

THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENTS OF SPANISH, ITALIAN, AND PORTUGUESE AND PSYCHOLOGY

READING WORDS IN SENTENCE CONTEXT IN THE FIRST OR SECOND LANGUAGE:
The effects of semantic constraint and cross-language ambiguity
in modulating reading performance

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Fall 2010

A thesis
submitted in partial fulfillment
of the requirements
for baccalaureate degrees
in SPANISH and PSYCHOLOGY
with interdisciplinary honors in SPANISH and PSYCHOLOGY

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Abstract

The present study investigated lexical processing within sentence context in monolinguals and bilinguals through a series of three experiments. In particular, the study examined the way that a linguistic factor, semantic constraint, modulates the availability of words in each of the bilingual's languages. This was examined by comparing the reading of sentences with high and low semantic constraint. For example, in the sentence, "The optometrist measured my eyesight and told me I needed *glasses* to see better," the context of the sentence guides the reader to predict the appearance of an instrument that aids poor vision. In contrast, in a sentence such as, "My mother liked everything on the menu but ordered the *fish* and a side salad," there is little semantic constraint to guide the reader's expectations. Furthermore, the target words in the sentences were either cognates or words that are unambiguously one language alone.

In Experiments 1-3, different speaker types (native English monolinguals and non-native speakers of English) were presented with sentences to read. In order to determine whether lexical processing within a sentence interacts with linguistic features, specifically, semantic constraint, critical words and their matched controls were embedded within sentences of either high or low constraint. Previous studies have shown that non-selective lexical access occurs for both monolingual and bilingual speakers. Of particular interest in this research was the cognate facilitation effect which bilinguals have been observed to produce out of context. Moreover, Experiments 1-3 investigated the interaction between semantic constraint and the cognate effect in a manner similar to that of Schwartz and Kroll (2006), who found that the non-selective access normally present in bilinguals, which was observed in the form of the cognate effect, was absent when sentences were highly constrained semantically.

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Acknowledgements

I would first like to thank Dr. Judith Kroll. I appreciate all of your patience, support, insight, and guidance throughout the entire process. I could never have come this far without you. I would also like to thank all of the other strong female mentors who have helped in shaping me along my academic career thus far and all of those in the Center for Language Science who have helped me throughout this experience. In particular, I would like to thank Colleen Balukas, Max Freeman, Jason Guillifer, and Jaimie Minnicks for helping me throughout the eleventh hour.

Chapter 1: Introduction

With increasing globalization and presence of non-native speakers of English in the US, there has been a heightened awareness of bilingualism and multilingualism. It is therefore of central importance that we understand the underlying neurocognitive processes that enable bilinguals to comprehend, read, and speak in more than one language (e.g. Kroll & De Groot, 2005). By studying bilinguals, we can ask how the brain and the mind enable the fluent use of each language in comprehension and production and, at the same time, enable bilinguals to switch back and forth between their two languages at will.

In the discussion of a bilingual's ability to handle more than one language the phenomenon of *codeswitching*, where a speaker switches between at least two languages within the course of one sentence, is of particular interest because even highly proficient bilinguals produce mixed sentences (e.g., Muysken, 2000; Myers-Scotton, 2002). Together with evidence for the parallel activation of both languages when only one language is required (e.g., Dijkstra, 2005), a critical question is how bilinguals eventually choose the language in which they will operate if they cannot easily choose to turn "off" one of their languages. Is it that bilinguals require a certain amount of unilingual input in order to inhibit their access to the non-target language? Or is it really that no matter how much experience bilinguals have in handling their two languages that they are unable to consciously control the access they have to their two languages?

Grosjean (1989) argued that bilinguals are not two monolinguals in one. Specifically, he noted that observation of language mixing in clinical populations cannot be taken as a sign of disordered language in clinical populations because code switching is commonplace among perfectly typical bilinguals. In a sense, language mixing or switching, is especially surprising

then when considering previous research has found that the ability to recognize and to discriminate between languages occurs in infants as young as 4 months (e.g., Bosch & Sebastián-Gallés, 2001). The fact that proficient bilinguals rarely make errors of language suggests that the ability to hold the two languages separate and, at the same time, to have both languages available simultaneously, is a hallmark of the cognitive control that bilingualism imposes.

In the current research, we examined the mental processing engaged by bilinguals when they read. To fully understand the context for the experiments reported here, it is important to first review past research on bilingual reading. I begin with an introduction of the main theories and models on the bilingual lexicon and the primary evidence for non-selective lexical access. Most of the support for language non-selectivity has been reported for word recognition experiments conducted out of context. I then consider the way in which lexical access is modulated both in and out of sentence context during reading. Finally, I will provide a brief summary of the research that considers the way that experience with cross-language parallel activity may hold consequences for cognition more generally.

A central focus in this review concerns the use of on-line paradigms and how they provide an opportunity to investigate the mental processes that are active when bilinguals are reading. In particular, I consider the studies that concentrate on the linguistic features that a sentence may contain which aid in language selection. Such features include and semantic constraint, as well as language ambiguous and non-ambiguous words. Throughout the introduction, I will also discuss some of the most influential studies that use comparisons of bilingual and monolingual reading in order to learn more about the architecture of the bilingual mind and brain. I then report the present study which included a series of experiments that were aimed at better understanding the way in which lexical activity is modulated when monolinguals

and bilinguals read in sentence context.

The bilingual lexicon

Critical to the implications of bilingual research is the understanding of how the two languages are stored. In early research on this topic, the two lexicons were believed to be stored separately from each other, allowing words in each language to be accessed independently without influence of the language not in use (e.g., McCormack, 1977). The alternative, an integrated lexicon with parallel access to both languages each time different characteristics of a word, are triggered, such as its semantics, phonology, and orthography, is now the preferred model (e.g., Dijkstra, 2005). Two of the most prominent bilingual lexicon models, the Revised Hierarchical Model, or the RHM, proposed by Kroll and Stewart (1994), and the Bilingual Interactive Plus Model, or the BIA+, proposed by Dijkstra & Van Heuven (2002), assume that the two languages share the same underlying concepts, or semantics. In particular, the models both posit that bilingual comprehension and production have either completely or partially shared semantics across the two languages. At the level of word form, the RHM assumes separation in representation (see Figure 1-1) whereas the BIA+ model takes a connectionist approach to represent the way in which the orthography and phonology of visually presented words is activated during word recognition.

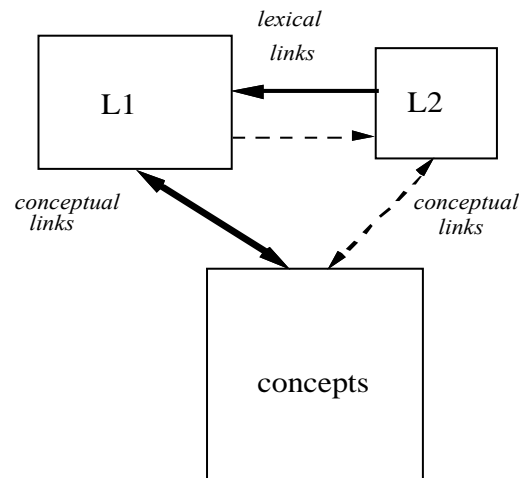


Figure 1-1: The Revised Hierarchical Model (Kroll and Stewart, 1994).

The RHM takes a developmental approach as it proposes that there are independent lexical representations for words in each language, but that at a conceptual level they are integrated. It is this connection at the conceptual level that is initially unavailable to the L2, requiring access to concepts via the L1 equivalent. With increased experience using the L2, the word's direct connection to its meaning strengthens, lessening the need for mediation through the L1.

Earlier researchers had also examined the bilingual lexicon through a developmental approach as they addressed the possibility that how the two lexicons are stored may be related to a bilingual's proficiency in each of the languages. In fact, the RHM merges two models, proposed by Potter, So, Eckhardt and Feldman (1984) that were hypothesized to depend on the bilingual's proficiency. The Word Association Model was believed to be representative of the internal lexical organization in situations in which the second language remains weaker and there is a direct connection between a word in the second language (L2) and a word in the first language (L2). On the other hand, the Conceptual Mediation Model was thought to be in effect

when the L2 word is no longer directly associated with the L1 word, but instead the words, and thus, the languages are connected by a non-linguistic concept (see Figure 1-2).

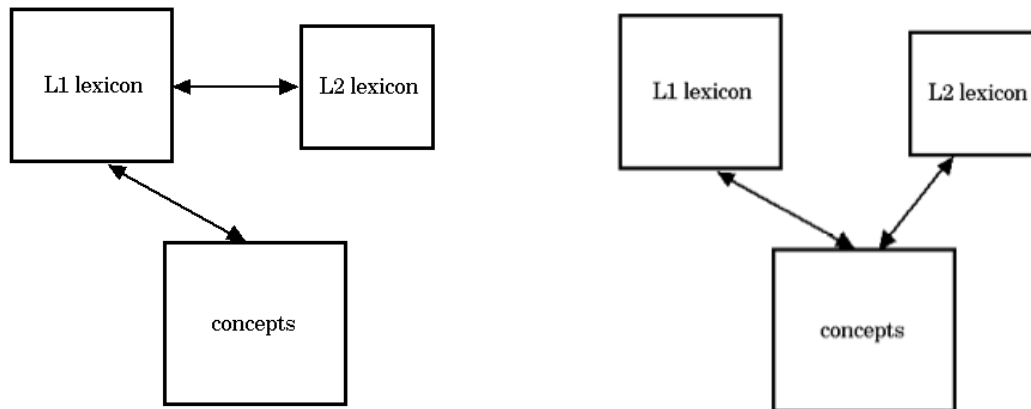


Figure 1-2: Hypothesized processing sequence according to the Word Association Model and the Concept Mediation Model (Potter et al., 1984).

The BIA+, on the other hand, as suggested by its name is an interactive activation model based on orthography. This model not only states that the representations from both languages are integrated into a single lexicon, but suggests that among other pertinent features, there are language nodes, which refer to “language membership” (e.g., Dijkstra, 2005). These nodes act in a top-down fashion to suppress and eventually eliminate word candidates from the unintended language upon visual presentation of a word (see Figure 1-3).

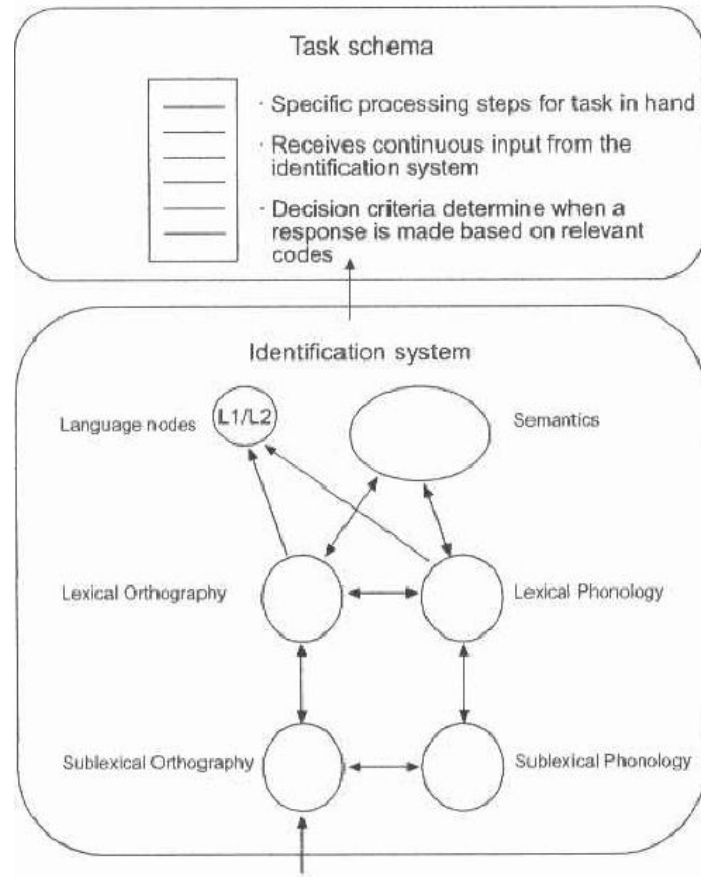


Figure 1-3: BIA+ Model (Dijkstra and Van Heuven, 1998)

Non-selective access during on-line studies

Previously proposed theories and accompanying models argue that either language specific or language non-specific activity occurs when encountering sentences that contain language ambiguous words. The idea of non-selective access, or the act of unintentionally accessing another candidate, such as a word from the non-target language, even when being in an otherwise linguistically specific environment, may seem counterintuitive initially, because at first glance it appears costly to put forth energy toward keeping alternative options unconsciously accessible and ready to process incoming stimuli appropriately. In reality, both monolinguals and

bilinguals encounter events that evoke this activity daily and being flexible and prepared for encountering unexpected stimuli may be beneficial with respect to processing times.

For example, this activity commonly occurs when readers face lexical ambiguity, or more specifically, when they encounter a word with multiple meanings and are required to resolve the conflict by applying the appropriate meaning. In a sentence that starts off with the phrase “The couple wanted to visit the bank...” a reader might expect the rest of the sentence to discuss needing money before running errands when the sentence actually continues, “of their favorite river to see the flowers newly in bloom”. Without non-selective access, activities like reading the example sentence would then become a tedious and exhausting task. However, because non-selective access occurs, the reader is able to quickly evaluate which potential meaning of a particular word is most appropriate considering the given sentence context. Seminal works that support this theory have been achieved using behavioral paradigms, like naming tasks, other lexical decisions tasks, and eye tracking recording (e.g. Duffy, Morris, & Rayner, 1988; Simpson, 1994; Tabossi, 1988; Tabossi, Colombo, & Job, 1987).

The logic of much of the research on bilingual word recognition has been to exploit the presence of language ambiguous words, or words that share orthography or phonology across the bilingual’s two languages. For example, cognates have often been used as language ambiguous stimuli, because of their special properties. Cognates are translation equivalents with similar orthography and phonology across languages. Examples of cognates include the English words *piano* and *actor*, which are the same semantically and orthographically in Spanish, with slight variation in their pronunciation in the two languages. However, not all words that are similar in form across languages are cognates. Homographs are words that are also similar in their written appearance, or even identical in two languages, yet vary distinctly in their semantics; they are

often referred to as false friends (e.g., Libben & Titone, 2009). An example of homographs is *embarrassed* and *embarazada*, where *embarrassed* is an English word that refers to a state of feeling ashamed or uncomfortable, meanwhile *embarazada* means that one is pregnant in Spanish.

