feed	word
fierce	word
firch	nonword
five	word
flen	nonword
foot	word
forn	nonword
freech	nonword
friend	word
frig	nonword
frings	nonword
gain	word
gasp	word
gate	word
gaw	nonword
gaze	word
ghost	word
glab	nonword
glap	nonword
glink	nonword
goot	nonword
gotch	nonword
guard	word
haid	nonword
haunt	word
herp	nonword
hife	nonword
hike	word
hint	word
hook	word
horps	nonword
kick	word
lare	nonword
marn	nonword
meet	word
mess	word
mile	word
month	word
moof	nonword
move	word
phick	nonword

pint	word
pramp	nonword
pumb	nonword
reash	nonword
rhyme	word
rire	nonword
robe	word
sail	word
sart	nonword
scack	nonword
scent	word
selay	nonword
shap	nonword
shunt	word
sild	nonword
sile	nonword
sing	word
sir	word
six	word
sliss	nonword
slood	nonword
slute	nonword
soap	word
soul	word
spod	nonword
staw	nonword
suite	word
sulls	nonword
surd	nonword
sut	nonword
swarm	word
sweep	word
swoon	word
tain	nonword
tame	word
tane	nonword
tent	word
thase	nonword
theat	nonword
thooch	nonword
thop	nonword
thread	word
thrive	word
thyme	word
ton	word
tramp	word
tranch	nonword
trough	word
trunch	nonword
vals	nonword
vekd	nonword
vine	word
vow	word
wab	nonword
wade	word
wail	word
waps	nonword
wart	word
wass	nonword
wice	nonword
wig	word
wolf	word
womb	word
wots	nonword
wuck	nonword

Block 2

baults	nonword
baze	nonword
beef	word
bind	word
blacts	nonword
bley	nonword
brand	word
bruise	word
chrome	word
clant	nonword
cleape	nonword
clig	nonword
coal	word
coe	nonword
comb	word
cosh	nonword
crust	word
dead	word
desk	word
doal	nonword
drain	word
dran	nonword
driek	nonword
drown	word
durp	nonword

fame	word
filt	nonword
flotch	nonword
flutch	nonword
fock	nonword
fole	nonword
folk	word
four	word
freeze	word
fright	word
front	word
furt	nonword
game	word
gats	nonword
gift	word
gire	nonword
glims	nonword
gloil	nonword
gown	word
gows	nonword
guest	word
guide	word
gun	word
gurb	nonword
hade	nonword
halt	word
heap	word
hilk	nonword
hoist	word
hongs	nonword
hont	nonword
hood	word
kank	nonword
male	word
meep	nonword
menk	nonword
mest	nonword
mind	word
mish	nonword
mooze	nonword
most	word
pearl	word
pime	nonword
pinch	word
pond	word
rombs	nonword
roop	nonword
rope	word
route	word
safe	word
sah	nonword
saint	word
salch	nonword
salt	word
scock	nonword
seed	word
sheep	word
shove	word
shump	nonword
shurn	nonword
sice	nonword
site	word
slea	nonword
smy	nonword
soist	nonword
son	word
soup	word
spuck	nonword
suff	nonword
suts	nonword
swan	word
sway	word
sweat	word
swoop	word
sword	word
tale	word
tate	nonword
tathe	nonword
tease	word
tet	nonword
thiced	nonword
threat	word
threme	nonword
thrust	word
tilt	word
tobbed	nonword
tomb	word
tount	nonword
trance	word
tread	word
tull	nonword
vash	nonword

veil	word
void	word
vun	nonword
wad	word
wage	word
wasp	word
wast	nonword
weag	nonword
whoz	nonword
wice	nonword
wick	word
wink	word
wook	nonword
worm	word
wug	nonword

APPENDIX D

MATERIALS FOR SELF-PACED READING & EYE-TRACKING STUDIES (CHAPTER 2)

Experimental Quartets

Quartet #/Condition #/Sentence
Comprehension Question/Correct Response

1/1/The popular magician recalled the trick when he performed it on stage.	
Did the magician perform the trick at the mall?	no
1/2/The popular magician recalled the trick could be hard to perform on stage.	
Was the trick easy to perform?	no
1/3/The popular magician admitted the trick when he performed it on stage.	
Did the magician perform the trick at the mall?	no
1/4/The popular magician admitted the trick could be hard to perform on stage.	
Was the trick easy to perform?	no
2/1/The famous athlete confirmed his role when he appeared at the press conference.	
Did the athlete appear at a press conference?	yes
2/2/The famous athlete confirmed his role could be a great dismay to his family and friends.	
Did the athlete make his family proud?	no
2/3/The famous athlete admitted his role when he appeared at the press conference.	
Did the athlete appear at a press conference?	yes
2/4/The famous athlete admitted his role could be a great dismay to his family and friends.	
Did the athlete make his family proud?	no
3/1/The disillusioned archeologist recalled the facts when he was confronted by his colleagues.	
Was the archeologist confronted by his colleagues?	yes
3/2/The disillusioned archeologist recalled the facts could be refuted by his colleagues.	
Was the archeologist congratulated by his colleagues?	no
3/3/The disillusioned archeologist confessed the facts when he was confronted by his colleagues.	
Was the archeologist confronted by his colleagues?	yes
3/4/The disillusioned archeologist confessed the facts could be refuted by his colleagues.	
Was the archeologist congratulated by his colleagues?	no
4/1/The jewel thief remembered the crime when he saw it on video.	
Did the thief see the video?	yes
4/2/The jewel thief remembered the crime could be caught on video.	
Could the crime be caught on tape?	yes
4/3/The jewel thief confessed the crime when he saw it on video.	
Did the thief see the video?	yes
4/4/The jewel thief confessed the crime could be caught on video.	
Could the crime be caught on tape?	yes

5/1/The belligerent judge forgot the case when he left the courtroom.	
Did the judge stay in the courtroom?	no
5/2/The belligerent judge forgot the case could be difficult to settle.	
Was the case a difficult one?	yes
5/3/The belligerent judge decided the case when he left the courtroom.	
Did the judge stay in the courtroom?	no
5/4/The belligerent judge decided the case could be difficult to settle.	
Was the case a difficult one?	yes
6/1/The novice plumberdenied his mistake when he saw the leak.	
Did the plumber do the repair correctly?	no
6/2/The novice plumber denied his mistake could be expensive to fix.	
Did the plumber do the repair correctly?	no
6/3/The novice plumber realized his mistake when he saw the leak.	
Did the plumber do the repair correctly?	no
6/4/The novice plumber realized his mistake could be expensive to fix.	
Did the plumber do the repair correctly?	no
7/1/The talented professor asserted his love when he knew it was inappropriate.	
Was the professor's love inappropriate?	yes
7/2/The talented professor asserted his love could be viewed as inappropriate.	
Was the professor in love?	yes
7/3/The talented professor confessed his love when he knew it was inappropriate.	
Was the professor's love inappropriate?	yes
7/4/The talented professor confessed his love could be viewed as inappropriate.	
Was the professor in love?	yes
8/1/The experienced florist recalled the bouquet when she saw it at a wedding.	
Did the florist see the bouquet at the wedding?	yes
8/2/The experienced florist recalled the bouquet could be difficult to assemble.	
Was the bouquet easy to assemble?	no
8/3/The experienced florist suggested the bouquet when she saw it at a wedding.	
Did the florist see the bouquet at the wedding?	yes
8/4/The experienced florist suggested the bouquet could be difficult to assemble.	
Was the bouquet easy to assemble?	no
9/1/The American scientist advised his collaborator when he analyzed the data.	
Did the scientist work alone?	no
9/2/The American scientist advised his collaborator could be falsifying the data.	
Did the scientist suspect his collaborator was falsifying data?	yes
9/3/The American scientist suspected his collaborator when he analyzed the data.	
Did the scientist have a collaborator?	yes
9/4/The American scientist suspected his collaborator could be falsifying the data.	
Did the scientist suspect his collaborator was falsifying data?	yes

10/1/The deceived electrician warned his cousin when he discovered his money was gone.
Was all of the electrician's money where he left it? no
10/2/The deceived electrician warned his cousin could be stealing his money.
Did someone steal money from the electrician? yes
10/3/The deceived electrician suspected his cousin when he discovered his money was gone.
Was all of the electrician's money where he left it? no
10/4/The deceived electrician suspected his cousin could be stealing his money.
Did someone steal money from the electrician? yes
11/1/The bus driver warned the passengers when he started having brake problems.
Was the bus driver having brake problems? yes
11/2/The bus driver warned the passengers could be getting annoyed.
Was the bus empty? no
11/3/The bus driver worried the passengers when he started having brake problems.
Was the bus driver having brake problems? yes
11/4/The bus driver worried the passengers could be getting annoyed.
Was the bus empty? no
12/1/The expecting mother comprehended the doctor when she saw him at her appointment.
Was the mother's appointment cancelled? no
12/2/The expecting mother comprehended the doctor could be taking on too many patients.
Did the doctor have a lot of patients? yes
12/3/The expecting mother worried the doctor when she saw him at her appointment.
Was the mother's appointment cancelled? no
12/4/The expecting mother worried the doctor could be taking on too many patients.
Did the doctor have a lot of patients? yes
13/1/The Catholic cardinal asserted his beliefs when he stood before his congregation.
Did the cardinal stand in the back of the church? no
13/2/The Catholic cardinal asserted his beliefs could be accepted by others.
Could the cardinal's beliefs be accepted by others? yes
13/3/The Catholic cardinal confessed his beliefs when he stood before his congregation.
Did the cardinal stand in the back of the church? no
13/4/The Catholic cardinal confessed his beliefs could be accepted by others.
Could the cardinal's beliefs be accepted by others? yes
14/1/The thoughtful husband remembered his promise when he spoke to his wife on the phone.
Did the husband and wife speak on the phone? yes
14/2/The thoughtful husband remembered his promise would be important to his wife.
Did the husband forget his promise? no
14/3/The thoughtful husband admitted his promise when he spoke to his wife on the phone.
Did the husband and wife speak on the phone? yes
14/4/The thoughtful husband admitted his promise would be important to his wife.
Did the husband forget his promise? no

15/1/The home owner learned her fate when she faced the jury.
Did the home owner appear before the jury? yes
15/2/The home owner learned her fate could be in the hands of the jury.
Was the home owner's fate decided by a judge? no
15/3/The home owner decided her fate when she faced the jury.
Did the home owner appear before the jury? yes
15/4/The home owner decided her fate could be in the hands of the jury.
Was the home owner's fate decided by a judge? no
16/1/The prominent journalist checked her story when she got to the office that morning.
Did the journalist skip work that day? no
16/2/The prominent journalist checked her story could be printed on the front page.
Did the journalist write a story? yes
16/3/The prominent journalist suggested her story when she got to the office that morning.
Did the journalist skip work that day? no
16/4/The prominent journalist suggested her story could be printed on the front page.
Did the journalist write a story? yes
17/1/The psychology researcher checked the solution when she reviewed the problem at hand.
Did the psychology researcher discover a solution? yes
17/2/The psychology researcher checked the solution could be right for the problem at hand.
Did the psychology researcher discover a solution? yes
17/3/The psychology researcher decided the solution when she reviewed the problem at hand.
Did the psychology researcher discover a solution? yes
17/4/The psychology researcher decided the solution could be right for the problem at hand.
Did the psychology researcher discover a solution? yes
18/1/The supermarket employee denied the accusations when he was approached by his business partner. Was the employee approached by his business partner? yes
18/2/The supermarket employee denied the accusations could be made by his business partner.
Did the employee have a business partner? yes
18/3/The supermarket employee admitted the accusations when he was approached by his business partner. Was the employee approached by his business partner? yes
18/4/The supermarket employee admitted the accusations could be made by his business partner.
Did the employee have a business partner? yes
19/1/The attentive paralegal forgot the title when she was typing the document.
Did the paralegal handwrite the document? no
19/2/The attentive paralegal forgot the title could be printed in color.
Could the document be printed in black and white? no
19/3/The attentive paralegal decided the title when she was typing the document.
Did the paralegal handwrite the document? no
19/4/The attentive paralegal decided the title could be printed in color.
Could the document be printed in black and white? no