If lexical access engages both languages even when bilinguals are reading in one language alone, then language ambiguous words, like cognates and homographs, will be processed differently than language unambiguous words. An interpretation of the non-selective access theory is that when a given representation or idea exists in both languages, these words are then stored collectively in one lexicon. As a result, when a language ambiguous word or representation is presented to the bilingual, activation of both languages occurs. For example, Schwanenflugel and Rey (1986) found this parallel activation in a lexical decision task, which requires the subject to identify a letter string as a word or non-word in a specific language. Specifically, they found priming effects that were equal between same-language and different-language primes, which were indicative of the two languages interacting with each other.

One attempt to determine the organization of the bilingual lexicon was by the use of language ambiguous words (e.g., Dijkstra, Grainger, & Van Heuven, 1999). The premise of the study was to evaluate how the frequency of a word interacts with its language-specific nature. The paradigm they chose was one in which Dutch-English subjects were asked to determine whether a given word was English. The set of stimuli consisted of words in both English and Dutch. It was comprised of six conditions, which varied by an individual word's similarity to the other language in semantics, orthography, and phonology. A series of analyses provided support for the non-selective access theory. More specifically, differences in reaction times depended on whether the presented word was a cognate or a homograph. However, the results also revealed

that the non-selective access theory is not absolute in functioning. Instead, the words that possessed semantic and orthographic similarities were identified as producing facilitation as determined by faster reading times, whereas phonological similarities actually produced slower reaction times. In turn, this discovery was then hypothesized to explain why cognates promote facilitation, whereas homographs, which lack semantic similarity, are more likely to result in interference.

Other evidence for non-selective access in out-of-context word recognition studies

Many studies investigating word recognition have reported evidence for language non-selectivity. Much of this evidence is based on studies that manipulate language ambiguity and produce the *cognate facilitation effect*. This phenomenon is characterized by faster naming latencies for cognates than unambiguous control words, which suggests that the cognates are being facilitated relative to language-specific words (e.g. Costa & Caramazza, 2000). Specifically, the facilitation effect is the result of nonselective access activating the shared aspects of a bilingual's lexicon when cognates are read.

Van Hell and Dijkstra (2002) examined the cognate effect in order to highlight the competition that can exist between a speaker's languages despite being in an exclusively unilingual context. In the study, Dutch-English-French trilinguals performed either a word association or lexical decision test in an environment that was created to be particular to their native language, Dutch, which was also their dominant language. The stimuli on which they were tested were drawn from a set of words that varied with respect to whether they were a cognate or non-cognate, as well as the languages for which the words were cognates (see Table 1-1).

	Example 1	Example 2	Example 3
Cognates with English	appel (apple, pomme)	brood (bread, plain)	zilver (silver, argent)
Cognates with French	citreon (lemon, citron)	gratis (free, gratuit)	taart (cake, tarte)
Non-Cognates	aardig (kind, gentil)	strand (beach, plage)	breed (wide, large)

Table 1-1: Three examples of the triplets from the overall set of Dutch words, with their respective English and French translations following (Van Hell & Dijkstra, 2002).

Van Hell and Dijkstra (2002) also looked at the way that a bilingual's expectations as to which language or languages will be affect their performance in the study at hand, as well as if there will be activation of other language systems considering the stimuli experiment was designed to occur in only their L1. Lastly, the subjects' varying proficiencies among their languages allowed the researchers to determine if the relative language fluency will affect the speaker's sensitivity to possible interference from their other languages.

Analyses revealed that the word association and lexical decision times were faster for words that were cognates with the participants' L2 than non-cognates (see Figure 1-4). Furthermore, for subjects with high proficiency in their third language, a cognate effect was also found between their L1 and L3. These and other related findings suggest that one's secondary, or even tertiary, language can impact the performance in one's native language. Thus, it is not unreasonable to expect that being proficient in two languages may have the consequence of changing reading performance, even in the native language.

The consequences of language non-selectivity

An important feature of the evidence for language non-selectivity is that there is hypothesized competition across the bilingual's two languages. That competition is thought to produce consequences for cognition more generally. These consequences have been explored by comparing the performance of speakers with different language experience, but matched on other factors on a variety of non-linguistic tasks. For example, research has concluded that being bilingual results in an overall smaller vocabulary size (Ransdell & Fischler, 1989) and disadvantages on semantic fluency (Gollan, Montoya, & Werner, 2002). On the other hand, it has been found that being functionally fluent in more than one language provides longer lasting executive control (Bialystok, Craik, Klein, & Viswanathan, 2004) which has been exhibited as advantages against aging, dementia, and even Alzheimer's. Furthermore, while most adults generally show a decline in their ability to ignore irrelevant stimuli, the unique development of control processes in bilinguals, which begins in childhood, affords bilinguals less of a decline in this area, because of their extensive experience throughout the lifetime using inhibitory control (e.g. Bialystok et al. 2004; Zied et al., 2004; Bialystok, Martin, & Viswanathan, 2005). These findings can be taken to support the idea that language and cognition are interdependent.

Lexical access within sentence context

Research on sentence processing has used different paradigms, some of which are based on conscious, meta-linguistic judgments (e.g., decisions about whether a sentence is plausible or grammatical) and others that reflect the on-line processes that are activated during comprehension (e.g., self-paced reading, eye tracking, and rapid serial visual presentation of a sentence word by word). A critical question for bilingual sentence reading has been to consider

whether the parallel activation of words in both languages observed out of context will be eliminated when words are placed in sentence context.

For example, Duyck and Van Assche (2007) sought to test the predictions of the Bilingual Interactive Activation Plus (BIA+) model (Dijkstra & Van Heuven, 2002) in a series of experiments on the effects of sentence context on lexical access. In particular, they investigated the generally accepted model in which bilinguals possess a shared lexicon between their two languages. In order to test the existence of a shared lexicon, they looked for non-selective activity in a unilingual context. Moreover, they were interested as to whether a bilingual can use the unilingual context of a sentence as a linguistic cue for lexical selection. If so, then cognates should be processed no differently than non-cognate controls, with only the language of the sentence context relevant to lexical selection.

Their first experiment replicated the cognate effect demonstrated in earlier studies and also confirmed that their stimuli, which consisted primarily of non-identical cognates and a small subset of identical cognates, were appropriate for the lexical access tests they would be later conducting. In the second experiment in the series, subjects were asked to evaluate using a lexical decision task the critical word for its appropriateness within a sentence given *serial visual presentation* (SVP). An analysis of the data revealed that in this task the subjects exhibited a cognate facilitation. Their third study revealed that the cognate effect is not absolute in nature. Using an eye-tracking paradigm to track fixations while the sentences were read revealed a cognate effect within sentence context but one that was modulated by the form of the cognates such that the first fixation durations were significantly shorter for identical cognates than for non-identical cognates.

One of the most surprising findings in research on lexical access in sentence context is that the results show that the effects of language non-selectivity remain in sentence context. That is to say, that even when reading in an environment particular to one language the cognate facilitation effect is still produced, suggesting that the other language remains activated. The observation of non-selectivity at all in sentence context is very counterintuitive and provides critical evidence in support of models like BIA+. Furthermore, this observation suggests that the language “mode” of a sentence is not enough to inhibit interference from the non-target language.

Linguistic features in sentence context

While investigating the conditions in which non-selectivity occurs, other factors that influence reading have also been considered. Such studies have found that the language parallel activity that was previously seen in the form of cognate facilitation can be reduced in certain situations. Indeed, the reaction times for cognates in certain sentences indicate that cognates in sentence context can be processed differently than when named in isolation or when named in sentences only consistent in their language of presentation.

Previous studies have considered both semantic constraints (e.g., Schwartz & Kroll, 2006; Van Hell & De Groot, 2008) and syntactic constraints (e.g., Gullifer, Dussias, & Kroll, 2010). Syntactic constraint refers the word order in a sentence and can be used by a speaker in order to better expect what part of speech will follow in a sentence. More research has investigated the effect of semantic constraints in limiting the scope of lexical access within sentence context. A reader can utilize it in order to help predict the upcoming content within a sentence. For example, in a sentence such as, “*One morning, I woke up feeling like I was coming*

down with something and so I wanted to check my temperature, but first I had to find the thermometer”, the content of the sentence made *thermometer* more probable to be the final word than a different word. Meanwhile, in a sentence such as, “*Because there was a sale while I was out shopping, I bought a new thermometer*”, the content of the sentence is not as restrictive, making other alternative words applicable to terminating the sentence.

Monolingual semantic constraint studies

Schwannenflugel and Stowe (1989) investigated the power of sentence context on concrete and abstract words in monolinguals. Specifically, they focused on the *context availability* of their target words, or how prior contextual experience for a given word can aid in processing it, as well as in establishing the foundation needed for the comprehension of the entire sentence. Their research on this topic was comprised of a naming task and a meaningfulness judgment task. The naming task looked to confirm whether in a supportive sentence context naming times decrease for abstract words, which are words that may otherwise lack predictability, because of their decreased context availability. Meanwhile the meaningfulness judgment task sought to evaluate word comprehension by asking subjects to determine whether the final word in a given sentence was congruous with the provided sentence context. These studies concluded that a supportive sentence context does promote equal processing times of these classes of words, which vary in their context availability. Because Schawnenflugel & Stowe’s findings were based on the performance of monolingual subjects, they may not be generalized to other populations.

Other experiments have also investigated how monolinguals can use semantic constraint to predict upcoming words of equal lexical frequency. These studies have concluded that more

predictable words are processed faster. These findings span across a variety of methods, such as naming studies (McClelland & O'Regan, 1981; Stanovich & West, 1983), lexical decision tasks (Fischler & Bloom, 1979, 1980; Schwanenflugel & Lacount, 1988; Schwanenflugel & Shoben, 1985), and eye tracking recording (e.g., Balota, Pollatsek, & Rayner, 1985; Ehrlich & Rayner, 1981; Rayner & Well, 1996).

Bilingual semantic constraint studies

The effect of semantic constraint on otherwise non-selective bilingual reading processes has been investigated, as mentioned previously, using a variety of different paradigms such. In this portion of the introduction, we will cover some of the most findings from naming studies using *rapid serial visual presentation* (RSVP), lexical decision tasks, and eye-tracking recording, respectively. Schwartz and Kroll (2006) extended the earlier finding that one's second language can impact first language processes made by Van Hell and Dijkstra (2002) by means of an on-line paradigm that allowed them to research both the cognate facilitation effect and semantic constraint simultaneously. They examined these effects in monolingual and bilingual subjects. Specifically, Schwartz and Kroll used the RSVP technique in which the words of a sentence are presented on a computer screen one word at a time. In this paradigm, the subject was asked to read along with the sentences for comprehension, which would be checked at random with questions following immediately after sentences. Additionally, each sentence contained a word that appeared in red, which each subject was to name out loud as quickly and accurately as possible. The red words were either target words, which were cognates between Spanish and English, or control words.

Schwartz and Kroll's research revealed that the bilingual subjects only exhibited cognate facilitation, representative of nonselective access, in sentences of low semantic constraint. This study shows that the semantics of words play a part in the selection of language. Following the findings from Schwartz and Kroll (2006), Van Hell and De Groot (2008) conducted a series of three studies that investigated further the effect of sentence context on parallel activity. In their first study, they used a paradigm similar to that of Schwartz and Kroll (2006), in which the target word was embedded into sentence context, which varied with respect to semantic constraint. However, instead of naming the target word, the subject was asked to perform a lexical decision task on the target word. This study also varied whether the target cognates were abstract or concrete in meaning. This decision was made in hope of finding discrete effects in non-selectivity depending on cognate type, which could then be used to revise what is known thus far about word-to-concept mappings across languages. Specifically, they hypothesized that abstract cognates would activate the non-target language to a lesser degree. The bilinguals in this study were Dutch-English bilingual university students.

Analyses on the data from the Van Hell and De Groot (2008) study provided a number of important findings. First of all, there were significant main effects of (semantic) context, cognate status, and concreteness. As a result, mean reaction times from the lexical decision task were faster for the high context condition, for cognates, and when the target word had a concrete meaning. The reaction time data also revealed a significant interaction between cognate status and context. Overall, this study, while using a different behavioral paradigm and testing speakers of different languages than in Schwartz and Kroll (2006), was able to replicate the same findings. This supports the previous report that the non-selectivity associated with cognates can indeed be dampened by having them appear in a sentence, although this inhibition specifically requires

high semantic content. Furthermore, this study re-confirms that language alone is not enough to narrow the language selection process for bilinguals.

Libben and Titone (2009) also examined lexical access in a sentence context, but did so using eye-tracking methodology. Eye tracking was chosen, because it allowed the researchers to evaluate the participants' comprehension without requiring them to make an overt decision. Furthermore, analyses could be performed on the amount of attention given to each word with the temporally sensitive eye-tracking data that other behavioral methods do not measure. These analyses could then be tailored to look at how lexical access varies by semantic constraint and word status.

The stimuli that were created for this study consisted of 32 French–English interlingual homographs and 32 French–English form-identical cognates. These words appeared in sentences, where the first clause was either semantically biased or un-biased toward the target word and the second clause contained the target word, regardless of whether it was the target word or its matched control. Participants were told to read the sentences that appeared on the screen for comprehension while the eye-tracking device followed their eyeball movement. They were also told respond 'yes' or 'no' to any comprehension questions that appeared after a sentence by pressing the appropriate button on the box.

The researchers examined the early and late eye tracking measures for comprehension. Of importance to the current study, the data revealed that there was a significant effect in which cognates that appeared in high constraint sentences received significantly shorter fixations than those in low-constraint sentences. This finding indicates that the condition in which there was semantic constraint provided the reader with information as to what to expect to follow in the sentence. Furthermore, the data from this study supported that of Schwartz and Kroll (2006),

which concluded that cognate facilitation existed for naming in low constraint, but not in high constraint sentences.

The present study

Three experiments are reported in which lexical access was examined in sentence context. The goal of Experiment 1 was to develop sentence materials that could be used to examine the effects of semantic constraint. A specific question in Experiment 1 was whether monolingual English speakers would be sensitive to the semantic constraints within the sentence contexts that were constructed and whether non-native speakers of English would be equally sensitive to these constraints. Although past studies have examined bilingual reading of words in sentence contexts in the second language (L2), these studies have not explicitly compared the sensitivity to semantic constraints for native and non-native readers. In the introduction to Experiment 1, we review the evidence on whether non-native speakers are sensitive to the nuances of meanings in the L2. In Experiment 2, we modify the sentence contexts used in Experiment 1 to again ask whether monolingual speakers of English are sensitive to semantic constraints. Finally, in Experiment 3 we compare the performance of monolingual speakers of English with Spanish-English bilinguals who are reading the English sentences in their L2 and for whom a set of cognates, functioning as the ambiguous critical words, are embedded within the sentences.