20/1/The young gardener recognized her troubles when she arrived at work that day.
Did the gardener take a vacation day? no
20/2/The young gardener recognized her troubles would be interfering with her work.
Was the gardener distracted by her troubles? yes
20/3/The young gardener realized her troubles when she arrived at work that day.
Did the gardener take a vacation day? no
20/4/The young gardener realized her troubles would be interfering with her work.
Was the gardener distracted by her troubles? yes
21/1/The expert negotiators protested the treaty when they learned of the conflict situation. Was the treaty made in peace time? no
21/2/The expert negotiators protested the treaty could be a serious problem for the entire world.
Would the treaty solve world conflicts? no
21/3/The expert negotiators suggested the treaty when they learned of the conflict situation.
Was the treaty made in peace time? no
21/4/The expert negotiators suggested the treaty could be a serious problem for the entire world.
Would the treaty solve world conflicts? no
22/1/The newspaper editor advocated the truth when she met with the mayor of the city.
Did the editor meet with the city council? no
22/2/The newspaper editor advocated the truth could be good for the public.
Did the editor want to publish the truth? yes
22/3/The newspaper editor realized the truth when she met with the mayor of the city.
Did the editor meet with the city council? no
22/4/The newspaper editor realized the truth could be good for the public.
Did the editor want to publish the truth? yes
23/1/The knowledgeable realtor insured the house when she met with the buyer.
Did the realtor meet with the seller? no
23/2/The knowledgeable realtor insured the house could be protected from flooding.
Could the house be protected from a flood? yes
23/3/The knowledgeable realtor suggested the house when she met with the buyer.
Did the realtor meet with the seller? no
23/4/The knowledgeable realtor suggested the house could be protected from flooding.
Could the house be protected from a flood? yes
24/1/The surgical nurses protested the procedure when they saw the results.
Did the nurses see the results of the procedure? yes
24/2/The surgical nurses protested the procedure could be unsafe for patients.
Was the procedure safe for patients? no
24/3/The surgical nurses suggested the procedure when they saw the results.
Did the nurses see the results of the procedure? yes
24/4/The surgical nurses suggested the procedure could be unsafe for patients.
Was the procedure safe for patients? no

25/1/The town mayor advocated the raise when he spoke to the police chief.
Did the mayor speak to the police chief? yes
25/2/The town mayor advocated the raise could be decided publicly.
Did the mayor decide on the raise by himself? no
25/3/The town mayor decided the raise when he spoke to the police chief.
Did the mayor speak to the police chief? yes
25/4/The town mayor decided the raise could be decided publicly.
Did the mayor decide on the raise by himself? no
26/1/The new salesman insured the car when he learned it had an anti-theft device.
Did the car have an anti-theft device? yes
26/2/The new salesman insured the car could be equipped with an anti-theft device.
Could the car have an anti-theft device installed? yes
26/3/The new salesman suggested the car when he learned it had an anti-theft device.
Did the car have an anti-theft device? yes
26/4/The new salesman suggested the car could be equipped with an anti-theft device.
Could the car have an anti-theft device installed? yes
27/1/The nosy neighbor confirmed the rumor when she saw her friend at the grocery store.
Did the neighbor hear a rumor? yes
27/2/The nosy neighbor confirmed the rumor could be true based on her observations.
Did the neighbor hear a rumor? yes
27/3/The nosy neighbor confessed the rumor when she saw her friend at the grocery store.
Did the neighbor hear a rumor? yes
27/4/The nosy neighbor confessed the rumor could be true based on her observations.
Did the neighbor hear a rumor? yes
28/1/The office manager advised the secretary when he noticed that she showed up late every day.
Was the secretary showing up on time? no
28/2/The office manager advised the secretary could be bothering every person there.
Was the secretary annoying? yes
28/3/The office manager suspected the secretary when he noticed that she showed up late every day.
Was the secretary showing up on time? no
28/4/The office manager suspected the secretary could be bothering every person there.
Was the secretary annoying? yes
29/1/The busy mother forgot the children when she drove them to soccer practice.
Did the mother drive the kids to soccer practice? yes
29/2/The busy mother forgot the children could be there at any moment.
Had the children already arrived? no
29/3/The busy mother worried the children when she drove them to soccer practice.
Did the mother drive the kids to baseball practice? no
29/4/The busy mother worried the children could be there at any moment.
Had the children already arrived? no

30/1/The biology student learned the facts when she met with her advisor.
Did the student meet with her classmate? no
30/2/The biology student learned the facts would be incorrectly applied to another species.
Were the facts applicable to other species? no
30/3/The biology student admitted the facts when she met with her advisor.
Did the student meet with her classmate? no
30/4/The biology student admitted the facts would be incorrectly applied to another species.
Were the facts applicable to other species? no
31/1/The district attorney warned the client when he prepared her for the witness stand.
Did the client take the witness stand? yes
31/2 The district attorney warned the client could be wrong to avoid the stand.
Did the attorney want his client to take the stand? yes
31/3/The district attorney worried the client when he prepared her for the witness stand.
Did the client take the witness stand? yes
31/4/The district attorney worried the client could be wrong to avoid the stand.
Did the attorney want his client to take the stand? yes
32/1/The kindergarten teacher advised the principal when she found out about her student's illness.
Was the student healthy? no
32/2/The kindergarten teacher advised the principal would be disappointed in her students' achievement. Did the students do well on their test? no
32/3/The kindergarten teacher worried the principal when she found out about her student's illness.
Was the student healthy? no
32/4/The kindergarten teacher worried the principal would be disappointed in her students' achievement. Did the students do well on their test? no
33/1/The taxi driver remembered the businessman when he drove him to work again the next day.
Did the businessman have the same cab driver twice? yes
33/2/The taxi driver remembered the businessman could be a difficult passenger.
Was the businessman a pleasant passenger? no
33/3/The taxi driver worried the businessman when he drove him to work again the next day.
Did the businessman have the same cab driver twice? yes
33/4/The taxi driver worried the businessman could be a difficult passenger.
Was the businessman a pleasant passenger? no
34/1/The amateur musician recognized the killer when he stepped out on the stage.
Did the musician stay backstage? no
34/2/The amateur musician recognized the killer could be among his band members.
Was the killer an actor? no
34/3/The amateur musician suspected the killer when he stepped out on the stage.
Did the musician stay backstage? no
34/4/The amateur musician suspected the killer could be among his band members.
Was the killer an actor? no
35/1/The diligent physicist comprehended the error when he discussed it with his collaborators.
Did the physicist discuss his error with others? yes
35/2/The diligent physicist comprehended the error could be changing the results of his study.
Could the error affect the results of the study? yes

35/3/The diligent physicist realized the error when he discussed it with his collaborators.
Did the physicist discuss his error with others? yes
35/4/The diligent physicist realized the error could be changing the results of his study.
Could the error affect the results of the study? yes
36/1/The make-up artist recognized her clients when she saw them on the streets.
Did the make-up artist see her clients at the grocery store? no
36/2/The make-up artist recognized her clients could be diminishing due to the bad economy.
Was the make-up artist gaining new clients? no
36/3/The make-up artist suspected her clients when she saw them on the streets.
Did the make-up artist see her clients at the grocery store? no
36/4/The make-up artist suspected her clients could be diminishing due to the bad economy.
Was the make-up artist gaining new clients? No

Filler Sentences

Filler #/Sentence
Comprehension Question/Correct Response
1/Someone shot the brother of the actress who was looking for her car when she left the party. Was the actress shot? no
2/Amelia was photographed with the sister of the boy who surfed with her friends on the weekend. Was Amelia photographed with a girl? yes
3/A student worked with the grandmother of the man who acted represented his company at the conference. Did the student work with the man's grandfather? no
4/The boys poked fun at the niece of the man who walked her dog every Thursday in the park. Did the niece walk her dog on Thursdays? yes
5/The gardener discussed the fertilizers with a niece of the man who wanted more roses in her garden. Did she want more daisies planted in her garden? no
6/Amy went skiing with the daughter of the truck driver who was annoyed with his job.
Did Amy go skiing? yes
7/The president of the oil company blamed the secretary of the man who hated her job and wanted to quit. Did the president blame the accountant? no
8/The dean interviewed the aunt of the carpenter who swims laps in his pool every morning. Does the carpenter swim laps in the morning? yes
9/The tourist took a picture of the daughter of the man who worked on her family's farm.
Did the daughter earn her living by weaving rugs? no
10/The couple brought oranges to the aunt of the elderly man who spent his summers at a lake. Did the couple vacation in Florida? Yes
11/Susan saw the son of the old woman who played his guitar on the balcony every afternoon. Did the son play his piano on the balcony? no
12/The postman gave a package to the sister of the guy who went to watch his son play baseball. Did the guy watch his son play baseball? yes

13/The baker ate cookies with the maid of the Duke who always talked about moving back to her hometown. Did the maid grow up in the same town? no

14/The lawyer wrote to the nephew of the ballerina who went to her city's local theatre every weekend. Did the ballerina have a nephew? yes

15/John ate breakfast with the sister of the monk who was overwhelmed by her many obligations to a local charity. Did John eat breakfast with a nun? no

16/The principal of the school spoke with the sister of the boy who forgot his bicycle at school. Did the boy forget his bike at school? yes

17/Yesterday Robert met the brother of the model who was photographed wearing a bikini last weekend. Did Robert meet the model's mother? no

18/The young girl gossiped with the aunt of the bullfighter who left his trophy at home. Did the bullfighter leave his trophy at home? yes

19/The lawyer handed a package of documents to the butler of the heiress who had a full beard and bright blue eyes. Did the butler have brown eyes? no

20/The journalist from the local newspaper interviewed the grandson of the maid who was caught topless at the beach. Did the maid go topless? yes

21/The usher seated the grandfather of the bride who was wearing a handsome tie for the ceremony. Was the grandfather wearing a tie? yes

22/The rude boys laughed at the grandfather of the girl who had a torn skirt in the marketplace. Did the boys laugh at the girl in the marketplace? no

23/The doctor gave the prescription to the uncle of the schoolgirl who broke her ankle playing tennis. Did the schoolgirl break her ankle? yes

24/Peter played a game with the sister of the man who was captain of the cheerleading squad in high school. Was the man's sister in the marching band? no

25/The architect called the sister of the actor who forgot his wallet at the movies. Did the architect forget his wallet at the movies? yes

27/Andrew had dinner yesterday with the nephew of the seamstress who met his future wife in Seville. Did he meet his wife in Seville? yes

28/The detective interrogated the brother of the waitress who recently gave birth to twins. Did the waitress have triplets? no

29/The mayor spoke to the father of the young woman who had won his honorary medal during the war. Did the father win an honorary medal? yes

30/The children followed the brother of the girl who rode her bicycle to school. Did the girl walk to school? No

31/Everybody at the service welcomed the brother of the nun who always walked with a cane after injuring his leg. Was the brother of the nun in a wheelchair? no

32/The cardiologists played basketball with the brother of the actress who bought her groceries at an expensive supermarket. Did the actress buy her groceries at an expensive supermarket? yes

33/At the retirement party, Daniel met the father of the hostess who was a heavyweight boxer many years ago. Was the father a bantamweight boxer? no

34/The impolite students stared at the daughter of the headmaster who drank her cup of coffee. Did the daughter drink tea? yes

35/The mayor talked with the grandfather of the fisherwoman who loved his job and had a red mustache. Was the grandfather's mustache grey? no

36/The rebels kidnapped the daughter of the king who recently gave birth to the country's first male heir. Did the rebels kidnap the princess? yes

37/The CIA director confirmed the rumor could mean a security leak.
Was the agent from the FBI? no

38/The scuba diver discovered the wreck became hidden by the reef.
Was the wreck hidden by the reef? yes

39/The cowboy that hid the pistol was known to be unreliable.
Was the cowboy unreliable? no

40/The talented photographer accepted the money might not be legally obtained.
Was the photographer concerned about the money? no

41/The hikers that fled the avalanche appeared on the six o'clock news.
Did the hikers appear on TV? yes

42/The reading instructor concluded the lesson stated its point very clearly.
Was the instructor teaching reading? yes

43/The angry residents warned the kids did not respect others' property.
Did the kids respect others' property? no

44/The divorce lawyer argued the issue involved facts outside the case.
Did the lawyer specialize in criminal cases? no

45/The weary traveler claimed the luggage would not be left alone.
Did the traveler have luggage? yes

46/The art critic wrote that the interview did not go very well.
Did the art critic write about the interview? yes

47/The primary suspect established that the alibi did not reflect the truth.
Did the police establish the alibi? no

48/The confident engineer maintained that the machinery might be easily stolen.
Could the machinery be stolen easily? yes

49/The patients that the pills cured were mentioned in the medical journal.
Were the patients mentioned in a TV program? no

50/The drug dealer that the street lamp lit stood on the corner of Oak.
Did the doctor stand of the corner of Oak? no

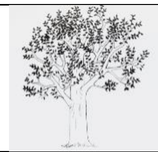
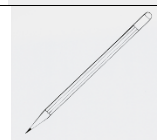
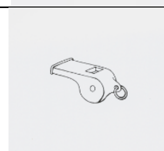
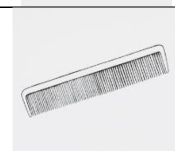
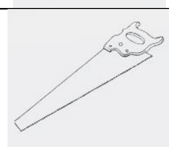
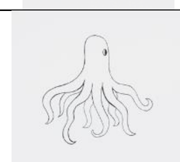
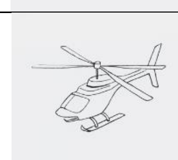
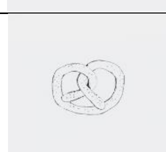
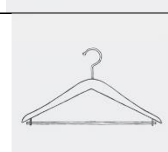
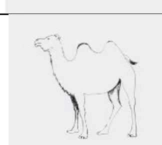
51/The experienced judge decided that the appeal should be started right away.
Was the judge experienced? yes

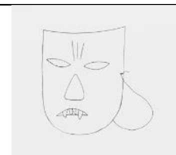
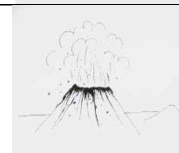
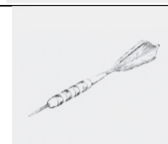
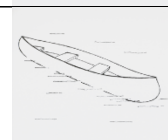
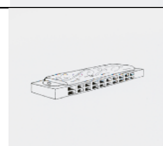
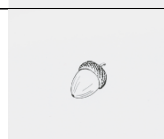
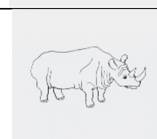
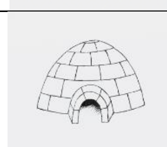
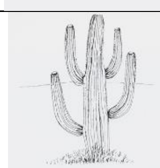
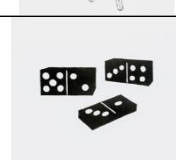
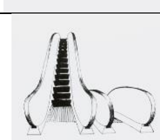
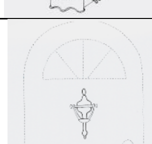
52/The kids that the pizza fed stayed in the basement all night.
Did the pizza stay in the basement all night? no

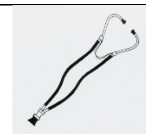
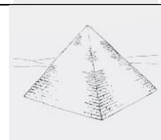
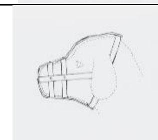
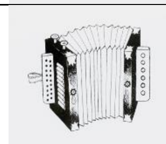
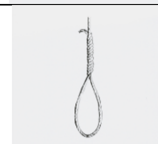
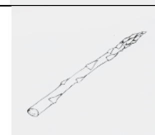
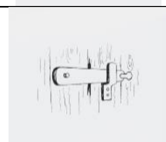
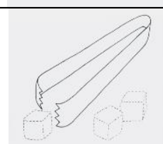
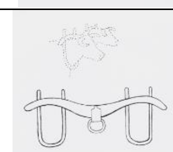
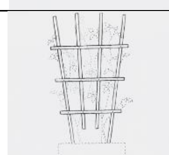
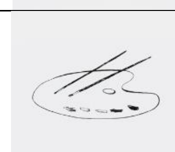
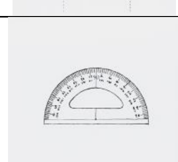
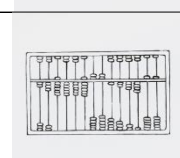
53/The senator that the article accused was forgotten after the election.
Was the senator forgotten? yes
54/The concerned congressman asserted that the belief might cause a scandal.
Was the congressman confident? no
55/The frustrated tourists understood the message despite it being spoken softly.
Was the message spoken loudly? no
56/The teaching assistant hinted the answer when the class quieted down.
Was the class quiet when the teaching assistant hinted the answer? yes
57/The car that crushed the secretary cost the insurance company a fortune.
Did the secretary get a lot of money? no
58/The elderly woman forgot the address while driving her friend home.
Did the elderly woman forget the address? yes
59/The rejected bachelor inferred the reason during one of many talks.
Was the person rejected a woman? no
60/The camp that housed the soldiers covered a large part of the forest.
Did the camp cover the majority of a park? no
61/The two hunters heard the birds while out in the forest.
Were there two hunters? yes
62/The class president assumed the burden despite talking with his colleagues.
Did the cheerleader assume the burden? no
63/The class clown pretended that the limp resulted from a serious injury.
Did the class clown have a serious injury? no
64/The fort that the soldiers occupied saved the city from the enemy.
Was the fort in a small town? no
65/The electric fan that the tourist brought was a nuisance for the maid.
Was the fan bothering the maid? yes
66/The fluid that the technician replaced filled the can next to the truck.
Was the can next to the truck? yes
67/The metal that the inspector found didn't harm the animals.
Was the metal harmless? yes
68/The tattoos that the wrestlers displayed were as ugly as they could be.
Were the tattoos pretty? no
69/The chemical that the scientist discovered came from Australia.
Was the chemical from Australia? yes
70/The bricks that the donkey carried fell over the cliff.
Did the bricks fall? yes
71/The airplane that the executive borrowed vanished into thin air.
Did the airplane land safely? no
72/The oil that the mechanic changed left a stain on the front seat.
Did the back seat have a stain? no

APPENDIX E

BOSTON NAMING TASK WITH CORRECT RESPONSES (CHAPTER 2, EXP. 2)

Block 1		Block 2	
tree		bed	
house		pencil	
whistle		comb	
flower		scissors	
saw		toothbrush	
broom		octopus	
mushroom		helicopter	
pretzel		hanger	
camel		wheelchair	

bench		mask	
racquet		snail	
seahorse		volcano	
wreath		dart	
globe		canoe	
harmonica		beaver	
acorn		rhinoceros	
igloo		stilts	
cactus		domino	
harp		escalator	
knocker		hammock	

pelican		stethoscope	
pyramid		muzzle	
funnel		unicorn	
accordion		noose/rope	
compass		asparagus	
latch		tripod	
tongs		scroll	
sphinx		yoke	
trellis		pallette	
protractor		abacus	

APPENDIX F

SPANISH GRAMMAR TEST ADAPTED FROM THE ADVANCED TEST OF THE *DIPLOMAS DE ESPAÑOL COMO LENGUA EXTRANJERA* (DELE)

DELE Test Adapted

Participante: **SECCION 1: Texto Incompleto**

<u>INSTRUCCIONES:</u>
Complete el siguiente texto eligiendo para cada uno de los huecos una de las tres opciones que se le ofrecen.

NIÑOS SALUDABLES

Los padres siempre se están preguntando cómo conseguir que sus hijos sean unos niños talentosos y sanos y las soluciones pueden estar más cerca de lo que creemos. Ni tónicos, ni vitaminas, ni cursos de lectura veloz pueden conseguir tantos resultados en los niños 1 la práctica constante de hábitos saludables, Un sueño reparador, una alimentación sabia, 2 a una actividad física constante y el control del estrés son claves a la hora de potenciar habilidades naturales de los más pequeños.

3 contrario de lo que se creía, el sueño está lejos de ser una fase de hibernación mental. 4 que se descansa es la musculatura, pero en el cerebro se inician procesos fisiológicos fundamentales 5 el adecuado funcionamiento del niño, indispensables en la prevención de 6 enfermedad. El sueño es como el supermercado de noche, al momento del 7 no se apagan las luces, 8 que se encienden muchas más para limpiar las instalaciones y reponer los productos.

No solo 9 vital para el niño dormir las horas recomendadas, también que lo 10 a la hora del crepúsculo, pues en ese momento se 11 la disminución gradual de su actividad y la cantidad de estímulos que acuden a su cerebro desciende.

En la comida están los nutrientes básicos, 12 cumplen importantes funciones estructurales. 13 nacimiento en adelante, el niño obtendrá de ahí la materia prima para formar su cerebro y organismo. Si se 14 un niño talentoso, lo primeo es aplicar en 15 mismo las normas de alimentación saludable.

Las frutas, por ejemplo, deben consumirse más 16 tres veces al día, no hay que permitir que el yogur, otro gran alimento, les 17 protagonismo en la dieta de los chicos.

A pesar de los conocimientos, padres con las mejores intenciones se han topado con la barreara del gusto. Pero la preferencia por la comida sana también se puede educar, acostumbrándolos desde pequeños y explicando el 18 siempre.

El cuerpo humano está diseñado para moverse. Pero, en la actualidad, el sedentarismo ha limitado el crecimiento intelectual y emocional. Para evitarlo es crucial que los niños 19 una actividad física constante, en forma sistemática. Lo preferible es la práctica de un deporte, por ejemplo, el tenis de mesa, que le 20 mucho al niño en términos de coordinación y estrategia.

[Adaptado de *El Mercurio*, Chile]
[Adapted from DELE test]

SECCION 2: Vocabulario

INSTRUCCIONES: elige el significado de la palabra en negrita.