Chapter 2: General Methods

General Approach

The logic of the current research was to verify whether bilinguals are equally sensitive to semantic constraint when reading in their second language as they are when they are reading in their first language and whether the ability to exploit semantic constraints depends on factors such as age, cognitive functioning, or age of second language acquisition. Furthermore, it looked at whether semantic constraint can aid a bilingual in their reading by limiting interference from the non-target language. To do so, it was first crucial to reproduce the finding that the language of presentation does not give a bilingual the ability to “turn off” the non-target language. It was also important to replicate past findings in which bilinguals produced facilitation effects when reading sentences that contained a cognate, but lacked semantic constraint. According to previous research, it was also expected that when bilinguals read sentences possessing both semantic constraint and a cognate they would no longer produce reading times indicative of the cognate facilitation, and thus these sentences would also no longer exhibit non-specific language activity.

An on-line task requiring the participants to read sentences was used to examine these questions. Specifically, the semantic constraint and language ambiguity (and specificity) was manipulated within the sentences. Then, in order to investigate how bilinguals actively process language ambiguous information while also being exposed to semantic constraint cognates were selected as the critical words. The cognates were carefully matched with language specific controls on their lexical properties, such as word length, number of syllables, and frequency.

In particular, I chose to investigate these effects in Spanish-English speakers and so the cognates were for Spanish and English. The words then served as the basis for the sentences that

varied with respect to semantic constraint. Each of these steps required extensive norming to determine that the sentences would be read in the intended manner and that the cognates were properly matched with their respective controls such that monolingual readers of English would not produce a cognate effect, because for a monolingual reader, a cognate is no different than any other word. It is only for a bilingual reader of Spanish and English that these cognates should have special status.

General participants

Three groups of participants were selected to participate in this study: Chinese-English bilinguals, English monolinguals, and Spanish-English bilinguals. All of these participants came from the Pennsylvania State University where they were either undergraduate or graduate students. Most of the bilingual participants had received several years of formal instruction in their second language.

Sentence context task

Materials

Target words

The critical words consisted in a set of 64 cognates and 64 matched non-cognate control words (See Appendix A). The cognates were not all identical in form, but did all have a high degree of orthographic similarity. As discussed above, the control words were matched via an item-by-item analysis.

Critical sentences

The critical sentences were constructed to differ in two dimensions. First, they were either high or low with respect to the degree of semantic constraint. Second, they were written so that either the cognate or non-cognate control word could appear within the sentence and have it remain semantically appropriate (See Table 2-1). Like the target words, the critical sentences were matched with respect to total number of words, as well as the position of the target word within the sentence. The target word never appeared final in the sentence. In order to verify the prominence of the semantic constraint, the sentences were tested in a norming experiment. Lastly, the sentences were divided into two lists so that no participant would see the same critical word, cognate or non-cognate, twice.

Target Type	Condition	Sentence
Alphabet (cognate)	High Constraint	The young kids happily practiced the letters of the alphabet that they learned.
	Low Constraint	The young kids happily practiced the song about the alphabet that they learned.
Apple (non-cognate)	High Constraint	In the fairy tale Snow White ate from an apple that her stepmother had poisoned.
	Low Constraint	The man drove to the store to buy an apple that he ate for breakfast.

Table 2-1: Example stimulus sentences taken from Experiment 3.

Filler sentences

A set of filler sentences was dispersed randomly between the critical sentences. The filler sentences were created so that they were similar in complexity to the critical sentences and the subjects would be unable to detect a difference between them and the critical sentences.

Comprehension questions corresponding to the content of these sentences were also written. The purpose of these filler sentences and comprehension questions was to check that the participants

were engaged with the task and paying attention to the meaning of the sentences (see Table 2-2). Specifically, subjects' attention was evaluated by the accuracy of their yes/no responses to questions that followed these sentences. No further analyses were done with the data from these sentences.

Filler Word	Sentence	Comprehension Question
church	Every Sunday the family would go to the church and have breakfast afterwards.	Did the family have lunch before going to church on Sunday?
prince	The princess found out she was betrothed to a handsome prince that she loved.	Is the princess in love?

Table 2-2: Example filler sentences from Experiment 3.

Measures of cognitive ability and language proficiency

A series of four additional tasks was administered after the sentence context trials had been completed. The data were used to examine the effect of cognitive functioning and language proficiency on reading processes. Analyses were later performed with the data collected from these tests in order to evaluate how well matched the groups of subjects were. Specifically, two cognitive functioning tests were included, which measured the subjects' working memory and selective attention. Two other linguistic tests were used, a picture naming test and lexical decision test, in order to look at the subjects' language proficiency.

General Procedure

Consent form and language history questionnaire

Upon arrival in the lab, participants were first greeted and then given a consent form to read through and sign. A language history questionnaire (see Appendix B) was then given to the

participant, in which they were asked to self-report on items such as their speaking, reading, and writing abilities in their dominant language and secondary language, as applicable.

Sentence context task

Because the RSVP paradigm used, subjects were told that sentences in the color black would appear one word at a time on a white computer screen. The words would always be presented in the middle of the screen and that there would be one word within each sentence would appear in the color red. They were told to name the red word out loud as quickly and accurately as possible into a microphone, which would then trigger the presentation of the remainder of the sentence. If unsure of the word, they were instructed to make their best effort at guessing the pronunciation. They were also told that following some sentences a question would appear and that they should answer this question with a “yes” or “no” out loud into the microphone. If they did not know the answer to the question, the experimenter recommended that the participant guess or respond with “I do not know”.

Before each trial a fixation point (“+”) appeared in the center of the screen. When the participant was ready to begin a trial, they were instructed to hit the space bar, which would trigger the disappearance of the fixation point and begin the word-by-word presentation of the given trial (see Figure 2-1). The presentation of the words was set to a fixed duration with the exception of the critical word. The critical word would disappear from the screen after the microphone registered a spoken response from the participant. Then the sentence would resume its word-by-word presentation.

Filler sentences were presented in the same manner, except that their respective comprehension questions appeared as a blocked question, not separated word by word. Once

again, the question remained on the screen until the microphone was triggered by a spoken response. Ten practice trials were given before the experimental phase, with the entire test lasting approximately 30 minutes.

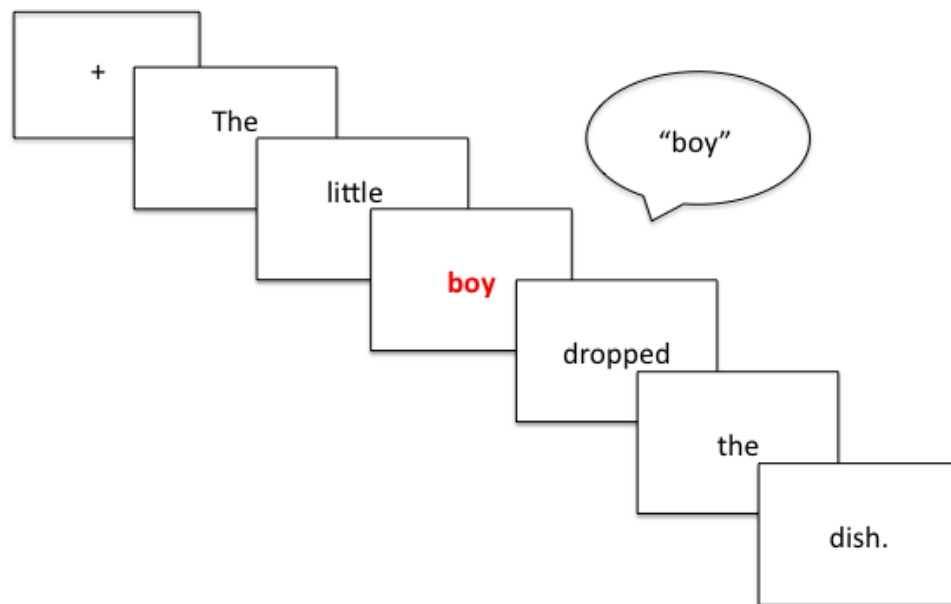


Figure 2-1: An illustration of the rapid serial visual presentation paradigm for a critical sentence. Each word was displayed at a fixed presentation rate (150 or 250 ms depending on the experimental condition) with the exception of the critical word. The target word remained on the screen until the microphone was triggered by a response.

Participants completed 10 practice trials introducing them to this set up before beginning the experimental phase. The specific number of critical sentences versus filler sentences in the experimental phase, as well as the overall rate of presentation, varied across experiment types and are detailed in the following sections. Following the practice session, the experimenter left the room. The spoken responses were recorded digitally for future analysis and the reaction times

were recorded in milliseconds by the computer. The task was divided into two halves with a break in the middle.

Working memory task

The Operation-Span (O-Span) test (Turner & Engle, 1989) was used in the experiments in order to measure the working memory of the participants. The test was two-fold in nature and the subjects were told that their success was determined by their performance in each aspect. First, on the computer screen the subjects were presented with simple arithmetic equations that had already been solved. They were told to decide whether these equations had been solved correctly as quickly and accurately as possible and respond by using the keyboard, where they would press 'd' for an incorrect equation and 'k' for a correct equation. The equations were presented at an individual rate of 3750 ms or until the subjects responded on its correctness. If the subjects were unable to decide on the correctness of an equation in the allotted time, they were encouraged to try and guess before the equation was removed from the screen. If they repeatedly were unable to decide on the correctness of these equations, then they were told to try and speed-up.

Between the presentation of these equations, words would appear on the screen for 1250 ms and the participants were told to memorize them. In Experiments 1 and 2, the language of the words in the O-Span task was always English. In Experiment 3, the language depended on what the subject ranked as their dominant language in the language history questionnaire, either English or Spanish. For bilinguals who reported that they were balanced in their two languages we assumed they were functionally more English dominant, because of their current environment in a predominantly English speaking university. At a predetermined point unknown to the

participants, the computer would stop alternating between presenting equations and words and instead display “Recall” in the center of the screen. At this point, the subjects were instructed to type in as many as the words they had just seen as they could remember. The order of the words did not matter, so long as they did not type the last word they had seen as the first in their list, unless it was the only word they could remember.

The sets of stimuli ranged from two words and two equations to six words and six equations. They would receive three different sets of the same size before the set size would increase. The sets were increased in numerical order. Three practice sets were given before the experimental phase began, which was made up of a total of 15 sets, with the entire test lasting between 10 and 15 minutes. The reaction times, accuracy in judging the equation, and lists of words recalled were recorded by the computer.

Language proficiency measures: Picture naming and lexical decision

Two proficiency tasks beyond the main sentence context experiment were conducted within each session. Lexical decision was administered in order to examine the participants’ English proficiency with respect to recognizing actual English words. One of two picture naming tasks, whose version depended on the experiment type, was also given to determine the participants’ ability to name visually presented objects.

As with the other tasks, the lexical decision trials were performed on the computer. Participants were told once again that prior to the start of the task a fixation point would appear on the screen. When ready, they were instructed to press the space bar to trigger. This would then trigger the appearance of the first string of letters, which would then appear in the center of the screen. Upon its presentation, they were asked to decide whether the string of letters made up a

real English word as quickly and accurate as possible, by responding either yes or no using the button box apparatus that had been placed in front of them. As in the Operation-Span task, participants in Experiment 1 and 2 were given letter strings in English. Specifically, they were to press the left-most button if the letter string was a word and the right-most button if it was not. If they were unsure, they were told to guess.

Each letter string was presented for 3000 ms and these strings would disappear after the computer, which was connected to the button box, had registered a response or if the allotted time had expired. Ten practice trials were given before the experimental phase, which consisted of a total of 538 trials, the entirety of the test lasting approximately 15 minutes. The reaction times and responses to the letter strings were recorded by the computer.

Participants in each experiment also performed a picture naming task. The subjects in Experiment 1 and 2 performed the Boston Naming Test (Kaplan, Goodglass, & Weintraub, 1983), while the participants in Experiment 3 received a modified picture naming test that included objects whose names were cognates specific to the subject population. Both naming tasks began with an initial fixation point that appeared in the center of the screen until the participant pressed the space bar indicating that they were ready for the presentation of the trials. At that point, a black and white line drawing would appear in the center of the screen. They were told to name the drawing out loud into the microphone. If uncertain, they were encouraged to guess or respond with “I don’t know”. Once the microphone recognized a spoken response that drawing would disappear and a new drawing would reappear in its place.

The Boston Naming Test consisted of 60 pictures, while the revised picture naming task included 72 pictures. Of the revised naming task, 48 of the pictures had names that were cognates between Spanish and English. The only difference in instructions between the two

naming tasks depended on the participant, in which the Spanish-English bilinguals were told to name one half of the items in Spanish and the other in English. The order of the language of their responses was counterbalanced across subjects.

Ten practice trials were given before the experimental phase. The task lasted for approximately 10. The spoken responses were recorded for future analysis.

Selective attention test: Flanker or Simon task

Each participant completed a test that evaluated his or her selective attention abilities, which was determined either by the Simon task (Simon, 1969) or the Flanker task (Eriksen & Eriksen, 1974). All of the participants in Experiment 1 and 2 performed the Simon task, whereas the participants in Experiment 3 performed the Flanker task.

In the Simon task, either a small blue or red box would appear on the screen in either the middle of a white screen. Only one box at a time could appear and it would appear in one of three positions: left, middle, or center. The test thus examined the participants' selective attention by asking them to respond only based off of the color of the stimulus and not its location on the screen. The subject was instructed then to press a key on the left side of the keyboard when the box was blue; the key had been marked with a sticker of corresponding color. Meanwhile, they were supposed to press a key on the right side of keyboard, also marked by a sticker, when the box was red. The boxes were presented at individual rates of 2000 ms and would disappear either after this allotted time or upon the pressing of either response key.

Ten practice trials were given before the experimental phase, which was comprised of 125 trials. The entire task lasted approximately 5 minutes. The responses and reaction times were recorded via the computer throughout the test.