21. Tengo la impresión de que los libros que yo tenía de pequeña están **dispersos** por la casa de mis padres.

elige uno

22. Estábamos en plena reunión y, **de buenas a primeras**, la directora empezó con el tema de la subida de impuestos.

elige uno

23. Es un club muy exclusivo. Tiene una **contraseña** para poder entrar en determinados días.

elige uno

24. Esa decisión es **inapelable**; ahora que, si tú quieres, puedes hablar con Juan a ver qué te dice.

elige uno

25. Es necesario **restituir** el honor de esa persona porque, si no, no querrá asistir a una reunión con todos los demás representantes.

elige uno

26. Llegamos al aeropuerto a las tres y a **duras penas** cogimos el avión, no sin antes hablar por teléfono con una de nuestras familias.

elige uno

27. Decidieron tener una conversación previa a la firma del tratado para **limar asperezas**.

elige uno

28. En medio de los exámenes el hijo de Marta tuvo un **bajonazo**: por eso sigue preparándose para ellos.

elige uno

29. La situación familiar hizo que mi abuelo **tomara cartas en el asunto** en aquella época.

elige uno

30. Con ese aspecto de **pasmado**, es el mejor escritor de su generación.

elige uno

SECCION 3: Gramática

INSTRUCCIONES: Elige la opción correcta para cada una de las siguientes oraciones.

31. En la compañía se está decidiendo estos días si __________ nuevos horarios para los trabajadores.

    elige uno

32. María no era de la opinión de que __________ todos a casa de Juan, pero al final fuimos.

    elige uno

33. En las vacaciones en Brasil gasté mucho dinero, más __________ pensaba: es que era todo tan bonito...

    elige uno

34. A Luisa le dio __________ decir que tenía sueño y se fue a casa.

    elige uno

35. No tenemos __________ idea de qué habrá podido pasar en la última jornada de Bolsa porque hemos estado de vacaciones.

    elige uno

36. Yo creo que a Carlos no le gustó nada que __________ en su casa sin avisar.

    elige uno

37. No estoy dispuesta a irme sin que __________ la verdad.

    elige uno

38. No sé si a Clara __________ han devuelto ya las maletas que perdió en el aeropuerto.

    elige uno

39. ¿Dónde han estado los chicos toda la tarde, que no los he visto?
- No sé, __________ porque mañana tienen un examen importante.

    elige uno

40. ¿Vas a asistir a la inauguración de la nueva sede?
- Si tengo tiempo, __________ hoy.

    elige uno

41. Yo __________ tú, hablaría con ella, es lo mejor para aclarar la situación.

elige uno

42. Ella le dijo que, si de verdad la __________, se lo demostrara.

elige uno

43. El hecho __________ lo eliminaron de la lista de candidatos todavía no está claro.

elige uno

44. __________ que se traslade a vivir a esta casa estará encantado con el paisaje alrededor.

elige uno

45. Nadie conseguirá aprobar ese examen __________ se prepare a conciencia: es muy duro.

elige uno

46. __________ salir de casa, se dio cuenta de que había dejado las llaves dentro.

elige uno

47. __________ haber sabido que ibais a venir, habríamos preparado más comida.

elige uno

48. Había mucha gente que quería acudir al estreno de la película, __________ decidiéramos ir otro día a verla.

elige uno

49. Cuando llegamos a la oficina __________ 15 personas esperando para hablar con nosotros.

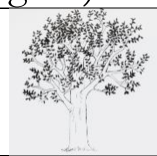
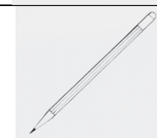
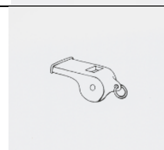
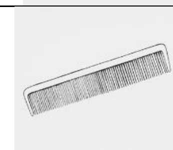
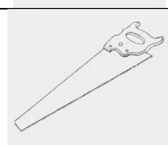
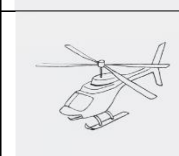
elige uno

50. Nuestros hijos ya son mayores. __________ arreglan muy bien en casa solos.

elige uno

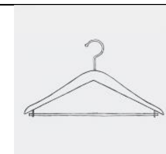
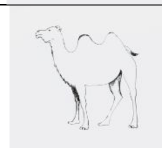
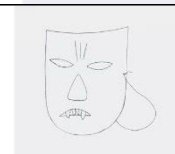
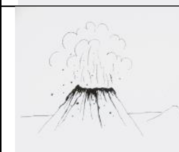
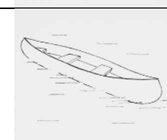
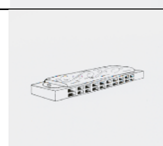
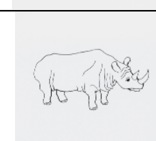
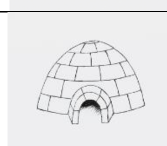
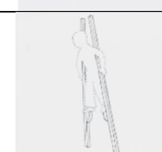
APPENDIX G

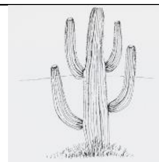
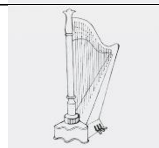
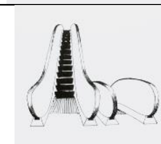
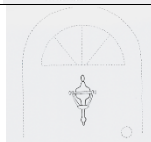
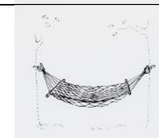
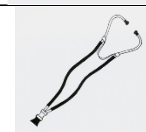
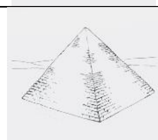
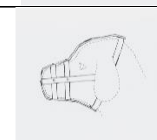
BILINGUAL BOSTON NAMING TASK WITH CORRECT RESPONSES (CHAPTER 4)

Block 1 (English)[14]		Block 2 (Spanish)[15]	
tree		cama	
house		lápiz	
whistle		peine	
flower		tijeras	
saw		cepillo de dientes	
broom		pulpo	
mushroom		helicóptero	

[14] Block 1 is identical to Block 1 in Appendix E (Chapter 2, Experiment 2). Block 2 uses the same images, but requires Spanish responses

[15] To account for dialectal differences, several correct responses were accepted for some images.

pretzel		gancho/percha/colgador	
Camel		silla de ruedas	
Bench		máscara	
racquet		caracol	
seahorse		volcán	
Wreath		dardo	
Globe		canoa/barca	
harmonica		castor	
Acorn		rinoceronte	
Igloo		zancos	

Cactus		dominos	
Harp		escalera mecánica/escalera eléctrica	
knocker		hamaca	
pelican		estetoscopio	
pyramid		bozal	
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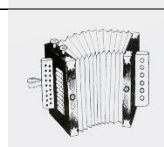
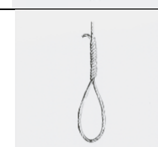
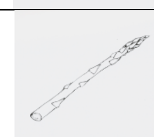
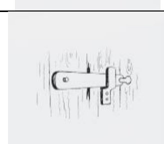
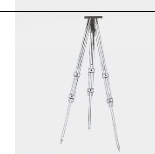
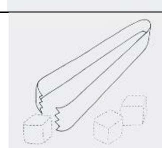
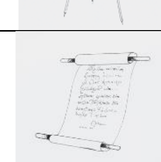
accordion		soga/cuerda/horca	
compass		espárrago	
Latch		trípode	
Tongs		papiro/pergamino	
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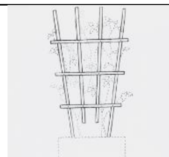
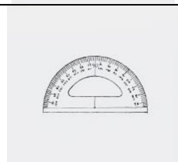
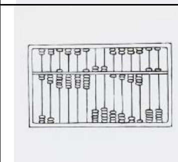
Trellis		paleta	
protractor		ábaco	

Appendix H

Lexical Decision Task (LDT) (Chapter 4)

Version A

Practice

goal	word
tet	nonword
zake	nonword
slave	word
flant	nonword
syrug	nonword
jokes	word
inflative	nonword
elbow	word
bat	word
belt	word
mevur	nonword

Test

pronting	nonword
thop	nonword
trough	word
vaning	nonword
shump	nonword
coffee	word
caven	nonword
strustion	nonword
headphones	word
kintle	nonword
camera	word
coob	nonword
firch	nonword
peoply	nonword
beak	word
coverite	nonword
melon	word
neck	word
whice	nonword
remembet	nonword
firls	nonword
lettuce	word
tunnel	word
selay	nonword
sevising	nonword
disc	word
moof	nonword
rocket	word
limit	word
toaster	word
rope	word
selun	nonword
balcony	word
tiara	word
thooch	nonword
dolphin	word
bone	word
guard	word
succension	nonword
ander	nonword
puppet	word
alphabet	word
envelope	word
incources	nonword
contility	nonword
vessel	word
irony	word
blanket	word
shoult	nonword
flen	nonword
lemon	word
wowen	nonword

begue	nonword
pea	word
bowl	word
tane	nonword
durner	nonword
weards	nonword
chrome	word
balloon	word
marint	nonword
kome	nonword
helmet	word
album	word
protage	nonword
destle	nonword
lip	word
rose	word
cleame	nonword
brike	nonword
cleape	nonword
flute	word
toilet	word
caim	nonword
forses	nonword
lobe	word
rinch	nonword
resuld	nonword
chapel	word
tathe	nonword
fork	word
violin	word
artichoke	word
alwder	nonword
mile	word
peraring	nonword
fame	word
orange	word
chalm	nonword
baby	word
letter	word
dayed	nonword
telephone	word
whill	nonword
beer	word
equipmend	nonword
stad	nonword
oval	word
parachute	word
towen	nonword

Version B

kome	nonword
begue	nonword
vessel	word
coverite	nonword
marint	nonword
telephone	word
resuld	nonword
firls	nonword
puppet	word
contility	nonword
melon	word
towen	nonword
pronting	nonword
peraring	nonword
parachute	word
rinch	nonword
coffee	word
lip	word
remembet	nonword
dayed	nonword
brike	nonword
chapel	word
mile	word
selay	nonword
flen	nonword
disc	word
caim	nonword
bone	word
guard	word

tunnel	word	vaning	nonword
artichoke	word	beer	word
stad	nonword	baby	word
violin	word	alwder	nonword
rope	word	strustion	nonword
succension	nonword	destle	nonword
balcony	word	rose	word
lettuce	word	toilet	word
alphabet	word	wowen	nonword
firch	nonword	tathe	nonword
kintle	nonword	camera	word
pea	word	durner	nonword
album	word	thooch	nonword
neck	word	orange	word
shump	nonword	sevising	nonword
shoult	nonword	headphones	word
tiara	word	irony	word
bowl	word	envelope	word
helmet	word	protage	nonword
weards	nonword	chrome	word
ander	nonword	equipmend	nonword
limit	word	oval	word
whill	nonword	trough	word
selun	nonword	cleame	nonword
beak	word	fame	word
lobe	word	blanket	word
incources	nonword	tane	nonword
forses	nonword	toaster	word
peoply	nonword	coob	nonword
lemon	word	rocket	word
letter	word	thop	nonword
cleape	nonword	chalm	nonword
caven	nonword	flute	word
balloon	word	fork	word
dolphin	word	moof	nonword
whice	nonword		

APPENDIX I

CORPUS-BASED MATERIALS FOR EYE-TRACKING STUDY (CHAPTER 4)

Experimental Quartets

Quartet #/Condition #/Sentence
Comprehension Question/Expected Response

1/1/Emily protested her story when she was confronted about lying.		
	Did Emily get confronted for telling the truth?	no
1/2/Emily protested her story had been a lie all along.		
	Did Emily admit to lying?	no
1/3/Emily confessed her story when she was confronted about lying.		
	Did Emily get confronted for telling the truth?	no
1/4/Emily confessed her story had been a lie all along. [16]		
	Was Emily telling the truth?	no
2/1/Daniel comprehended the accident when the car was found on the side of the road.		
	Was the car on the side of the road?	yes
2/2/Daniel comprehended the accident had been a set-up.		
	Was the accident a set-up?	yes
2/3/Daniel confessed the accident when the car was found on the side of the road.		
	Did Daniel confess?	yes
2/4/Daniel confessed the accident had been a set-up.		
	Was the accident a set-up?	yes
3/1/Mary proposed her knowledge when she was asked about playing a pirate in a school play.	Did Mary play a pirate once?	yes
3/2/Mary proposed her knowledge had been derived from having once played a pirate in a school play.	Did Mary play a pirate once?	yes
3/3/Mary confessed her knowledge when she was asked about playing a pirate in a school play.	Did Mary play a pirate once?	yes
3/4/Mary confessed her knowledge had been derived from having once played a pirate in a school play.	Did Mary play a pirate once?	yes
4/1/Brian protested his role when the ongoing scheme was uncovered.		
	Did Brian admit his involvement in the scheme?	no
4/2/Brian protested his role had been active in the ongoing scheme.		
	Did Brian admit his involvement in the scheme?	no
4/3/Brian confessed his role when the ongoing scheme was uncovered.		
	Was Brian's scheme complete?	no
4/4/Brian confessed his role had been active in the ongoing scheme.		
	Was Brian's scheme complete?	no

[16] Sentences indicated in **bold** are the stimuli extracted directly from the corpus.

5/1/Samantha comprehended her feelings when she realized they were counterproductive for her progress. Were Samantha's feelings productive? no
5/2/Samantha comprehended her feelings could be counterproductive for her progress. Were Samantha's feelings productive? no
5/3/Samantha confessed her feelings when she realized they were counterproductive for her progress. Did Samantha hide her feelings? no
5/4/Samantha confessed her feelings could be counterproductive for her progress. Did Samantha hide her feelings? no
6/1/Peter comprehended the board when he appeared before them at the question-and-answer session. Did Peter attend the question-and-answer session? yes
6/2/Peter comprehended the board had been nearing a decision during the question-and-answer session. Did Peter attend the question-and-answer session? yes
6/3/Peter indicated the board when he appeared before them at the question-and-answer session. Did Peter speak at the question-and-answer session? yes
6/4/Peter indicated the board had been nearing a decision during the question-and-answer session. Did Peter speak at the question-and-answer session? yes
7/1/Eric comprehended the woman when he saw Susan Dawson walk in. Did Susan Dawson walk in? yes
7/2/Eric comprehended the woman had been Susan Dawson. Was Susan Dawson the woman? yes
7/3/Eric indicated the woman when he saw Susan Dawson walk in. Did Susan Dawson walk in? yes
7/4/Eric indicated the woman had been Susan Dawson. Was Susan Dawson the woman? yes
8/1/Oliver protested the police when he noticed them on his trail. Was Oliver hidden from the police? no
8/2/Oliver protested the police would be on his trail soon. Did Oliver think the police would catch him? no
8/3/Oliver indicated the police when he noticed them on his trail. Did Oliver think he was safe from the police? no
8/4/Oliver indicated the police would be on his trail soon. Did Oliver think he was safe from the police? no
9/1/Michael proposed the information when it became clear on the screen. Did the information appear on a screen? yes
9/2/Michael proposed the information should be clear to make reading easier. Did Michael want the information to be clear? yes
9/3/Michael indicated the information when it became clear on the screen. Did the information appear on a screen? yes
9/4/Michael indicated the information should be clear to make reading easier. Did Michael want the information to be clear? yes
10/1/Andrew proposed the detergent when he was asked for advice about water systems. Did Andrews propose a broom? no
10/2/Andrew proposed the detergent would be a good choice for a water system. Did Andrew indicate that the detergent was a bad choice? no
10/3/Andrew indicated the detergent when he was asked for advice about water systems. Did Andrew indicate a broom? no
10/4/Andrew indicated the detergent would be a good choice for the water system. Did Andrew indicate that the detergent was a bad choice? no

11/1/James protested the administration when he was replaced as president of the organization. According to this report, was James replaced? yes
11/2/James protested the administration could have replaced him at any time. According to James could the administration replace him? yes
11/3/James suspected the administration when he was replaced as president of the organization. According to this report, was James replaced? yes
11/4/James suspected the administration could have replaced him at any time. According to James, could the administration replace him? yes
12/1/Julie comprehended the inconsistencies when she realized her students were struggling. Were Julie's students doing well in the class? no
12/2/Julie comprehended the inconsistencies could be caused by hearing only from struggling students. Did Julie hear from her best students? no
12/3/Julie suspected the inconsistencies when she realized her students were struggling. Were Julie's students doing well in the class? no
12/4/Julie suspected the inconsistencies could be caused by hearing only from struggling students. Did Julie hear from her best students? no
13/1/Zoe protested her mother when she found that her money was gone. Did Zoe protest? yes
13/2/Zoe protested her mother would want the money after all. Did Zoe protest? yes
13/3/Zoe suspected her mother when she found that her money was gone. Did Zoe suspect her mother of stealing the money? yes
13/4/Zoe suspected her mother would want the money after all. Did Zoe suspect her mother wanted the cash? yes
14/1/Sophie comprehended her maid when the news broke about her divorce. Did Sophie's divorce remain a secret? no
14/2/Sophie comprehended her maid was the most protected woman in all of Scotland. Was Sophie's maid in France? no
14/3/Sophie suspected her maid when the news broke about her divorce. Did Sophie's divorce remain a secret? no
14/4/Sophie suspected her maid was the most protected woman in all of Scotland. Was Sophie's maid in France? no
15/1/Ann comprehended her son when he sneaked out in the middle of the night. Did Ann's son leave the house at night? yes
15/2/Ann comprehended her son had been hiding there. Did Ann think her son was hiding? yes
15/3/Ann suspected her son when he sneaked out in the middle of the night. Did Ann's son leave the house at night? yes
15/4/Ann suspected her son had been hiding there. Did Ann think her son was hiding yes
16/1/Bill proposed the affair when he was cornered by his secretary. In this report, did Bill deny the affair? no
16/2/Bill proposed the affair had been with one of his interns. In this report, did Bill deny the affair? no
16/3/Bill confessed the affair when he was cornered by his secretary. In this report, did Bill deny the affair? no
16/4/Bill confessed the affair had been with one of his interns. Was Bill's affair with a security guard? no

17/1/Matthew protested the truth when he discovered she was pregnant.
Did Matthew doubt she was pregnant? yes
17/2/Matthew protested the truth would be hard to cover up.
Did Matthew protest? yes
17/3/Matthew confessed the truth when he discovered that she was pregnant.
Was the woman expecting a child? yes
17/4/Matthew confessed the truth would be hard to cover up.
Was the truth hard to cover up in this case? yes
18/1/William protested the robbery when he learned Ellen had also been robbed.
Had Ellen also been robbed at the time of this report? no
18/2/William protested the robbery had been an act of passion.
Is William the person who was robbed? no
18/3/William confessed the robbery when he learned Ellen had also been robbed.
Had Ellen also been robbed at the time of this report? no
18/4/William confessed the robbery had been an act of passion.
Was the robbery premeditated? no
19/1/Vincent proposed the murder would be planned seven months later.
Was Vincent planning a murder? yes
19/2/Vincent proposed the murder when he came forward seven months later.
Was Vincent planning a murder? yes
19/3/Vincent confessed the murder when he came forward seven months later.
Did Vincent commit murder? yes
19/4/Vincent confessed the crime had been planned seven months earlier.
Was Vincent planning a murder? yes
20/1/Thomas proposed his love when he called her six years later.
Did Thomas confess his love in person? no
20/2/Thomas proposed his love should not have been revealed via phone call.
Did Thomas confess his love in person? no
20/3/Thomas confessed his love when he called her six years later.
Did Thomas confess his love in person? no
20/4/Thomas confessed his love should not have been revealed via phone call.
Did Thomas confess his love in person? no
21/1/Laura comprehended the saxophonist while he played the long, haunting notes of "Summertime." Was the song "Summertime"? yes
21/2/Laura comprehended the saxophonist had been playing "Summertime" all wrong.
Was the song "Summertime"? yes
21/3/Laura indicated the saxophonist while he played the long, haunting notes of "Summertime." Was the song "Summertime"? yes
21/4/Laura indicated the saxophonist had been playing "Summertime" all wrong.
Was the song "Summertime"? yes
22/1/John proposed the house as he drove by it.
Did John propose a new car? no
22/2/John proposed the house would be finished by springtime.
Was the house already competed? no
22/3/John indicated the house as he drove by it.
Did John point out a car? no
22/4/John indicated the house would be finished by springtime.
Was the house already completed? no

23/1/Catherine proposed the need after he observed the admissions officials' strategies.
Was there a need for more effective strategies, in Catherine's opinion? yes
23/2/Catherine proposed the need would be great for admissions officials to develop effective strategies.
Was there a need for more effective strategies, in Catherine's opinion? yes
23/3/Catherine indicated the need after he observed the admissions officials' strategies.
Was there a need for more effective strategies, in Catherine's opinion? yes
23/4/Catherine indicated the need would be great for admissions officials to develop effective strategies.
Was there a need for more effective strategies, in Catherine's opinion? yes
24/1/James comprehended the woman had been a classmate of his in high school.
Did James know the woman from work? no
24/2/James comprehended the woman as he made a short thrust of his head towards the left. Did James thrust his head to the right? no
24/3/James indicated the woman had been a classmate of his in high school.
Did James know the woman from work? no
24/4/James indicated the woman as he a made short thrust of his head towards the left.
Did James thrust his head to the right? no
25/1/Essa proposed the bench as she pointed her finger out the door.
Was the bench outside? yes
25/2/Essa proposed the bench might be a nice place to sit for lunch.
Did Essa want to sit on the bench? yes
25/3/Essa indicated the bench as she pointed her finger out the door.
Was the bench outside? yes
25/4/Essa indicated the bench might be a nice place to sit.
Did Essa want to sit on the bench? yes
26/1/Andrews proposed the boyfriend when the female victim was found.
Did Andrews suspect the victim's father? no
26/2/Andrew proposed the boyfriend should be arrested when the victim was found.
Did Andrews suspect the victim's father? no
26/3/Andrews suspected the boyfriend when the female victim was found.
Did Andrews suspect the victim's father? no
26/4/Andrews suspected the boyfriend should be arrested when the victim was found.
Did Andrews suspect the victim's father? no
27/1/Louis protested the neighbors when he heard the gunshots.
Did Louis hear gunshots? yes
27/2/Louis protested the neighbors would be the ones to call the cops.
Did Louis doubt his neighbors would call the cops? yes
27/3/Louis suspected the neighbors when he heard the gunshots.
According to Louis, were the neighbors the ones firing guns? yes
27/4/Louis suspected the neighbors would be the ones to call the cops.
Would the neighbors call the cops, according to Louis? yes
28/1/Holly protested the enhancement when she saw her thick pouty lips.
Did the woman have pouty lips? yes
28/2/Holly protested the enhancement had been the reason for her pouty lips.
Did the woman have pouty lips? yes
28/3/Holly suspected the enhancement when she saw her thick, pouty lips.
Did the woman have pouty lips? yes