The Flanker task also required that the participants respond according to one aspect of the visual stimuli on the screen, while ignoring another aspect of it, this time by clicking on either side of the mouse. The entire task was comprised of six subtests in which the directions were continually being modified, which meant that successful performance required frequently updating what material should receive be receiving attention and ignoring the previously attended to material. Before each subtest, a practice session with feedback occurred that they were allowed to perform more than once in order to ensure the participants' fully understood the instructions. A fixation point was presented on the screen before each stimulus for 250 ms and then the stimulus was presented for 2000 ms or until the participant responded using the mouse. Collectively, this task lasted for approximately 10 to 15 minutes.

Chapter 3: Experiment 1

Introduction

The purpose of Experiment 1 was to confirm that the desired effects are produced when the sentences are presented using in the RSVP paradigm. Like other research, one of the goals of this experiment was to determine whether bilinguals are able to equally access semantic content from a sentence. Some researchers have argued that equal access to L2 linguistic features is not fully possible, whereas others believe it is possible depending on level of L2 proficiency or the age of L2 acquisition. For example, Kotz and Elston-Güttler (2002) investigated the processing patterns in semantic information in late L2 learners of varying proficiency levels by measuring reaction times and event-related potentials during a word list lexical decision priming task. The semantic information that they tested was either associative or categorical in nature. They concluded that late learners produced associative reaction times and N400 ERP priming effects similar to early advanced learners and native speakers. Meanwhile, very limited categorical priming effects were observed. On the other hand, less proficient learners did not show reaction times effects for either type of semantic information, only an event-related potential (N400) indicative of associative information. Notably, much of the past research on semantic processing in bilinguals has investigated this question using out of context studies.

Given that the current study is using the same on-line paradigm as that of Schwartz and Kroll (2006) it is possible that new findings will be observed with respect to the availability of semantics to non-native speakers. In particular, it was expected that when the current experiment's stimuli was presented to English monolinguals, only facilitation from the semantic constraint would occur, because these participants should be sensitive to this linguistic feature and process sentences faster when it is present. Meanwhile, monolinguals would be insensitive to

the cognate status of the target words, because their lack of knowledge of Spanish would make the cognates no different than any other word in English.

As previously discussed, for non-native speakers of English late learning of the L2 has been associated with incomplete development of the parts of the L2 linguistic system and research has reported that the semantics are sometimes used differently in the L2 than in the L1 in order to compensate for the deficits in the L2's syntax and phonology. The critical question then was whether these non-native speakers, who were all relatively proficient in their L2, would be as sensitive to the constraint provided by the semantic constraint in the sentence context as the English monolinguals were. Furthermore, a speaker type effect was expected in which the native English speakers would produce faster naming times than the non-native English-speaking participants. Because the non-native English speakers that participated in this experiment were not speakers of Spanish, no effect of a cognate status was anticipated, just as with the monolinguals. Instead, if anything, they should only be expected to produce an effect of semantic constraint.

Finally, in Experiment 1 I varied the placement of critical word. The semantic constraint could appear either in the first or second half of the sentence. It was hypothesized that the integration of semantic information might vary according to the placement of the material. If access to semantic information occurs early on in processing, similar to the time course of lexical access, then it could be possible for semantic constraint to still appear in sentences with early placement. The alternative then being that if the integration occurs later on in processing then early placement would eliminate the effect of semantic constraint.

Methods

Participants

Participants were recruited via flyers that had been hung throughout the university campus. 22 English monolingual and 15 Chinese-English bilingual students from The Pennsylvania State University completed this experiment.

Materials

The sentence context test in Experiment 1 was comprised of a total of 160 sentences (see Appendix C). Specifically, it was made of 128 critical sentences, with 64 cognates and 64 non-cognate control words, and 32 filler sentences (see Table 3-1 for examples and for the full set of sentences, Appendix D). To counterbalance the materials, we created four different scripts. Of the 128 critical sentences, half were of high semantic constraint and the other half were of low constraint. For the monolingual participants, half of them received the words presented at an individual rate of 150 ms and the other half had the words presented at a rate of 250 ms. The Chinese-English bilinguals all saw words presented at an individual rate of 250 ms. Unique to this experiment, these sentences also were manipulated to vary in the location of the constraint, with it occurring either early or late within the sentence.

Target Word	Condition	Sentence
fish	E-LC-NC	When I was a child my mother rarely prepared fish for dinner because she knew that nobody really liked it.
	E-HC-NC	Cod tilapia and salmon are types of fish commonly sold in supermarkets as well as in the best fish markets across the country.
	L-LC-NC	After dinner we sat around the table to tell stories about our childhood and I remembered that my mother rarely prepared fish because my brothers didn't like it.
	L-HC-NC	The Atlantic salmon named scientifically by zoologist and taxonomist Carolus Linnaeus in 1758 is one of the many species of fish that undergo their greatest feeding and growth in salt water.

Target Word	Condition	Sentence
flute	E-LC-C	The girl asked her mother if she could get flute lessons for her birthday because she really liked listening to classical music during her spare time.
	E-HC-C	A long cylindrical woodwind instrument similar to the clarinet is the flute which produces its sound from the flow of air against an edge.
	L-LC-C	Hannah did not want to go to school yesterday because she could not remember where she had left her flute and could not leave until she found it.
	L-HC-C	In order to mimic the sound of a bird in the theater production a member of the orchestra played her flute very skillfully and convincingly.

Table 3-1: Example sentences from each of the eight critical conditions in Experiment 1. E stands for early placement, L for late placement, LC for low constraint, HC for high constraint, NC for non-cognate, and C for cognate.

The tasks used to assess cognitive abilities and language proficient in Experiment 1 were the Operation-Span task, the Boston Naming Task, the Simon task, and the lexical decision test.

All tasks used in Experiment 1 were programmed using E-Prime.

Procedure

The experiment was conducted in the following order:

- 1) Consent Form and Language History Questionnaire
- 2) Sentence Context Test
- 3) Lexical Decision Test
- 4) Operation-Span Test
- 5) Simon Test

- 6) Boston Picture Naming Test
- 7) Debriefing Form

Results

General approach

The data that follows are based on participant means. Item analyses have not yet been conducted but will be when this study is prepared for publication. A variety of analyses were performed on the language history questionnaire, sentence context task, and cognitive task data. In particular, for the sentence context task, a 2 (cognate status) x 2 (constraint status) x 2 (critical word placement) ANOVA was conducted with between-participant factor of speaker type (monolingual English vs. non-native speaker of English) and duration.

Language history questionnaire data

Data from the language history questionnaire are shown in Table 3-2. The bilingual participants' ages ranged from 19 to 45 years and the mean age was 26. Meanwhile, the monolingual participants' ages ranged from 18 to 45 years and the mean age here was 22. A one-way ANOVA was conducted on the self-reported data which referred to participants' first and second language proficiency in the areas of reading, writing, speaking, and speech comprehension, which was then sorted by speaker type. From self report on a scale of 1 to 10, where a score of 1 referred to being not at all fluent and 10 referred to being functionally fluent, bilinguals and monolinguals ranked themselves similarly on their first language proficiency. Bilinguals also reported being more proficient in their second language.

Speaker Type	Youngest Age	Oldest Age	Average Age
Bilingual	19 years	45 years	26 years
Monolingual	18 years	45 years	22 years

Speaker Type	L1 Reading	L1 Writing	L1 Speaking	L1 Speech Comprehension
Bilingual	9.38	8.63	9.38	9.63
Monolingual	9.14	8.73	9.14	9.09

Speaker Type	L2 Reading	L2 Writing	L2 Speaking	L2 Speech Comprehension
Bilingual	7.73	6.93	6.80	7.27
Monolingual	2.59	2.27	2.23	2.50

Table 3-2: Language history questionnaire data for participants in Experiment 1.

Data trimming procedure for sentence context task

Reaction times that were below 200 ms and above 2000 ms for the monolinguals and below 300 ms and above 3000 ms for the bilinguals were excluded from analyses. These removed times made up the absolute outliers. Reaction times that were more than 2.5 times above or below the participant's mean standard deviation were also eliminated from analyses. These were classified as relative outliers. The mean reaction time for each condition was performed after these two sets of exclusions had been made.

In all conditions, naming accuracy included only those target words that were named correctly the first time. Any target word that was named more than once, whether due to human or mechanical error, was excluded from analysis of both overall condition accuracy, as well as that condition's mean reaction time. Also excluded from overall condition accuracy were the words corresponding to relative and absolute outliers. For the condition that referred to the comprehension accuracy for questions about the meaning of the sentence, two separate accuracies were calculated. First the naming accuracy and mean reaction time was calculated as

described above. The comprehension question accuracy however only considered correctly answered questions. Respective naming accuracy and naming latencies was not factored into the equation.

Naming latencies for sentence context data

The analyses performed on the data from this experiment were first separated by speaker type, because the monolingual participants had a within-subjects factor specific to them: duration. Afterward, differences between the non-native speakers and only the set of English monolinguals that received with sentences at a rate of 250 ms were investigated. A significant effect was found of speaker type in that, as expected, monolinguals were consistently faster to name the target words than non-native speakers (see Figure 3-1).

Two 2 x 2 x 2 ANOVAs were performed on the sentence context data from Experiment 1. Included within the first ANOVA was a comparison of the mean reaction times for naming target words of the monolinguals as a function of cognate status and semantic constraint and critical word placement between duration (see Figure 3-2). The analysis showed that there was marginally significant effect of constraint status, as was expected [$F(1,20)=3.109, p=.093$].

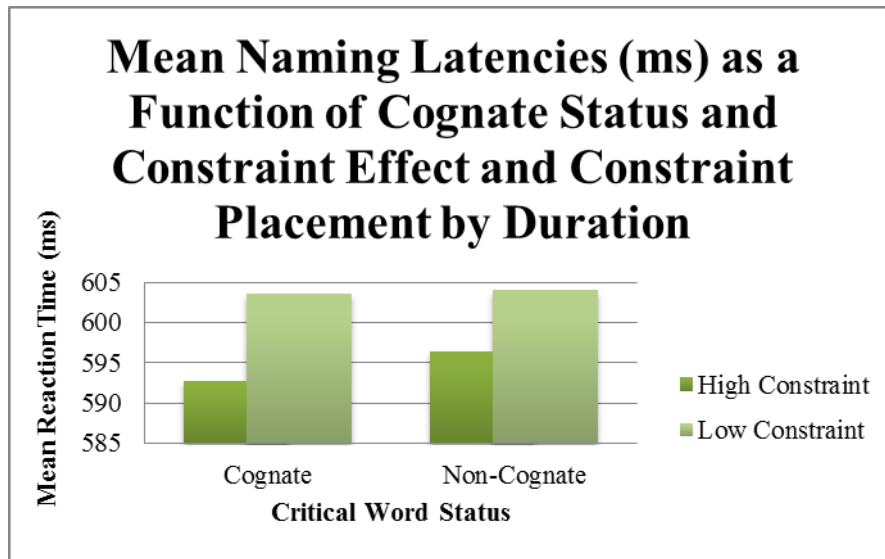


Figure 3-1: Bar graphs demonstrating the constraint effect found in the monolinguals from Experiment 1.

Furthermore, the ANOVA revealed a significant effect of critical word placement [$F(1,20)=11.309, p=.003$] (see Figure XXX).

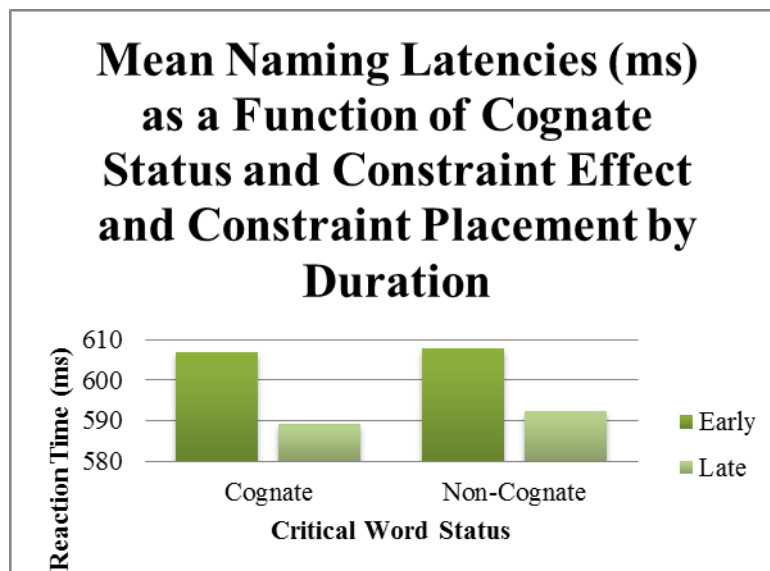


Figure 3-2: Bar graphs demonstrating the critical word placement effect found in the monolinguals Experiment 1.

The ANOVA also showed, which was expected that there was not a significant effect by cognate status [$F(1,20)=.245$]. No other effects or interactions were found to be significant.

The second ANOVA conducted was still a 2 x 2 x 2, but it was a comparison of the mean reaction times for naming target words of the monolinguals and bilinguals who received the same duration rate (250 ms). This ANOVA revealed an effect of cognate status (see Figure 3-3). This status was significant [$F(1,34)=9.284$, $p=.004$] and qualified by a interaction by speaker type (see Figure 3-4) which was also significant [$F(1,34)=12.129$, $p=.001$].

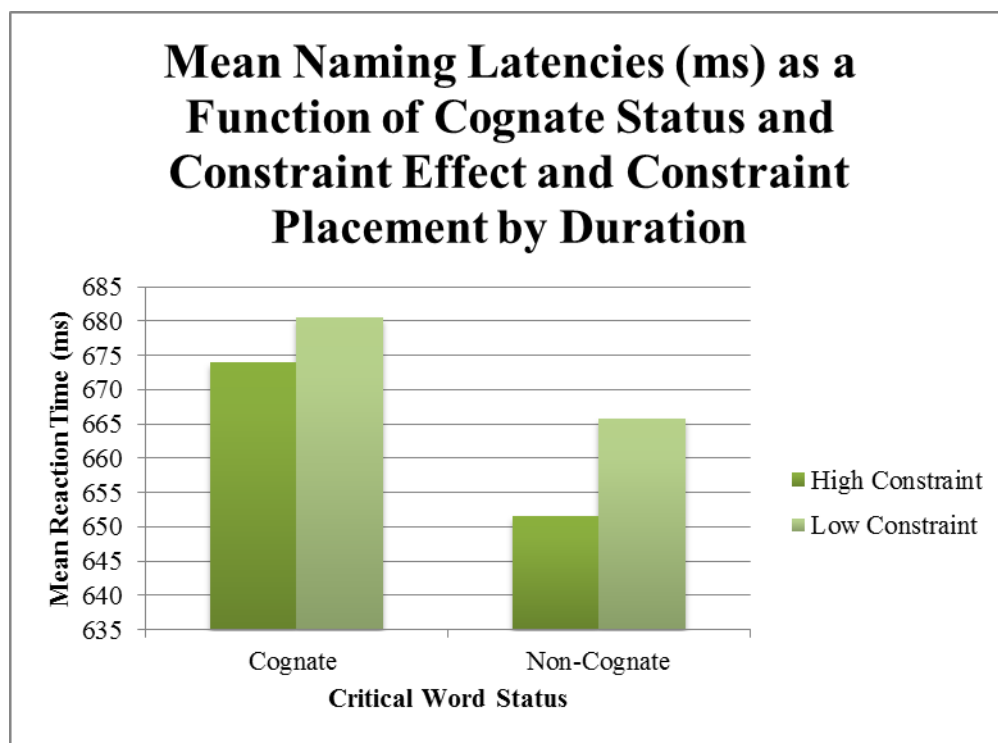


Figure 3-3: Bar graphs demonstrating the cognate effect found in the participants who received the same duration rate in Experiment 1.

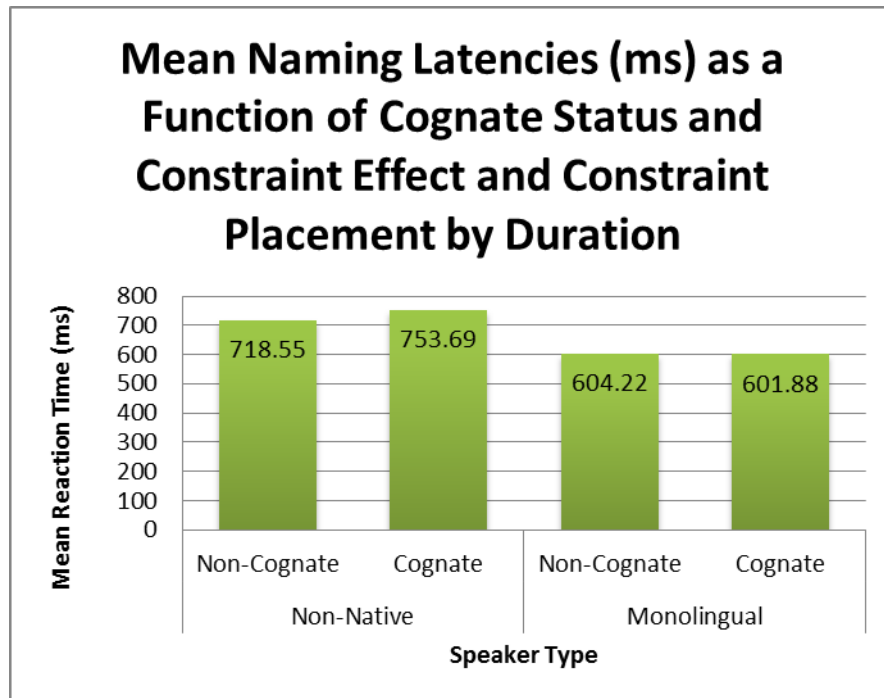


Figure 3-4: Bar graphs demonstrating the interaction between speaker type and critical word status in the participants who received the same duration rate in Experiment 1.

This ANOVA also revealed a significant interaction [$F(1,34)=5.408, p=.036$] of critical word placement by speaker type, as well as a significant effect of constraint status regardless of speaker type [$F(1,34)=4.558, p=.040$] (see Figures 3-5 and 3-6).

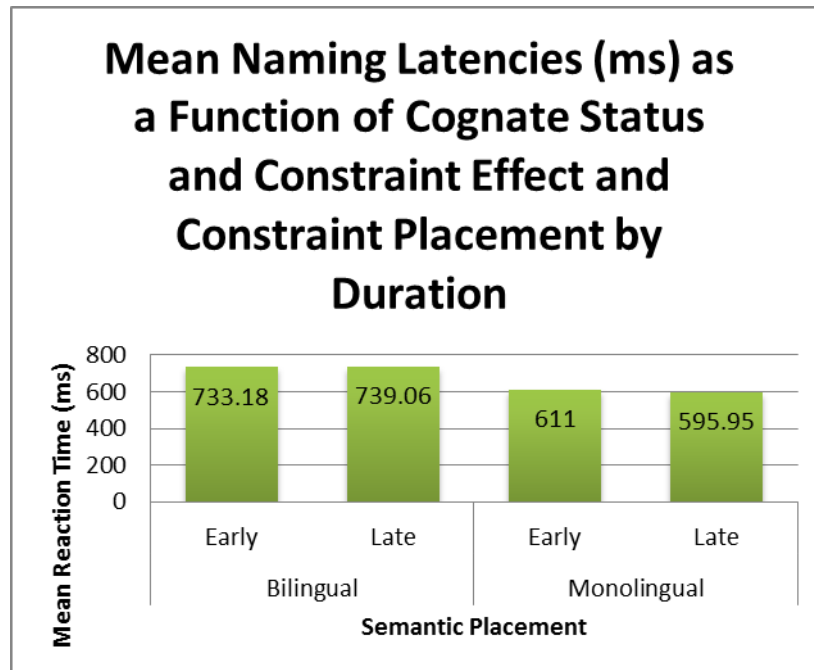


Figure 3-5: Bar graphs demonstrating the interaction between critical word placement by speaker type in the participants who received the same duration rate in Experiment 1.

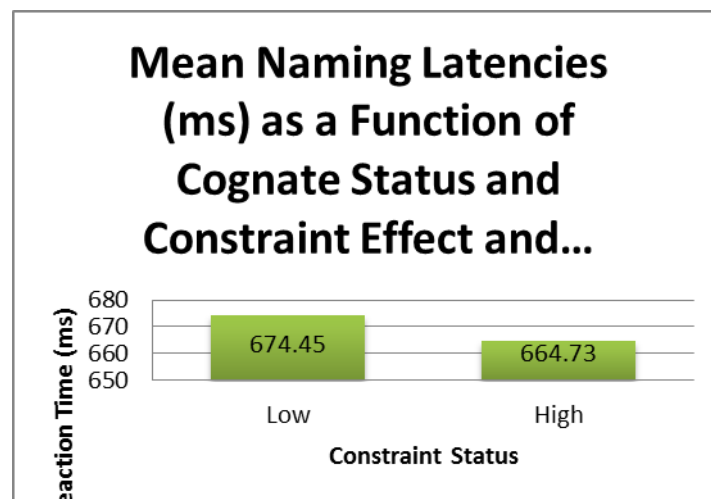


Figure 3-6: Bar graphs demonstrating the effect of constraint status found in the participants who received the same duration rate in Experiment 1.

Lastly, the first ANOVA concluded that there was a significant effect [$F(1,34)=15.176$, $p=.000$] of speaker type (see Figure 3-7). No other effects or interactions were significant.

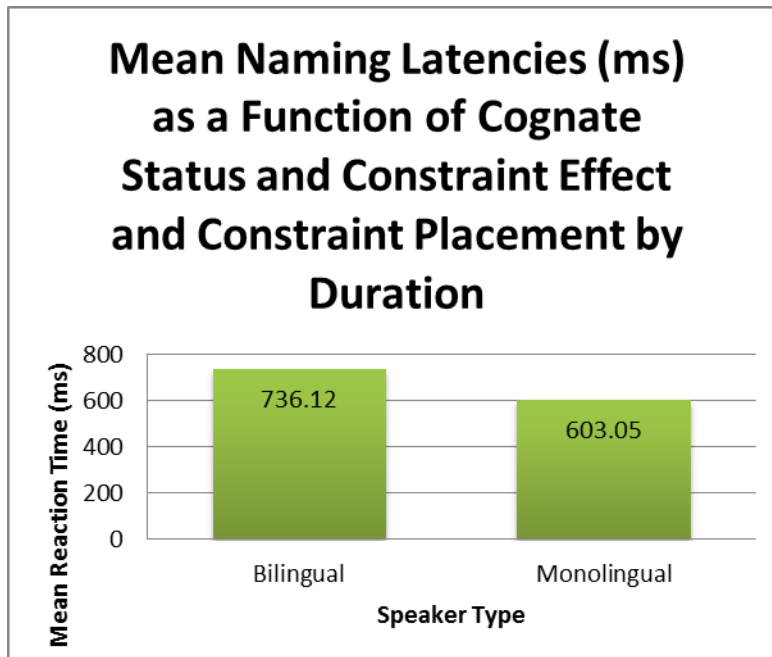


Figure 3-7: Bar graphs demonstrating the effect of speaker type found in the participants who received the same duration rate in Experiment 1.

Data trimming for individual difference tasks and proficiency measures

For the Simon test, the “Simon effect” was calculated by subtracting the mean reaction time for the congruent trials from the mean reaction time for the incongruent trial for each participant. These differences were then averaged together by both speaker type and duration type.

For the O-Span test, both the mean reaction times for correct responses and number of correctly recalled words were combined. Before calculating this number, which was to be used as an index of the participant’s operation span, those reaction times above and below 2.5 times the mean standard deviation were once again removed from consideration of the mean reaction time that was to be calculated. These indices were then averaged together by both speaker type and duration type.

Both picture naming tests were evaluated in the same manner, by analyzing the spoken responses for accuracy. This was done using conservative criterion such that only the exact word was accepted (i.e.: plane was not acceptable for airplane), and pictures that were not named were also scored as incorrect. The total number of named items was then used as the individual index, which was later averaged together by speaker type and duration type. Finally, analyses for the lexical decision test were performed on the accuracy of identifying words and non-words, as well as on the mean reaction times for these identifications. Before calculating the mean reaction times, absolute outliers below 300 ms and above 3000 were removed, as well as the relative outliers which were those values above and below the 2.5 times the standard deviation.

Individual difference measures

Analyses were conducted which compared the mean cognitive performance between the speaker types (see Table 3-3). These analyses concluded that the two speaker types were overall well matched cognitively. However, there was a clear difference in their language performance, which was indicated by the bilinguals' lower overall scores on the two language processing tasks, the picture naming and lexical decision tasks. The difference in the language processing tasks is likely to be due to the fact that all participants performed these tasks in English, the L1 for the monolinguals and the L2 for the non-native speakers.

Speaker Type	O-Span Recall (out of 60)	Simon Score
Bilingual	45.94	42.19
Monolingual	45.27	39.84

Speaker Type	Boston Naming Accuracy	Mean Non-Word Accuracy
Bilingual	43.74%	73.34%
Monolingual	72.04%	84.92%

Table 3-3: A comparison of the average cognitive functioning by speaker type and cognitive test in Experiment 1.

Discussion

The results from Experiment 1 demonstrated that despite having conducted a norming study on the stimuli there was still fine-tuning to be done on the sentences. The constraint effect was present in the right direction, but it did not reach significance. Furthermore, there was a cognate effect present for the non-native speakers, although these speakers were not bilingual in English and Spanish and should not have been sensitive to the cognate status of the critical words. On the other hand, the results from Experiment 1 showed that bilinguals are equally able to sensitive to semantic constraint in sentence context. Furthermore, this was possible despite the fact that they were significantly slower to name the English target words.

An important trend that was consistent across the analyses performed on the data in this experiment reflects on the work done by MacDonald (2006) on the effect of cognitive stressors, such as memory, decoding, and speed on language processing. More specifically, it appears that when monolinguals were subjected to a faster presentation rate in the main task their performance began to resemble that of the bilinguals with respect to their reaction times, accuracy, and the mental processes available in their reading, just as the monolinguals began to perform similarly to the late bilinguals in MacDonald's work. If further studies continue to investigate this idea that situational cognitive pressures may be responsible for the differences in bilinguals' proficiency in their two languages, it may then be used to weaken the plausibility of the Critical Period Hypothesis, which argues that differences in language processing are due to the later age of acquisition in bilinguals.

Chapter 4: Experiment 2

Introduction

The purpose of Experiment 2 was to confirm a newly revised set of sentences would reproduce the semantic constraint effect discussed in Experiment 1 with English monolingual speakers. Again, these monolingual participants were not predicted to produce a cognate facilitation effect because the cognates were defined with respect to English and Spanish and these participants did not have knowledge of Spanish.

Methods

Participants

Participants were recruited via flyers that had been hung throughout the university campus and in the downtown area. 21 English monolingual students from the Pennsylvania State University completed this experiment.

Materials

A total of 192 sentences were presented within Experiment 2's main task (See Appendix E). This set of sentences was comprised of 128 critical sentences, with 64 cognates and 64 non-cognate control words, and 64 filler sentences (see Table 2-4 for example sentences or Appendix F). The critical sentences varied only with respect to cognate status and semantic constraint. Words were presented at an individual rate of 150 ms, except for the critical word, which appeared on the screen until a spoken response was registered.

Target Word	Condition	Sentence
tunnel	C-HC	You can drive from France to England through the tunnel that is build under water.
	C-LC	We did not take the road leading to the tunnel because of all the traffic.
turkey	NC-HC	On Thanksgiving Jennifer was working on the stuffing for the turkey when the guests arrived.
	NC-LC	Jennifer made some pasta because she did not like the turkey her mother was serving.

Table 4-1: Example critical sentences from all four of the conditions tested in Experiment 2.

Here C refers to cognate, NC to non-cognate, HC to high constraint, and LC to low constraint.

The out-of-context tests in Experiment 2 were the same as those used in Experiment 1.

Procedure

See Experiment 1.

Results

General approach

As in Experiment 1, the data that follows is based on participant means. Item analyses have not yet been conducted but will be when this study is prepared for publication. A variety of analyses were performed on the language history questionnaire, sentence context task, and cognitive task data. In particular, for the sentence context task, a 2 (cognate status) x 2 (constraint status) ANOVA was conducted.

However, following the effects revealed in the analyses on the sentence materials in Van Den Boer et al. (2010), who was a collaborator who took the same materials developed here and

tested them in the Netherlands with Dutch-English speakers using a reduced set of sentence items, and thus, target words, in Dutch and English, as well as Spanish and English, as designed originally, I decided to analyze the sentence context data in two ways. First, I analyzed all of the sentence stimuli. Second, I focused on the same subset of the target words that Van Den Boer et al. had isolated. I analyzed these materials separately to see if my data would produce the same findings. Specifically, I was interested in whether a reverse constraint effect would be replicated in which the naming times would be faster for sentences of low constraint.