28/4/Holly suspected the enhancement had been the reason for her pouty lips.
Did the woman have pouty lips? yes
29/1/Murray comprehended the man when he noticed him hiding things.
Did Murray think the man was being completely honest? no
29/2/Murray comprehended the man had been hiding things from him.
Did Murray think the man was being completely honest? no
29/3/Murray suspected the man when he noticed him hiding things.
Did Murray think the man was being completely honest? no
29/4/Murray suspected the man had been hiding things from him.
Did Murray think the man was being completely honest? no
30/1/Margaret protested the reason when she visited Marcus at the farm.
Was Marcus at the farm? yes
30/2/Margaret protested the reason could be found at Marcus' farm.
Did Marcus own a farm? yes
30/3/Margaret suspected the reason when she visited Marcus at the farm.
Was Marcus at the farm? yes
30/4/Margaret suspected the reason could be found at Marcus' farm.
Did Marcus own a farm? yes
31/1/Phil protested the changes when he attended a recent school board meeting.
Did Phil protest the changes over the phone? no
31/2/Phil protested the changes would be bad for school district.
Did Phil think the changes would be good for the school? no
31/3/Phil indicated the changes when he attended a recent school board meeting.
Did Phil indicate the changes over the phone? no
31/4/Phil indicated the changes would be bad for the school district.
Did Phil think the changes would be good for the school? no
32/1/Mark protested the bill as he led a rally on the steps of the Capitol.
Was the rally on the steps of the Capitol? yes
32/2/Mark protested the bill could change the course of the nation.
Would the bill change history? yes
32/3/Mark indicated the bill as he led a rally on the steps of the Capitol.
Was the rally on the steps of the Capitol? yes
32/4/Mark indicated the bill could change the course of the nation.
Would the bill change history? yes
33/1/Paul protested the war when he moved to Houston as a special education teacher. Did Paul move to Miami? no
33/2/Paul protested the war could be detrimental to his campaign.
Did Paul think the war would benefit his campaign? no
33/3/Paul suspected the war when he moved to Houston as a special education teacher.
Did Paul move to Miami? no
33/4/Paul suspected the war could be detrimental to his campaign.
Did Paul think the war would benefit his campaign? no
34/1/David protested the point when he said that those who earn the most will save the most. Was David trying to save money? yes
34/2/David protested the point had been simply to save the most money possible.
Would the wealthiest people save the most under David's plan? yes
34/3/David confessed the point when he said that those who earn the most will save the most. Would the wealthiest people save the most under David's plan? yes
34/4/David confessed the point had been simply to save the most money possible.
Was David trying to save money? yes

35/1/Jeff protested the grade when he saw he didn't get an A on the final exam.
Did Jeff think his grade was too high? no
35/2/Jeff protested the grade would be lower than he deserved.
Did Jeff think his grade was too high? no
35/3/Jeff indicated the grade when he saw he didn't get an A on the final exam.
Did Jeff think his grade was too high? no
35/4/Jeff indicated the grade would be lower than he deserved.
Did Jeff think his grade was too high? no
36/1/Brad proposed the idea when he ran into him at Adam Sandler's holiday party in 2010. Was the idea proposed to Adam Sandler? yes
36/2/Brad proposed the idea had been Adam Sandler's in 2010.
Was it Adam Sandler's idea? yes
36/3/Brad confessed the idea when he ran into him at Adam's Sandler's holiday party in 2010. Was the idea proposed to Adam Sandler? yes
36/4/Brad confessed the idea had been Adam Sandler's in 2010.
Was it Adam Sandler's idea? yes
37/1/Benjamin proposed the merger when he appeared before Congress last February. Did Benjamin appear before Congress in April? no
37/2/Benjamin proposed the merger should be blocked by Congress.
Did Benjamin think the merger should be approved? no
37/3/Benjamin suspected the merger when he appeared before Congress last February
Did Benjamin appear before Congress in April? no
37/4/Benjamin suspected the merger would be blocked by Congress.
Did Benjamin think the merger would be approved? no
38/1/Ethan proposed the program when he spoke to the board members that morning. Did Ethan speak to the board in the morning? yes
38/2/Ethan proposed the program would solve the company's budget crisis.
Would the program intended to solve the budget crisis? yes
38/3/Ethan indicated the program when he spoke to the board members that morning.
Did Ethan speak to the board in the morning? yes
38/4/Ethan indicated the program would solve the company's budget crisis.
Would the program intended to solve the budget crisis? yes
39/1/Kevin proposed the budget when he learned of the pay raise for teachers and state workers. Was the proposed pay raise for plumbers? no
39/2/Kevin proposed the budget would be destroyed by a pay raise for teachers.
Was the proposed pay raise for plumbers? no
39/3/Kevin indicated the budget when he learned of the pay raise for teachers and state workers. Was the proposed pay raise for plumbers? no
39/4/Kevin indicated the budget would be destroyed by a pay raise for teachers.
Was the proposed pay raise for plumbers? no
40/1/Alex proposed the package after he observed a series of political and financial scandals. Did Alex observe political scandals? yes
40/2/Alex proposed the package could be the solution for a series of political and financial scandals. Might the package solve financial scandals? yes
40/3/Alex suspected the package after he observed a series of political and financial scandals. Did Alex observe political scandals? yes
40/4/Alex suspected the package could be the solution for a series of political and financial scandals. Might the package solve financial scandals? Yes

41/1/Nicholas comprehended his words when he suddenly felt something ooze between his toes. Did Nicholas understand? yes
41/2/Nicholas comprehended his words could have impact on the people around him.
Did Nicholas understand? yes
41/3/Nicholas confessed his words when he suddenly felt something ooze between his toes.
Did Nicholas confess? yes
41/4/Nicholas confessed his words could have impact on the people around him.
Did Nicholas confess? yes
42/1/Ellen comprehended the explanation when she reached the apartment.
Did Ellen go to the school? no
42/2/Ellen comprehended the explanation would be more clear in a few hours.
Was the explanation clear to Ellen immediately? no
42/3/Ellen suspected the explanation when she reached the apartment.
Did Ellen go to the school? no
42/4/Ellen suspected the explanation would be more clear in a few hours.
Was the explanation clear to Ellen immediately? no
43/1/Jonathan comprehended the tragedy when he learned she had lost her sister.
Did Jonathan lose his sister? no
43/2/Jonathan comprehended the tragedy would be hard for his sister to overcome.
Did Jonathan think his sister would get over the tragedy easily? no
43/3/Jonathan suspected the tragedy when he learned she had lost her sister.
Did Jonathan lose his sister? no
43/4/Jonathan suspected the tragedy would be hard for his sister to overcome.
Did Jonathan think his sister would get over the tragedy easily? no
44/1/Camille comprehended the text once she grasped the meanings of the unknown words. Did Camille have difficulty with some of the words? yes
44/2/Camille comprehended the text had been written long ago.
Was the text written long ago? yes
44/3/Camille indicated the text once she grasped the meanings of the unknown words.
Did Camille have difficulty with some of the words? yes
44/4/Camille indicated the text had been written long ago.
Was the text written long ago? yes
45/1/Sam comprehended the messages when they were spoken in their original Arabic. Were the messages originally in Spanish? no
45/2/Sam comprehended the messages would be clearer in their original Arabic.
Were the messages originally in Spanish? no
45/3/Sam suspected the messages when they were spoken in their original Arabic.
Were the messages originally in Spanish? no
45/4/Sam suspected the messages would be clearer in their original Arabic.
Were the messages originally in Spanish? no
46/1/Walter protested the state after they tainted his reputation.
Did the state taint Walter's reputation? yes
46/2/Walter protested the state had been unfair when it tainted his reputation.
Did the state taint Walter's reputation? yes
46/3/Walter suspected the state after they tainted his reputation.
Did the state taint Walter's reputation? yes
46/4/Walter suspected the state had been unfair when it tainted his reputation.
Did the state taint Walter's reputation? yes

47/1/Jesse protested the school when they allowed an admitted terrorist to address the students. Did the person in the report deny being a terrorist? no
47/2/Jesse protested the school had never allowed an admitted terrorist to address the students. Did the person in the report deny being a terrorist? no
47/3/Jesse suspected the school when they allowed an admitted terrorist to address the students. Did the person in the report deny being a terrorist? no
47/4/Jesse suspected the school had never allowed an admitted terrorist to address the students. Did the person in the report deny being a terrorist? no
48/1/Hank protested the bombs as he walked past the restaurant.
Did Hank protest the bombs? yes
48/2/Hank protested the bombs could have destroyed a restaurant.
Could the bombs have destroyed the restaurant? yes
48/3/Hank indicated the bombs as he walked past the restaurant.
Did Hank point out bombs? yes
48/4/Hank indicated the bombs could have destroyed a restaurant.
Could the bombs have destroyed the restaurant? yes
49/1/Jane protested the test as she complained of its unfair questions.
Was the test unfair, according to Jane? yes
49/2/Jane protested the test would be unfair because the questions were made up about things of no consequence. Was the test unfair, according to Jane? yes
49/3/Jane indicated the test as she complained of its unfair questions.
Was the test unfair, according to Jane? yes
49/4/Jane indicated the test would be unfair because the questions were made up about things of no consequence. Was the test unfair, according to Jane? yes
50/1/Steven protested her position as she was interviewed by the press.
Was Steven interviewed by the police? no
50/2/Steven protested her position had been mischaracterized by the press.
Did the press represent Steven accurately? no
50/3/Steven confessed her position as she was interviewed by the press.
Was Steven interviewed by the police? no
50/4/Steven confessed her position had been mischaracterized by the press.
Did the press represent Steven accurately? no
51/1/Fiona proposed her technique when she planned to conduct a large-scale study.
Was the technique intended for small studies? no
51/2/Fiona proposed her technique would be a useful one for conducting large-scale studies. Was the technique intended for small studies? no
51/3/Fiona confessed her technique when she planned to conduct a large-scale study.
Was the technique intended for small studies? no
51/4/Fiona confessed her technique would be a useful one for conducting large-scale studies. Was the technique intended for small studies? no
52/1/Nancy proposed the measure when she realized the city was in trouble.
Was the city in trouble? yes
52/2/Nancy proposed the measure should be passed because the city was spending too much money.
Did Nancy think the city was spending too much money? yes
52/3/Nancy indicated the measure when she realized the city was in trouble.
Was the city in trouble? yes
52/4/Nancy indicated the measure should be passed because the city was spending too much money. Did Nancy think the city was spending too much money? yes

53/1/Harry proposed the name when he saw the tumor on the x-ray.
Was Harry looking at a book? no
53/2/Harry proposed the name would more accurately reflect the origin of the tumor. Was the name given to a pet? no
53/3/Harry confessed the name when he saw the tumor on the x-ray.
Was Harry looking at a book? no
53/4/Harry confessed the name would more accurately reflect the origin of the tumor.
Was the name given to a pet? no
54/1/Frank proposed the plan when he reviewed the standards set forth in the new law.
Were the standards taken from an old law? no
54/2/Frank proposed the plan would not meet the standards set forth in the Magnus-Stevenson Act.
Did Frank think the plan would meet the standards? no
54/3/Frank confessed the plan when he reviewed the standards set forth in the new law.
Were the standards taken from an old law? no
54/4/Frank confessed the plan would not meet the standards set forth in the Magnus-Stevenson Act. Did Frank think the plan would meet the standards? no
55/1/Andy proposed the business when he tried to sell his art.
Was Andy trying to sell his art? yes
55/2/Andy proposed the business could also be great art.
According to Andy, can business be art? yes
55/3/Andy suspected the business when he tried to sell his art.
Was Andy trying to sell his art? yes
55/4/Andy suspected the business could also be great art.
According to Andy, can business be art? yes
56/1/Richard comprehended his role when the paparazzo stopped him on the street.
Did Richard get stopped by a paparazzo? yes
56/2/Richard comprehended his role could be a metaphor for the assimilating immigrant. Did Richard understand his role? yes
56/3/Richard confessed his role when the paparazzo stopped him on the street.
Did Richard confess? yes
56/4/Richard confessed his role could be a metaphor for the assimilating immigrant.
Did Richard confess? yes
57/1/Terri comprehended the changes when she was questioned at the weekly meeting.
Was everything going to stay the same? no
57/2/Terri comprehended the changes would be dire ones, but she did not react.
Would the changes be minor? no
57/3/Terri confessed the changes when she was questioned at the weekly meeting.
Was everything going to stay the same? no
57/4/Terri confessed the changes would be dire ones, but she did not react.
Would the changes be minor? no
58/1/Joshua comprehended his parents when he found his goldfish floating in the toilet.
Was Joshua's goldfish in the toilet? yes
58/2/Joshua comprehended his parents might be angry at him.
Did Joshua think his parents were angry? yes
58/3/Joshua suspected his parents when he found his goldfish floating in the toilet.
Was Joshua's goldfish in the toilet? yes
58/4/Joshua suspected his parents might be angry at him.
Did Joshua think his parents were angry? yes