Language history questionnaire data

Data from the language history questionnaire are shown in Table 4-2. The participants' ages ranged from 18 to 21 years and the mean age here was 19. As in Experiment 1, self-reported data referred to participants' first and second language proficiency in the areas of reading, writing, speaking, and speech comprehension, which was then sorted by speaker type. From self report on a scale of 1 to 10, where a score of 1 referred to being not at all fluent and 10 referred to being highly fluent, monolinguals ranked themselves significantly more proficient in their first language with very low rating in the second language, suggesting that they were functionally monolingual.

Speaker Type	Youngest Age	Oldest Age	Mean Age
Monolingual	18 years	21 years	19 years

Speaker Type	L1 Reading	L1 Writing	L1 Speaking	L1 Speech Comprehension
Monolingual	9.5	9.5	9.5	9.7

Speaker Type	L2 Reading	L2 Writing	L2 Speaking	L2 Speech Comprehension
Monolingual	3.6	3.3	3.1	3.6

Table 4-2: Language history questionnaire data for participants in Experiment 2.

Naming latencies for sentence context data

A 2 x 2 ANOVA was performed on the sentence context data from Experiment 2. Included within this ANOVA was a comparison of the mean reaction times for naming target words as a function of cognate status and semantic constraint (see Figure 4-1). The analysis showed that there was not a significant effect of cognate status, as had been predicted [$F(1,20)=1.398, p > .10$]. A significant effect was found for constraint status, as well ($F(1,20)=4.853, p=.039$). Interestingly, though, the effect was in the opposite direction expected. The participants were slower to name the target words that appeared in a sentence providing semantic constraint. Lastly, the ANOVA showed that the interaction between critical word type and constraint status was non-significant [$F(1,20)<1$].

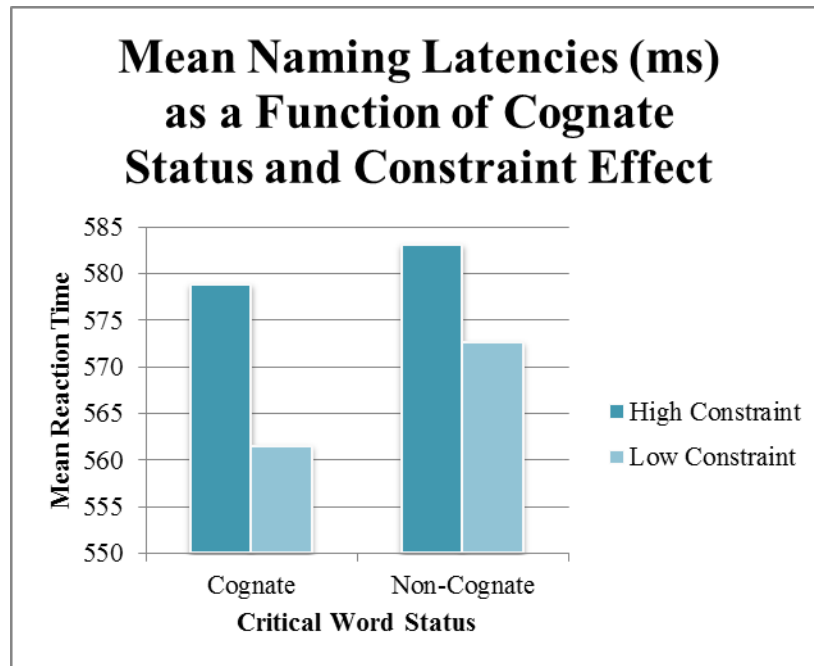


Figure 4-1: Bar graphs demonstrating the absence of a cognate effect in Experiment 2.

Individual difference measures

In order to verify that these participants were well matched to those who completed Experiment 1 the means were calculated on their cognitive performance (see Table 4-3).

Speaker Type	Mean O-Span Recall	Mean Simon Score	Mean Boston Naming Task Accuracy	Mean Non-Word Accuracy
Monolingual	43.95	36.86	77.38%	87.7%

Table 4-3: The average cognitive functioning of participants in Experiment 2.

Discussion

In Experiment 2, I sought to verify whether the newly created sentences would produce the intended effects when presented to English monolinguals. As expected, no cognate status was found. However, what was not expected was the reverse constraint effect. This is important to

note, though, because in Altarriba (1996) it was noted that sentences of high constraint with target words of high frequency did not produce expected constraint effect. Instead, a reference frequency effect was observed for high constraining sentences when the unexpected language appeared, suggesting conflict between the lexical and sentence levels. Furthermore, Van Den Boer et al. (2010) concluded a reverse constraint effect occurred in the word naming task completed by their Dutch-English bilinguals using the exact same overall and subset of sentence stimuli. However, this reverse constraint effect did not extend to the participants' performance on the picture naming task. The fact that the reverse constraint was limited to the word naming task suggests that this is not an issue of confounding lexical properties, but is related to the task at hand. Moreover, these results all contrast with the previous work on sentence processing with monolingual and bilingual participants which suggest that semantic constraint is used to facilitate in reading times (e.g. Schwartz & Kroll, 2006).

Chapter 5: Experiment 3

Introduction

The purpose of Experiment 3 was two-fold. First, it examined whether when reading in one's second language there is the same access to processing semantic constraint in a sentence as it is when reading in one's first language. If semantic constraint is accessible, it was then asked whether this linguistic cue could be used to dampen or even fully inhibit non-specific language activity, or more specifically, the cognate facilitation effect. In order to look at these questions, Spanish-English bilinguals were tested on a subset of sentences that had been used in Experiment 2. Specifically, this change was made after a colleague using these stimuli in the Netherlands. English monolinguals, functioning as the control group, were also tested using this design.

Methods

Participants

Participants were recruited via flyers that had been hung throughout the university campus and in the downtown area. 23 English monolingual and 18 Spanish-English bilingual students from The Pennsylvania State University completed this experiment.

Materials

A total of 128 sentences were presented within Experiment 1's main task (See Appendix G). This set of sentences was comprised of 64 critical sentences, with 32 cognates and 32 non-cognate control words, and 64 filler sentences (See Table 5-1 or Appendix H). The critical sentences varied only with respect to cognate status and semantic constraint. Words were

presented at an individual rate of 350 ms, except for the critical word, which appeared on the screen until a spoken response was registered.

Target Word	Condition	Sentence
balcony	C-HC	Juliet was courted by the handsome Romeo from a balcony of her house.
	C-LC	The couple was looking for a house with a balcony because they enjoyed the view.
balloon	NC-HC	Before the party I bought helium to fill a balloon for my sister.
	NC-LC	Susie went to the surprise party and got a balloon for her niece.

Table 5-1: Example sentences from the four conditions tested within Experiment 3. The conditions are coded the same way as in Experiment 2 where C refers to cognate, NC to non-cognate, HC to high constraint, and LC to low constraint.

The out-of-context tests used in Experiment 3 were the Operation-Span test, a picture naming test, a working memory test, and the lexical decision test. Specifically, the revised picture naming test was used and the Flanker test.

Procedure

- 1) Consent Form & Language History Questionnaire
- 2) Sentence Context Test
- 3) Operation-Span Test
- 4) Picture Naming Test
- 5) Flanker Test
- 6) Lexical Decision Test
- 7) Debriefing Form

Results

As in Experiment 1 and 2, the data that follows is based on participant means. Item analyses have not yet been conducted, but will be when this study is prepared for publication. A variety of analyses were performed on the language history questionnaire, sentence context task, and cognitive task data. For the sentence context task, a 2 (cognate status) x 2 (constraint status) ANOVA was conducted with a between-participants factor of speaker type.

Language history questionnaire data

Data from the language history questionnaire are shown in Table 5-2. The bilinguals' ages ranged from 18 to 35 years and the mean age here was 25.8. The monolinguals' ages ranged from 18 to 25 years and the mean age was 20.2. As in the previous two experiments, self-reported data referred to participants' first and second language proficiency in the areas of reading, writing, speaking, and speech comprehension, which was then sorted by speaker type. From self-report on a scale of 1 to 10, where a score of 1 referred to being not at all fluent and 10 referred to being functionally fluent, monolinguals and bilinguals ranked themselves similarly with respect to their L1 proficiency. On the other hand, bilinguals ranked themselves high in their L2 skills than the monolinguals.

Speaker Type	Youngest Age	Oldest Age	Mean Age
Bilingual	18	35	25.8
Monolingual	18	25	20.2

Speaker Type	L1 Reading	L1 Writing	L1 Speaking	L1 Speech Comprehension
Bilingual	9.71	9.47	9.65	9.71
Monolingual	9.3	9.26	9.74	9.7

Speaker Type	L2 Reading	L2 Writing	L2 Speaking	L2 Speech Comprehension
Bilingual	8.06	7.65	8	8.12
Monolingual	2.95	2.27	2.32	2.45

Table 5-2: Language history questionnaire data for participants in Experiment 3.

Naming latencies for sentence context data

A 2 x 2 ANOVA was performed on the sentence context data from Experiment 3 with a between-participants factor of speaker type. In the ANOVA was a comparison of the mean reaction times for naming target words as a function of cognate status and semantic constraint across speaker type (see Figure 5-1). The analysis showed that there was a significant effect of cognate status, as had been predicted given the inclusion of bilingual speakers [$F(1,39)=5.817$, $p=.021$].

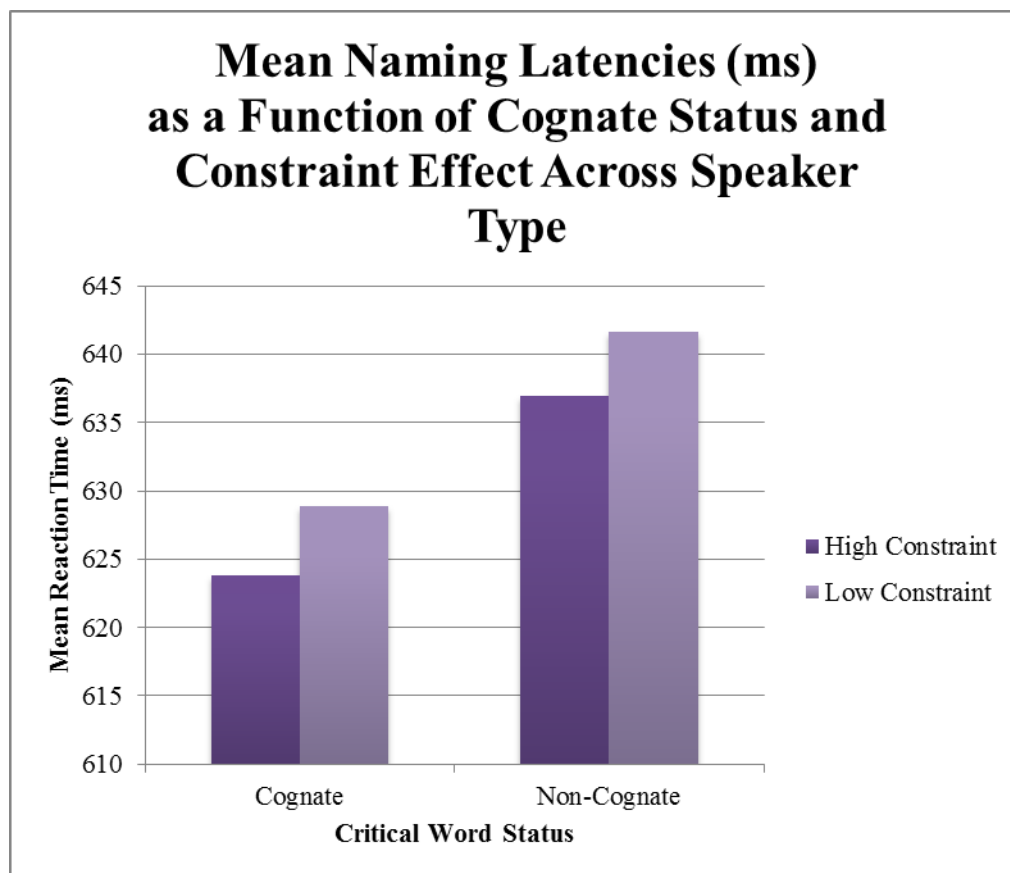


Table 5-1: Bar graphs demonstrating the cognate status found across speaker type in Experiment 3.

Shown in Table XX is the effect of speaker type found in these ANOVAS. This effect was predicted and found to be significant ($F(1,39)=10.136, p=.001$).

Speaker Type	Critical Word Status	Constraint Status	Mean Reaction Time
Bilingual	Cognate	High	685.5469246
	Cognate	Low	694.0267425
	Non-Cognate	High	702.6279024
	Non-Cognate	Low	710.0815146
Monolingual	Cognate	High	575.5494087
	Cognate	Low	577.9060579
	Non-Cognate	High	585.5073161
	Non-Cognate	Low	588.0788979

Table 5-3: Mean reaction times demonstrating the effect of speaker type in Experiment 3.

Moreover, the ANOVA revealed that the effect for constraint status was not even marginally significant [$F(1,39)=1.757, p>.10$].

Individual difference measures

As in Experiment 1, analyses were also conducted that compared the average cognitive performance between the speaker types (see Table 5-3). These analyses concluded that the two speaker types were well matched cognitively. On the other hand, there was a noted difference in their language performance, which was indicated by the bilinguals' lower overall scores on the picture naming and lexical decision test. There was also a slight, but non-significant difference in their working memory as indicated by the difference in mean O-Span recall scores.

Speaker Type	O-Span Recall (out of 60)	Picture Naming Accuracy	Mean Non-Word Accuracy
Bilingual	46.06	84.95%	83%
Monolingual	44.91	91.71%	86%

Table 5-4: A comparison of the average cognitive functioning by speaker type and cognitive test in Experiment 3.

Discussion

The analyses from Experiment replicated the cognate facilitation effect found in previous research. On the other hand, the constraint effect that was expected was not significant, suggesting that the sentences need to be further modified in order to draw out this facilitation effect. It is likely that an item-by-item analysis will provide me with better insight as to the ongoing processes active when reading sentences. However, when considering the successful constraint effect found in Experiment 1 it appears that both bilinguals and monolinguals are equally able to access the semantics of a sentence despite using different time courses. In order to replicate past findings in which the constraint inhibits the cognate facilitation effect, and thus, language non-selectivity, a future study will need to be conducted with updated sentences on a new set of Spanish-English bilinguals.

Chapter 6: General Discussion

The primary goal of this study was to research whether semantic constraint modulates lexical access as monolinguals and bilinguals process sentences. This was achieved through a series of 3 experiments with 3 different speaker groups. English monolinguals, Chinese-English bilinguals, and Spanish-English bilinguals participated in the study which consisted of 5 tasks that measured them as they read sentences and completed cognitive tests. The sentence context task was manipulated such that the stimuli varied according to constraint status, cognate status, and in Experiment 1, to critical word placement. These conditions allowed me to look at how the different speaker types utilize semantic constraint, as well the effect of cognates when reading. Furthermore, I was able to investigate the interplay between semantic constraint and cognates in the Spanish-English data. Overall, the set of experiments replicated past findings and also produced some unique findings that were not expected.

In Experiment 1, it was found that semantic constraint was able to be accessed across speaker type, which means that non-native speakers are indeed equally sensitive to semantic constraint in their L2 as they are in their L1. This is important when considering the previous literature which has discussed the availability of linguistic features to a bilingual in their L1. Clahsen and Felser (2006) reported that unlike early L2 learner, late L2 learners showed differences in their ability to integrate syntactic information when compared to native speakers of their L2. However, it can be reasoned that if this is true then inhibition of lexical nonselectivity would never be achieved by semantic constraint effect, because the semantics of the language would not be able to be properly incorporated with its syntactic and morphological counterparts. This is clearly not true according to the findings from Experiment 1, where the semantic information in sentence context is available to both non-native and monolingual

speakers. It was also expected that the non-native speakers in Experiment 1 would not demonstrate cognate facilitation. However, in Experiment 1 a significant reverse cognate effect was found for these speakers. In future studies that use these stimuli on Chinese-English speakers it will be important to phonologically normalize the target words in order to highlight any underlying similarities that were missed in this study.

In Experiment 2, as predicted there was no cognate effect exhibited by the monolingual participants in the overall or subset analysis. However, there was a reverse constraint effect present. This finding is rather unique, because first of all, semantic priming within sentence context is typically difficult to achieve. As discussed in Chapter 4, this finding also goes against previous research, including the previous experiment, where semantic constraint aids in reading times. However, because these stimuli appropriately did not produce a cognate effect in the monolingual participants, this reverse constraint effect cannot be explained by a confounding lexical factor. Instead, future studies will need to be conducted using the same set of stimuli to see if the findings continue to be replicated. Moreover, future studies should continue to look at picture naming and word naming tasks the use all of the same stimuli except for the target item, which in this case would vary by modality, for differences in results. It is possible that thus far word naming tasks have properties that have been hidden.

Lastly, in Experiment 3, the materials were adapted for Spanish-English bilinguals, which meant that both types of critical words were finally functional. Here, as had been expected, the bilingual participants exhibited a cognate facilitation effect. The semantic constraint that was anticipated to occur across speaker types however did not reach significance. The stimuli from this experiment will need to be revised and normalized before the study is replicated on more Spanish-English bilinguals. A larger number of participants should be recruited, as well. By

doing this, hopefully cleaner effects will be found and more can be revealed concerning the counterintuitive possibility of high constraint sentences resulting in longer naming times.

Future studies

By successfully creating stimuli I will be able to look at what factors are necessary for bilinguals to equally integrate semantic information into their reading process. In other words, I can examine whether it is possible for bilinguals to inhibit activity from the non-target language. If it is, I can do further analyses to see whether there is a relationship between sentence processing and cognition. In broader sense, I can look then investigate the relationship between language and cognition.

While the research conducted on these questions has had the added challenge of untangling correlation from causation, one approach has been to compare the performance of bilinguals and monolinguals on domain general cognitive tasks that themselves do not require language processing. If language and cognition depend on shared processes, then life experience as a bilingual may come to influence performance on purely cognitive tasks. To illustrate, Bialystok and Martin (2004) conducted a series of non-linguistic tasks on age-matched monolingual and bilingual children. The goal of this study was to examine past reports that bilinguals were superior to monolinguals in the domain of inhibitory control. Specifically, they were interested in determining whether the advantage observed for bilingual children was due to a difference in their representational abilities or rather in their processing and resolution of conflict. Using a card-sorting task, they found that the bilingual children were better at conceptual inhibition as evidenced by their faster reaction times after the directions of the task had switched, suggesting that they were able to inhibit the original instructions and process the

stimuli in a new manner. The hypothesis is that the requirement to select one language enables bilinguals to adopt cognitive strategies that more effectively control competition across possible alternatives, regardless of whether those alternatives are linguistic or not.

In the planned study, I will investigate the relationship between language processing and cognition by asking participants to perform a sentence reading task and also an inhibitory control task, similar to the card-sorting task used by Bialystok and Martin (2004). I propose to compare four groups of language users, two bilingual and two monolingual. The two bilingual groups will include younger (8-12 year olds) and older (university students) Spanish-English bilinguals who acquired Spanish first and then entered school in an English-dominant environment. The monolingual groups will include age-matched younger and older native English speakers.

Two experiments are planned. In the first experiment, all of the participants will be given a self-paced sentence reading task in which they process sentences in their native language. The sentences will vary in syntactic complexity and in whether or not a picture substitutes for a concrete noun. Past research has shown that readers are able to integrate the meaning of a picture in a sentence even when the modality difference requires a switch in processing (e.g., Potter et al., 1986; Willems et al., 2008). Bilingual participants will return to the lab for a second session in which they will be asked to perform the same sentence processing task in English, their second language, with or without pictures as in the first session. In the second experiment, the same design will be implemented but instead of pictures, the bilinguals will read sentences, analogous to the sentences containing pictures substituting for words, in which words from the other language are substituted. In each of the experiments, all participants will perform an age-appropriate non-linguistic task to assess inhibitory control (e.g., Bialystok, 2005).

The proposed experiments have a number of specific aims. One is to determine whether bilingual experience affects non-linguistic performance on tasks measuring executive function. The past research suggests that there are advantages for bilinguals relative to their monolingual counterparts. Here, we ask whether we can replicate the reported advantages and whether they differ for younger and older bilinguals. Critically, the second specific aim is to determine whether there is a relationship between performance on the sentence processing task and the measure of executive function. We hypothesize that when faced with the requirement to switch modality (Experiment 1) or language (Experiment 2), bilinguals will be better able to negotiate the potential conflict these differences impose. Only bilinguals will be able to perform the language switching experiment but the picture-in-sentences study will determine whether a bilingual advantage is observed even when processing one language alone and whether, if an advantage is found, it differs as a function of the age of the bilingual. A third specific aim is to determine whether monolingual performance on switches to a picture in a sentence context is modulated by individual differences in inhibitory control.

The intellectual merit of this study is to determine whether the ability to resolve the potential conflict imposed by a modality or a language switch is related to bilingual language experience and/or to differences in inhibitory control. For bilinguals the comparison of sentences with pictures to sentences with language switches can also be used as a way to directly evaluate whether codeswitching is associated with cognitive costs similar to those caused by switch tasks. Furthermore, this study will allow us to better predict linguistic performance according to age.

Investigating language development through the relationship of language and cognition also provides an opportunity for applying basic research on language processing to reading skills.

Research on this topic has broader impact in that it holds implications for the acquisition of literacy among a group of bilingual readers who are often disadvantaged by entering school without English reading skills. Achieving high levels of literacy in a second language is critical to academic success. The proposed study may contribute important information about the component cognitive and linguistics processes that underlie academic success.

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Appendix A: Critical words

Cognate (in English)	Non-Cognate
alphabet	anchor
angel	apple
attic	arrow
baby	bag
balcony	balloon
bananas	bathtub
bicycle	battery
bikini	beak
bomb	beaver
bottle	blanket
bus	boat
cactus	bone
camera	boots
cannon	box
car	bread
cereal	candle
chocolate	carrot
circle	cats
computer	cherry
dentist	coconut
dolphin	cookies
elephant	crib
flute	devil
fruits	dress
garage	eyebrow
guitar	fish
hamburger	fork
harp	freckles
hockey	frog
kangaroo	glasses
kiwi	globe
lamp	hammer

Cognate (in English)	Non-Cognate
lemon	helmet
lion	hook
map	key
painter	leaves
panda	leg
pants	lip
pear	monkey
pedals	pan
piano	peach
picnic	pen
pineapple	pencil
pipe	picture
pirate	pillow
pizza	pockets
plant	puppet
plates	puzzle
radio	rain
rat	road
robot	rocket
rose	rope
salad	scar
soup	seal
spaghetti	shower
statue	snow
sweater	spider
tiger	stairs
toaster	stamp
tomato	teapot
train	toilet
tunnel	trashcan
violin	tree
volcano	turkey

Appendix B: Language history questionnaire

Language History Questionnaire

This questionnaire is designed to give us a better understanding of your experience with other languages. We ask that you be as accurate as thorough as possible when answering the following questions.

1. Gender
 - ☐ Female
 - ☐ Male
2. Age: _____ years
3. Do you have any known visual or hearing problems (corrected or uncorrected)?
 - ☐ No
 - ☐ Yes [Please explain] _____
4. Native Country
 - ☐ United States
 - ☐ Other _____
5. Native Language
 - ☐ English
 - ☐ Other _____
6. Language(s) spoken at home (Please check all that apply).
 - ☐ English
 - ☐ Spanish
 - ☐ German
 - ☐ Other [Please explain: _____]

The following ratings are for your native language.

7. Please rate your native language reading proficiency. (1=not literate and 10 = very literate)

<input type="checkbox"/> 1	<input type="checkbox"/> 6
<input type="checkbox"/> 2	<input type="checkbox"/> 7
<input type="checkbox"/> 3	<input type="checkbox"/> 8
<input type="checkbox"/> 4	<input type="checkbox"/> 9
<input type="checkbox"/> 5	<input type="checkbox"/> 10
8. Please rate your native language writing proficiency. (1=not literate and 10=very literate)

- | | |
|----------------------------|-----------------------------|
| <input type="checkbox"/> 1 | <input type="checkbox"/> 6 |
| <input type="checkbox"/> 2 | <input type="checkbox"/> 7 |
| <input type="checkbox"/> 3 | <input type="checkbox"/> 8 |
| <input type="checkbox"/> 4 | <input type="checkbox"/> 9 |
| <input type="checkbox"/> 5 | <input type="checkbox"/> 10 |

9. Please rate your native language speaking ability. (1=not fluent and 10=very fluent)

- | | |
|----------------------------|-----------------------------|
| <input type="checkbox"/> 1 | <input type="checkbox"/> 6 |
| <input type="checkbox"/> 2 | <input type="checkbox"/> 7 |
| <input type="checkbox"/> 3 | <input type="checkbox"/> 8 |
| <input type="checkbox"/> 4 | <input type="checkbox"/> 9 |
| <input type="checkbox"/> 5 | <input type="checkbox"/> 10 |

10. Please rate your native language speech comprehension ability. (1=unable to understand conversation and 10=perfectly able to understand)

- | | |
|----------------------------|-----------------------------|
| <input type="checkbox"/> 1 | <input type="checkbox"/> 6 |
| <input type="checkbox"/> 2 | <input type="checkbox"/> 7 |
| <input type="checkbox"/> 3 | <input type="checkbox"/> 8 |
| <input type="checkbox"/> 4 | <input type="checkbox"/> 9 |
| <input type="checkbox"/> 5 | <input type="checkbox"/> 10 |

The next section of the questionnaire deals with your second language learning experience.

11. Have you studied any second language?

- ☐ No → **If NO, please go to question #19**
- ☐ Yes *Which language(s)? _____

If YES, where and when? Please check all that apply and indicate length of study.

- ☐ Home Language: _____
 - ☐ Since Age ()
- ☐ Elementary School Language: _____
 - ☐ () year(s)
- ☐ Middle School Language: _____
 - ☐ () year(s)
- ☐ High School Language: _____
 - ☐ 1 year
 - ☐ 2 years
 - ☐ 3 years
 - ☐ 4 years
- ☐ College Language: _____
 - ☐ Have not studied a second language in college

- ☐ Less than a one semester
- ☐ 1-2 semesters
- ☐ 3-4 semesters
- ☐ 5-6 semesters
- ☐ 7-8 semesters
- ☐ 8+ semesters

12. If you are taking/have taken any second language at college, please answer the following question. Are you: (Please check all that apply.)

- ☐ A Spanish, German, etc. 3 student
- ☐ Taking a second language for a requirement but interested in being a major or minor.
- ☐ Taking a second language for a requirement; NOT interested in being a major or minor.
- ☐ A second language minor
- ☐ A second language major
- ☐ A second language graduate student
- ☐ Other [please explain _____]

13. Have you studied / lived abroad?

- ☐ Yes
- ☐ No

If Yes, where and when did you study, for how long, and what language did you speak?

Country	Approx. dates	Length of Stay	Language

The next section asks you to rate your skills in your primary second language.

14. Please rate your second language reading proficiency. (1=not literate and 10=very literate)

- | | |
|----------------------------|-----------------------------|
| <input type="checkbox"/> 1 | <input type="checkbox"/> 6 |
| <input type="checkbox"/> 2 | <input type="checkbox"/> 7 |
| <input type="checkbox"/> 3 | <input type="checkbox"/> 8 |
| <input type="checkbox"/> 4 | <input type="checkbox"/> 9 |
| <input type="checkbox"/> 5 | <input type="checkbox"/> 10 |

15. Please rate your second language writing proficiency. (1=not literate and 10=very literate)

- | | |
|----------------------------|-----------------------------|
| <input type="checkbox"/> 1 | <input type="checkbox"/> 6 |
| <input type="checkbox"/> 2 | <input type="checkbox"/> 7 |
| <input type="checkbox"/> 3 | <input type="checkbox"/> 8 |
| <input type="checkbox"/> 4 | <input type="checkbox"/> 9 |
| <input type="checkbox"/> 5 | <input type="checkbox"/> 10 |

16. Please rate your second language speaking ability. (1=not fluent and 10=very fluent)

- | | |
|----------------------------|-----------------------------|
| <input type="checkbox"/> 1 | <input type="checkbox"/> 6 |
| <input type="checkbox"/> 2 | <input type="checkbox"/> 7 |
| <input type="checkbox"/> 3 | <input type="checkbox"/> 8 |
| <input type="checkbox"/> 4 | <input type="checkbox"/> 9 |
| <input type="checkbox"/> 5 | <input type="checkbox"/> 10 |

17. Please rate your second language speech comprehension ability. (1=unable to understand conversation and 10=perfectly able to understand)

- | | |
|----------------------------|-----------------------------|
| <input type="checkbox"/> 1 | <input type="checkbox"/> 6 |
| <input type="checkbox"/> 2 | <input type="checkbox"/> 7 |
| <input type="checkbox"/> 3 | <input type="checkbox"/> 8 |
| <input type="checkbox"/> 4 | <input type="checkbox"/> 9 |
| <input type="checkbox"/> 5 | <input type="checkbox"/> 10 |

18. In my second language classes I get:

- ☐ Mostly A's
- ☐ Mostly A's and B's
- ☐ Mostly B's
- ☐ Mostly B's and C's
- ☐ Mostly C's

19. If you speak or have studied more than one second language, please explain about your additional language experience (i.e. years, level of proficiency, etc.)