59/1/Allan comprehended the book when he was asked about literature containing aquatic images. Did Allan say the book had lots of celestial images in it? no

59/2/Allan comprehended the book would be rife with aquatic images.
Did Allan say the book had lots of celestial images in it? no

59/3/Allan indicated the book when he was asked about literature containing aquatic images. Did Allan say the book had lots of celestial images in it? no

59/4/Allan indicated the book would be rife with aquatic images.
Did Allan say the book had lots of celestial images in it? no

60/1/Jeremy comprehended the plan when the interrogator appealed to his pride.
Did Jeremy misunderstand the plan when interrogated? no

60/2/Jeremy comprehended the plan had been created with such pride and cleverness. Was the plan created with shame, according to Jeremy? no

60/3/Jeremy confessed the plan when the interrogator appealed to his pride.
Did Jeremy deny the plan when interrogated? no

60/4/Jeremy confessed the plan had been created with such pride and cleverness.
Was the plan created with shame, according to Jeremy? no

Original Filler Sentences

Filler #/Sentence
Comprehension Question/Expected Response

101/Jacob estimated that cigarette smoke causes 3,800 deaths a year from lung cancer.
Were the deaths Jacob mentioned caused by car accidents? no

102/Barbara estimated the profits to be lower this year.
Did Barbara expect the profits to be higher? no

103/Christopher estimated that the shortfall would be significant.
Did Christopher expect a shortfall? yes

104/Jessica estimated that making the changes would increase annual revenue.
Was Jessica trying to increase annual revenue? yes

105/Ryan estimated that the rules will cost airlines lots of money for the next year.
Would the airlines make money from the new rules? no

106/Gregory estimated that the changes would cause housing prices to drop.
Were housing prices expected to rise? no

107/Gary estimated that he raised millions for nature conservation programs.
Was Gary raising money for nature conservation? yes

108/Susan calculated numbers that estimated immediate losses to farmers in the area.
Should the farmers expect a loss? yes

109/Karen demonstrated a financial model that was estimated without the influence of additional factors. Were additional factors considered in the model? no

110/Nicole was a director who demanded beautiful singing from her choir.
Did Nicole direct a band? no

111/Patricia demanded property from a person at a bus stop.
Did this happen at a gas station? no

112/Hillary demanded an unconditional apology for the November attack.
Did the attack occur in January? no

113/George created an emergency situation which demanded a response.
Was the situation an emergency? yes

114/Jason noted that the approach demanded by Germany was not so unique.
Was the demand from Germany unique? no
115/Christine demanded to know everything her boyfriend had lied about.
Did Christine think her boyfriend had lied? yes
116/Jenny looked at the students that demanded her attention.
Did Jenny look at students? yes
117/Carl demanded modifications to the actor's performance.
Did Carl want the actor's performance to change? yes
118/Betty demanded that her father explain what he perceived as lapses in judgment.
Did Betty demand an explanation from her father? yes
119/Natalie read the newspaper so she might be informed about what went on in the world.
Did Natalie read the newspaper? yes
120/Claire was informed that several of the children were staying behind.
Did all of the children come along? no
121/Sarah informed the public that Cambodia was still at war.
Was Cambodia still at war? yes
122/Jackie informed him of the loss with an air of tragic dignity.
Did Jackie tell him about the loss with dignity? yes
123/Adam, when informed about the test, decided to withdraw his application.
Did Adam withdraw his application? yes
124/Eric informed his colleagues that the car was not damaged in the storm.
Did Eric's car get damaged? no
125/Scott said he informed his boss of the report's conclusions immediately.
Was Scott hesitant to share the conclusions with his boss? no
126/Luke informed the jury of the new document in the case.
Was there a new document in the case? yes
127/Joan was outraged when they informed her that her practice was illegal.
Was Joan's practice legal? no
128/Edward predicted that the same thing would happen at the Olympics.
Was Edward making predictions about the Olympics? yes
129/Joseph predicted that when the budget process was finished there may be some modest improvements.
Might the end of budget process result in improvements? yes
130/Janet predicted that holding a democratic vote would end the army occupation.
Did Janet think the occupation might end? yes
131/Elizabeth predicted the closing of the wage gap between the sexes.
Did Elizabeth predict the wage gap would widen? no
132/Ross visited the doctor who predicted he would have ankle issues after the accident.
Did Ross have knee problems? no
133/Cory predicted that the meeting would go well.
Did Cory expect the meeting to go poorly? no
134/Carol predicted her condition and refused treatment.
Did Carol want to be treated? no
135/As predicted, Brian and his friends became very rich.
Is Brian rich? yes
136/Judy predicted that the woman would be involved in the arts before the end of the year.
Was the prediction for this year? yes
137/Brett announced that because of his advancing age he is resigning.
Was Brett a young man? no
138/Evan thought that the plan the president announced was the right choice.
Did Evan agree with the president? yes

139/Kate's entrance was announced by a ringing bell.
Was a telephone ringing? no
140/Vanessa hated the decision which was announced as people gathered outside the embassy.
Were people gathering outside the embassy? yes
141/Brandon received the award that was announced on Friday
Was the announcement made on Tuesday? no
142/Tim filed the complaint that announced the misuses of tax money in the government.
Was the government misusing tax money? yes
143/Lynn read the sign that announced that she was driving down Route 66.
Was Lynn on Route 66? yes
144/Michelle bought the clock that announced the hour with a loud buzzing sound.
Was the clock quiet? no
145/Owen announced that the player as eligible for selection.
Was the player eligible? yes
146/Gwen asked the children if they considered that music helped them learn.
Did Gwen ask the children a question? yes
147/Tony considered that proposal for a moment, then nodded.
Did Tony nod? yes
148/Adrienne considered that this feeling had happened many other times in her life.
Did Adrienne have this feeling before? yes
149/Derek, who considered himself a scientist, had issues with physics.
Did Derek struggle with physics? yes
150/Leah was a little girl who considered everyone a friend.
Was Leah a grown woman? no
151/Jordan considered the situation with his hands clenched on the steering wheel of the car.
Did Jordan let go of the steering wheel? no
152/Dana considered the proposition before her.
Did Dana consider the proposition? yes
153/Patrick considered that the man may be innocent.
Did Patrick think a woman was innocent? no
154/Christian considered that fact when he made his decision.
Did Christian make his decision based on instinct only? no
155/Tiffany determined that she would at least document what had happened in Turkey.
Did Tiffany document what happened in Brazil? no
156/Kelly determined that the boy was suffering from a very significant illness.
Was the boy's illness serious? yes
157/Chelsea addressed the voters who determined the outcome of the elections.
Did Chelsea talk to the voters? yes
158/Abigail administered the test which determined if there was a different between the two systems.
Did Abigail administer the test herself? yes
159/April listed the factors that determined the risk for infection.
Was April listing factors for recovery? no
160/Lily determined which practices were supported by research.
Were the practices supported by research? yes
161/Jack determined that the homes would not stand up to a hurricane.
Would the homes stand against a hurricane? no
162/Justin determined if any of the manuals contained a sample of children with disabilities.
Was Justin looking for samples of children without disabilities? no
163/Noah determined the area was lacking in stores that sell fresh food.
Did the area have plenty of store selling fresh food? no

Additional Filler Sentences

Filler #/Sentence
Comprehension Question/Expected Response

171F/The tattoos that Dominic displayed were as ugly as they could be.
Were the tattoos pretty? no
172F/The oil that Jimmy changed left a stain on the front seat.
Did the back seat have a stain? no
173F/The airplane that Donald borrowed vanished into thin air.
Did the airplane land safely? no
174F/The exam that Sharon gave took three hours to complete.
Was the exam short? no
175F/The electric fan that Lucy brought was a nuisance for the maid.
Was the fan bothering the maid? no
176F/The fluid that Ray replaced filled the can next to the truck.
Was the can next to the truck? yes
177F/The metal that Tori found didn't harm the animals.
Was the metal harmless? yes
178F/The mineral that Phillip discovered came from Australia.
Was the mineral from Australia? yes
179F/The bricks that Dora carried fell over the cliff.
Did the bricks fall? yes
180F/Carrie dropped her tray on the brother of the princess who wore a top hat to the special dinner. Did Carrie drop her tray on the princess? no
181F/Scott ate cookies with the maid of the Duke who always talked about moving back to her hometown. Did the maid grow up in the same town? no
182F/Liam welcomed the brother of the nun who always walked with a cane after injuring his leg.
Was the brother of the nun in a wheelchair? no
183F/Dexter talked with the grandfather of the fisherwoman who loved his job and had a red mustache. Was the grandfather's mustache grey? no
184F/Dennis blamed the secretary of the man who hated her job and wanted to quit.
Did Dennis blame the accountant? no
185F/Kenneth ate breakfast with the sister of the monk who was overwhelmed by her obligations.
Did Kenneth eat breakfast with a nun? no
186F/Ricky handed a package of documents to the butler of the heiress who had a full beard.
Did the butler have a goatee? no
187F/Linda played a game with the sister of the boy who was captain of the cheerleading squad.
Was the boy's sister in the marching band? no
188F/Dorothy discussed the fertilizers with a niece of the man who wanted more roses in her garden. Did she want more daisies planted in her garden? no
189F/Helen took a picture of the daughter of the farmer who worked on her family's farm.
Did the daughter earn her living by weaving rugs? no
190F/Sandra met the father of the hostess who was a heavyweight boxer.
Was the father a bantamweight boxer? no
191F/Ruth kidnapped the daughter of the king who recently gave birth to the country's first heir.
Did Ruth kidnap the princess? yes
192F/Donna stared at the daughter of the headmaster who drank her cup of coffee.
Did the daughter drink coffee? yes

193F/Carol saw the son of the old woman who played his guitar on the balcony every afternoon.
Did the son play his guitar on the balcony? yes
194F/Becky spoke to the father of the young woman who had won his medal during the war.
Did the father win an honorary medal? yes
195F/Kimberly had dinner with the nephew of the seamstress who met his future wife in Seville.
Did the nephew meet his wife in Seville? yes
196F/Deborah poked fun at the niece of the man who walked her dog in the park.
Did the niece walk her dog in the park? yes
197F/Roger was photographed with the sister of the boy who surfed with her friends on the weekend. Was Randy photographed with a girl? yes
198F/Randy followed the brother of the girl who rode her bicycle to school.
Did the girl walk to school? no
199F/Evan interrogated the brother of the waitress who recently gave birth to twins.
Did the waitress have triplets? no
200F/Britney laughed at the grandfather of the girl who had a torn skirt.
Did Britney laugh at the girl's torn blue jeans? no
201F/Bridget shot the brother of the actress who was looking for her car when she left the party.
Was the actress shot? no
202F/Katelyn worked with the grandmother of the man who represented his company at the conference. Did Katelyn work with the man's grandfather? no
203F/Lindsey called the sister of the actor who forgot his wallet at the movies.
Did the director forget his wallet at the movies? no
204F/Leslie met the brother of the model who was photographed wearing a bikini last weekend.
Did Leslie meet the model's mother? no
205F/Edith seated the grandfather of the bride who was wearing a handsome tie for the ceremony.
Was the grandfather wearing a tie? yes
206F/Zachary played basketball with the brother of the actress who bought her groceries at an expensive supermarket.
Did the actress buy her groceries at an expensive supermarket? yes
207F/Colin spoke with the sister of the boy who forgot his bicycle at school.
Did the boy forget his bike at school? yes
208F/Mark interviewed the aunt of the carpenter who swims laps in his pool every morning.
Does the carpenter swim laps in the morning? yes
209F/Sadie gossiped with the aunt of the bullfighter who left his trophy at home.
Did the bullfighter leave his trophy at home? yes
210F/Noah interviewed the grandson of the maid who was caught topless.
Did the maid go topless? yes
211F/Elliott wrote to the nephew of the ballerina who went to her local theatre every weekend. Did the ballerina have a nephew? yes
212F/Grace went skiing with the daughter of the truck driver who was annoyed with his job.
Did Grace go skiing? yes
213F/Harriet brought oranges to the aunt of the man who spent his summers at a lake.
Did Harriet bring oranges? yes
214F/Annabelle gave a package to the sister of the guy who went to his son's baseball game.
Did the guy watch his son play baseball? yes
215F/Toby gave the prescription to the uncle of the schoolgirl who broke her ankle playing tennis.
Did the schoolgirl break her ankle? yes

APPENDIX J

ANOVA TABLES FOR ANALYSIS OF ALL TRIALS

Gaze Duration

Descriptive Statistics

	group	Mean	Std. Deviation	N
DO bias + NP	1	164.8868	116.15285	34
	2	224.3088	157.19671	34
	3	288.0017	117.72636	30
	Total	223.1908	140.11171	98
DO bias + clause	1	141.1338	100.77334	34
	2	200.3122	108.44636	34
	3	261.1811	120.27581	30
	Total	198.4142	118.95657	98
SC bias + NP	1	175.6615	73.06146	34
	2	209.3867	87.54728	34
	3	292.2366	121.30893	30
	Total	223.0484	105.62266	98
SC bias + clause	1	149.9908	67.15848	34
	2	206.8844	79.80817	34
	3	248.5552	78.83123	30
	Total	199.9022	84.74423	98

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
bias	Pillai's Trace	.000	.004[b]	1.000	95.000	.948	.000	.004	.050
	Wilks' Lambda	1.000	.004[b]	1.000	95.000	.948	.000	.004	.050
	Hotelling's Trace	.000	.004[b]	1.000	95.000	.948	.000	.004	.050
	Roy's Largest Root	.000	.004[b]	1.000	95.000	.948	.000	.004	.050
bias * group	Pillai's Trace	.009	.410[b]	2.000	95.000	.665	.009	.819	.115
	Wilks' Lambda	.991	.410[b]	2.000	95.000	.665	.009	.819	.115
	Hotelling's Trace	.009	.410[b]	2.000	95.000	.665	.009	.819	.115
	Roy's Largest Root	.009	.410[b]	2.000	95.000	.665	.009	.819	.115
cont	Pillai's Trace	.083	8.572[b]	1.000	95.000	.004	.083	8.572	.826
	Wilks' Lambda	.917	8.572[b]	1.000	95.000	.004	.083	8.572	.826
	Hotelling's Trace	.090	8.572[b]	1.000	95.000	.004	.083	8.572	.826
	Roy's Largest Root	.090	8.572[b]	1.000	95.000	.004	.083	8.572	.826
cont * group	Pillai's Trace	.012	.571[b]	2.000	95.000	.567	.012	1.141	.142
	Wilks' Lambda	.988	.571[b]	2.000	95.000	.567	.012	1.141	.142
	Hotelling's Trace	.012	.571[b]	2.000	95.000	.567	.012	1.141	.142
	Roy's Largest Root	.012	.571[b]	2.000	95.000	.567	.012	1.141	.142
bias * cont	Pillai's Trace	.000	.003[b]	1.000	95.000	.956	.000	.003	.050
	Wilks' Lambda	1.000	.003[b]	1.000	95.000	.956	.000	.003	.050
	Hotelling's Trace	.000	.003[b]	1.000	95.000	.956	.000	.003	.050
	Roy's Largest Root	.000	.003[b]	1.000	95.000	.956	.000	.003	.050
bias * cont * group	Pillai's Trace	.010	.469[b]	2.000	95.000	.627	.010	.939	.125
	Wilks' Lambda	.990	.469[b]	2.000	95.000	.627	.010	.939	.125
	Hotelling's Trace	.010	.469[b]	2.000	95.000	.627	.010	.939	.125
	Roy's Largest Root	.010	.469[b]	2.000	95.000	.627	.010	.939	.125

a. Design: Intercept + group
Within Subjects Design: bias + cont + bias * cont

b. Exact statistic

c. Computed using alpha = .05

Total times

Descriptive Statistics

	group	Mean	Std. Deviation	N
DO bias + NP	1	311.1294	186.50209	34
	2	464.4757	222.32765	34
	3	496.0492	280.36335	30
	Total	420.9393	242.45712	98
DO bias + clause	1	264.9501	170.62433	34
	2	428.1660	221.28722	34
	3	422.9070	254.07396	30
	Total	369.9302	227.55827	98
SC bias + NP	1	346.1520	161.80593	34
	2	496.9488	201.92543	34
	3	547.3451	302.53385	30
	Total	460.0590	239.84036	98
SC bias + clause	1	303.0165	147.45963	34
	2	435.0532	191.03506	34
	3	392.7675	154.76638	30
	Total	376.2999	173.63910	98

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
bias	Pillai's Trace	.032	3.165[b]	1.000	95.000	.078	.032	3.165	.421
	Wilks' Lambda	.968	3.165[b]	1.000	95.000	.078	.032	3.165	.421
	Hotelling's Trace	.033	3.165[b]	1.000	95.000	.078	.032	3.165	.421
	Roy's Largest Root	.033	3.165[b]	1.000	95.000	.078	.032	3.165	.421
bias * group	Pillai's Trace	.008	.367[b]	2.000	95.000	.694	.008	.734	.107
	Wilks' Lambda	.992	.367[b]	2.000	95.000	.694	.008	.734	.107
	Hotelling's Trace	.008	.367[b]	2.000	95.000	.694	.008	.734	.107
	Roy's Largest Root	.008	.367[b]	2.000	95.000	.694	.008	.734	.107
cont	Pillai's Trace	.192	22.550[b]	1.000	95.000	.000	.192	22.550	.997
	Wilks' Lambda	.808	22.550[b]	1.000	95.000	.000	.192	22.550	.997
	Hotelling's Trace	.237	22.550[b]	1.000	95.000	.000	.192	22.550	.997
	Roy's Largest Root	.237	22.550[b]	1.000	95.000	.000	.192	22.550	.997
cont * group	Pillai's Trace	.045	2.259[b]	2.000	95.000	.110	.045	4.519	.450
	Wilks' Lambda	.955	2.259[b]	2.000	95.000	.110	.045	4.519	.450
	Hotelling's Trace	.048	2.259[b]	2.000	95.000	.110	.045	4.519	.450
	Roy's Largest Root	.048	2.259[b]	2.000	95.000	.110	.045	4.519	.450
bias * cont	Pillai's Trace	.016	1.504[b]	1.000	95.000	.223	.016	1.504	.229
	Wilks' Lambda	.984	1.504[b]	1.000	95.000	.223	.016	1.504	.229
	Hotelling's Trace	.016	1.504[b]	1.000	95.000	.223	.016	1.504	.229
	Roy's Largest Root	.016	1.504[b]	1.000	95.000	.223	.016	1.504	.229
bias * cont * group	Pillai's Trace	.015	.746[b]	2.000	95.000	.477	.015	1.492	.173
	Wilks' Lambda	.985	.746[b]	2.000	95.000	.477	.015	1.492	.173
	Hotelling's Trace	.016	.746[b]	2.000	95.000	.477	.015	1.492	.173
	Roy's Largest Root	.016	.746[b]	2.000	95.000	.477	.015	1.492	.173

a. Design: Intercept + group
Within Subjects Design: bias + cont + bias * cont

b. Exact statistic

c. Computed using alpha = .05

APPENDIX K

LEXICAL PROPERTIES OF DISAMBIGUATING WORDS (CHAPTER 4)

Word	Length	Log_Freq_HAL	Ortho_N	Phono_N	Phono_N_H	OG_N	OG_N_H	BG_Mean	NPhon	NSyll	I_Mean_RT	I_Mean Accuracy	I_NMG Mean_RT	I_NMG Mean_Accuracy
could	5	13.208	4	19	19	1	1	2,810.50	3	1	587.375	0.94	710.923	0.963
had	3	13.532	21	44	47	18	18	2,265.00	3	1	645.212	0.97	538.815	1
might	5	12.534	9	36	39	8	8	1,485.75	3	1	612	0.97	554.714	0.966
should	6	13.295	0	20	20	0	0	2,315.20	3	1	607.906	1	698.231	1
was	3	14.556	19	13	13	0	0	2,165.50	3	1	601.121	0.97	574.963	1
would	5	14.061	6	18	21	1	1	1,811.75	3	1	638.941	1	609.429	1
after	5	12.934	3	4	4	2	2	5,634.25	4	2	658.057	1	568.037	1
as	2	14.787	16	27	27	6	6	3,062.00	2	1	653.094	0.94	566.963	0.964
once	4	12.149	1	4	4	0	0	4,491.00	4	1	579.839	0.97	628.346	0.963
when	4	13.758	8	6	6	2	2	3,731.00	4	1	610.483	0.88	605.375	1
while	5	12.558	5	9	9	3	3	3,128.00	4	1	608.5	1	611.778	1

VITA

Amelia J. Dietrich

Amelia Jane Dietrich was born to Jessica Stellar Ryan and Michael Dietrich on March 2, 1986. She was joined two years later by her little sister and best friend Jocelyn and spent their apparently monolingual childhood unknowingly preparing her phonetic inventory for later with Mom's Pimsleur French tapes, shucking corn and feeding chickens with PA Dutch Pappy, and begging their Slovak *Baba* for JuicyFruit gum. Eager to see the world and thanks in large part to the love and support she received from her stepfather, Peter Ryan, she spent a year as an AFS exchange student in Alberobello, Italy before graduating from Kutztown Area High School in 2004. Upon her return she enrolled at Moravian College in Bethlehem, Pennsylvania. In college she spent a semester in Washington, DC in the Transforming Communities program and conducting research on both low-wage work and bilingual education, which in turn transformed her world view and her educational directions. She later spent a semester in Córdoba, Argentina perfecting her *cantito* at the Universidad Blas Pascal. Amelia graduated with a double major in Political Science and Spanish and a minor in English in 2008 and briefly joined the corporate world. A year later, fueled by what her mother would describe as her lifelong nosiness, she returned to the academy, joining Penn State's Dual Title Program in Hispanic Linguistics and Language Science in 2009. Her research interests were born not only of her own bilingual experience, but also out of a strong sense that bilingualism and language maintenance are a person's right, not a privilege, which have powerful social, cultural and cognitive benefits and should therefore be protected and promoted in communities and nations around the world.