Appendix C: Conditions and critical sentence stimuli from Experiment 1

Condition	
1	Early- Low Constraint- Non-Cognate
2	Early- High Constraint - Non-Cognate
3	Late- Low Constraint- Non-Cognate
4	Late- High Constraint- Non-Cognate
5	Early- Low Constraint- Cognate
6	Early- High Constraint- Cognate
7	Late- Low Constraint- Cognate
8	Late- High Constraint- Cognate

Target	Condition	Sentence
alphabet	5	The kids in the kindergarten class practiced the alphabet song so that they would know it by tomorrow afternoon for the rehearsal.
	6	To spell their names the kids learned the alphabet with the help of their teacher.
	7	The kindergarten teacher was proud of the students who had done well on the test because they had studied the alphabet every night before going to bed.
	8	The teacher wanted the kids to learn to spell their names so together they sang songs that helped them learn the alphabet by heart.
anchor	1	To decorate his beach house the architect hung an anchor on the wall and put two large ropes on each side.
	2	Often used on ships and boats an anchor normally weighs between one and three tons.
	3	In order to decorate his beach house the architect who lives on the fourth floor decided to hang an anchor on the wall and put two large ropes on each side.
	4	Normally used to attach a ship to the bottom of a body of water at a specific point an anchor normally weighs between one and three tons.
angel	5	For the Halloween party Laura wanted to be an angel and wear a blue and white dress with glitter.
	6	Evan bought a halo and wings to dress up as an angel for Halloween this year.
	7	Jane went to the costume store and after spending several hours there she finally decided to dress up as an angel for the Halloween party.
	8	My whole family participates in the decoration of our Christmas tree and my task is to top the tree with an angel that

		my mother made when she was young.
apple	1	The host said that she needed to buy an apple two oranges one pear a few bananas and some grapes to make a fruit salad.
	2	In the biblical story after Adam and Eve eat an apple from the forbidden tree they were expelled from Heaven.
	3	If you want to follow the recipe that my daughter found online the other day you need to buy an apple two oranges one pear a few bananas and some grapes to make a fruit salad.
	4	In a biblical story in Genesis which is the first of the Five Books of Moses after Adam and Eve eat an apple from the forbidden tree they were expelled from Heaven.
arrow	1	The antiques collector could not find the arrow that he had bought at the auction so he went back to see whether he had forgotten it.
	2	After he split an apple with his bow and arrow William Tell came to be known as the most skillful archer of his time.
	3	While the boys were exploring the forest during the night they found an old leather bag and an arrow that were buried near the lake.
	4	William Tell a legendary hero of disputed historical authenticity who became famous because he split an apple with his bow and arrow lived in Switzerland in the 14th century.
attic	5	The landlord of the small house cleaned the attic before moving so that the next family that was going to live in the house wouldn't find a mess.
	6	All the large boxes were stored up in the attic so that they wouldn't take up room in the basement.
	7	When she finished putting away the kitchen plates in her new house Martha put all the empty boxes into the attic so that the garage would not look cluttered.
	8	After we moved my husband put away the kitchen appliances and the books and then stored the boxes up in the attic so that they wouldn't take up room in the basement.
baby	5	The famous actress was happy to have a baby girl; she took lots of time to decorate her room and buy her toys.
	6	After the birth everyone wanted to meet the baby and so they called the mother to find out whether she would see visitors.
	7	While she was shopping at the mall the actress bought plenty of clothes for herself and some toys for the baby who was at home.
	8	When the couple found out that they were expecting they yelled out the window that they were having a baby
bag	1	After she finished the little girl looked for a bag in the cabinet because she wanted to put away all her toys.
	2	After the cashier put the groceries in a bag an attendant took them to the supermarket's van and delivered them to us.

	3	Hannah wanted to go to the party so she asked her mother if she could buy a black dress and a bag to match it.
	4	The young cashier scanned the eggs the bread the lettuce and the water then put all the items in a bag and handed it to the customer.
balcony	5	At breakfast the two friends ate on the balcony where there was a perfect breeze and plenty of sunshine.
	6	The sliding glass door of his high-rise apartment opened to the balcony where he often ate his breakfast.
	7	After having enjoyed a wonderful lunch with their closest friends the family decided to eat their dessert in the balcony where it was warm.
	8	He heard that the view from the twentieth floor was spectacular but they needed to step out onto the balcony to see it.
balloon	1	Before the party the father went to buy a balloon and tied it around the mailbox to signal to the guests the location of the birthday party.
	2	The man brought helium to fill the balloon that was going to take the newlyweds for a ride over the city.
	3	For Susie's first birthday her parents ordered her a heart-shaped cake and went to the store to buy a balloon that they could tie around the mailbox.
	4	The man who owns the adventure sports store downtown brought three large cans of helium to fill the balloon that was going to take the newlyweds for a ride over the city.
bananas	5	The cook that is from Italy bought fresh bananas and vanilla ice cream to make himself a smoothie that would go with his dinner.
	6	The monkeys at the Miami zoo ate all the bananas that the men had picked in the rainforest so they had no more fruit left.
	7	After thinking for a while about a dessert to have after her dinner the girl decided to order the banana ice cream with some cinnamon on top.
	8	The monkeys that were being transported to the lab got away and entered a fruit store where they ate all the bananas that were on site.
bathtub	1	During her vacation Rose washed her clothes in the bathtub of the hotel where she and her husband were staying.
	2	The mother put the rubber duck into the bathtub and gave her baby son his first bath.
	3	Jane left for work hurriedly that morning because she woke up late so and didn't have time to clean the bathtub or the shower.
	4	The little boy liked to play while taking a bath so the mother put a rubber duck inside the bathtub and told him that he could play for five minutes.

battery	1	Luke went to the store to buy a battery but when he returned home he realized that it was the wrong type.
	2	When she went camping Kristin forgot to bring a battery for her flashlight.
	3	The girl was happy that she had gotten the toy that she asked for but she didn't know that there was a battery missing when she tried to turn it on.
	4	I changed the light bulb in the flashlight but then realized that the problem was that it needed a new battery so I sent John to the store to buy one.
beak	1	As the pelican was diving it hit its beak against some rocks and missed the fish.
	2	A pelican catches fish using its beak which it does close to shore.
	3	The famous painter had almost finished painting the multi-colored toucan on his canvas when the easel fell and the beak of the bird was ruined.
	4	The diet of a pelican consists of small fish but they also eat amphibians that they catch with their very long beak and distinctive pouch.
beaver	1	When we went camping in Canada we saw a beaver that was cutting wood most likely to build a dam.
	2	Best known for its natural trait of building dams a beaver is a semi-aquatic rodent native to North America and Europe.
	3	The 4th grade students went camping in Canada and one of them wrote in his diary that he saw a beaver that was cutting wood most likely to build a dam.
	4	Best known for their natural trait of building dams in rivers and streams and building their homes in the resulting pond beavers are native to North America and Europe.
bicycle	6	For the Tour de France Neil Armstrong got a new bicycle and began training arduously every day for five hours.
	5	The student that had little money bought a new bicycle so that she could ride it instead of the bus to go to the market to buy her groceries.
	7	After the motorcycle accident last weekend Harry decided to go to the shop after his class and fix his bicycle to ride it to school.
	8	To prepare himself for the Tour de France that started in three months Lance Armstrong bought a brand new bicycle and began his arduous training.
bikini	5	My daughter was excited when she found a bikini that fit her because now she is ready to go on a cruise with her friends.
	6	To show off her belly button piercing at the beach she bought a bikini in every color for all the days she was going to be at the beach.

	7	Sarah decided to go shopping with her friends after school so that they could help her pick out a bikini for the pool party.
	8	Since she always wanted to wear a two-piece bathing suit Sarah lost some weight and then went to the mall to buy a bikini to fit her slim figure.
blanket	1	I need to put away the blanket that I used during the winter and take out the summer comforter for the bed.
	2	Because people were cold the flight attendant distributed a blanket to all the passengers and reassured everyone that the temperature would reach a comfortable level.
	3	Because I needed to make room in my closet for the new purse I bought during my trip I put away the blanket that was on one of the shelves.
	4	All the passengers on the plane were complaining about being cold so the flight attendant decided to give each a blanket and raised the temperature.
boat	1	While we were sitting by the beach a boat approached the shore so fast that we thought it would run aground.
	2	Because John lived by a marina he bought a boat so that he could take short trips along the nearby islands.
	3	While we were sitting by the beach in one of the Greek islands that we visited this summer a boat approached the shore so fast that we thought it would run aground.
	4	John bought a beautiful house by the marina and because he loves being on the water he bought a boat so that he could take short fishing trips to the nearby lake.
bomb	5	The history students didn't know that a bomb invented in 1939 by three famous scientists caused Hiroshima's destruction.
	6	World War II ended when the US dropped a bomb on the Japanese cities of Hiroshima and Nagasaki.
	7	For the final research project the electrical engineering students searched the internet for instructions on how to build a bomb that could destroy a whole city.
	8	The students didn't know that during World War II the Japanese cities of Hiroshima and Nagasaki were destroyed by a bomb that was dropped by the United States.
bone	1	The scientists thought that they had found the bone of a prehistoric bird but it ended up being a chicken bone.
	2	She loved grilled trout but was worried that she would swallow a bone so she ate it very carefully.
	3	The news article published in the magazine had a very funny story about two scientists who thought they had found the bone of a prehistoric bird but it ended up being a chicken bone.
	4	The museum curator was upset to discover that the skeleton on display was missing a bone and therefore they had to delay the exhibit.

boots	1	The cowboy was glad that he had his boots as he walked through the tall grass and stepped on a snake.
	2	To walk through the snow Jane bought boots that were waterproof and were lined with sheep skin in the inside.
	3	Before she left for the camping trip my friend went shopping with her sister to buy boots using some of the money she received for her birthday.
	4	James is planning a trip to Boulder this winter so to walk through the snow he bought a pair of boots that are waterproof and are lined with sheep skin.
bottle	5	My grandfather who lives in Italy gave me a large bottle full of olive oil which he had made in his summer house.
	6	The French wine we bought came in a bottle that was made out of fine glass and had a distinctive label explaining where the grapes were produced.
	7	When the family went to Italy they decided to learn how to make olive oil so that they could bring a bottle of it back to the Unites States.
	8	The Spanish wine that my cousin and my aunt gave my parents for their wedding anniversary had a decorative label on the bottle that was made out of fine glass.
box	1	I went to the post office to buy a box in order to send my nephew his birthday present.
	2	Before wrapping the present I put the figurine in a box covered it with packing and secured the lid with tape.
	3	The paparazzi photographed the sister of the actress who lived in Chile while she was at the delicatessen buying a box of chocolates for a friend.
	4	Before wrapping the crystal figurine that I purchased at the jewelry store the store owner wrapped it in tissue and put it in a box and secured the top with tape.
bread	1	Because Tom had gained some weight he stopped eating bread and started eating more fruits vegetables and grains instead.
	2	Tom spread some butter on a slice of bread served himself a cup of coffee and sat down to read the newspaper.
	3	Brenda went to pick the children up at school and then stopped by the supermarket to get some bread lettuce and fish for dinner.
	4	Ralphie wanted to make a peanut butter and jelly sandwich but his roommate had finished off the last slice of bread earlier that day.
bus	5	Jack didn't have much money left so the bus was the only option he had to go to work and home without spending too much.
	6	The guide stated that students without a car catch a bus that takes them from their apartment complex to the main

		university campus.
	7	As soon as her alarm clock went off the girl got dressed had breakfast and went outside but the bus had already left.
	8	Because they wanted to see the monuments in Florence and Pisa the group of friends hurried up and got on the bus as quickly as possible.
cactus	5	My friend Kate painted a detailed picture of a cactus during her excursion to the desert and gave it to her mother on her birthday.
	6	A plant known for growing in arid regions like Arizona the cactus is a member of the spine plant family Cactaceae.
	7	While the girl was looking at the album with her mom she said that she liked the picture of the cactus that was taken at the Saguaro National Monument.
	8	Of all the interesting vegetation they saw during their excursion through the Arizona desert the tourists thought the most unique was a cactus with four feet long branches.
camera	5	For their graduation all the high school students received a camera with a memory card with lots of space to take pictures during their trip to Europe.
	6	The famous photographer from New York used his expensive camera to take pictures of the beach before going home with his family.
	7	The young girl did not want to write a wish list for Christmas so her parents decided to buy her a camera because she loved taking pictures.
	8	He had a good offer from a famous travel magazine so the very experienced photographer put film in his camera to take the pictures of exotic places.
candle	1	When the lightning struck our neighborhood Katie lit a candle in the room so that we would have some light.
	2	Before we sang "Happy Birthday" the mother lit one candle and gathered all the guests around the cake so that they would begin singing.
	3	When the lightning struck our home and we lost power during the thunderstorm we lit a candle so that we would have some light.
	4	Before we sang "Happy Birthday" the mother gathered all the kids around the cake took her camera out lit one candle and turned off the lights.
cannon	5	The military museum that we visited had a cannon that was used during the battle of Gettysburg during the American Civil War.
	6	The pirates prepared to attack the ship by aiming the cannon at the hull.

	7	The producer needed to get ready for the play about the Civil War so he asked his assistants to build the cannons and houses that would decorate the stage.
	8	A type of artillery used on ships that is usually large and tubular and uses gunpowder to launch a round projectile the cannon was utilized in World War I during naval combat.
car	5	The newlyweds went to look for a car because they needed to get a new one since their old one didn't pass inspection.
	6	The successful businessman that arrived yesterday drove his new car from his hometown in Seattle down to Texas and along the Gulf of Mexico.
	7	John decided that he wanted to spend some time with a few of his friends but he forgot to get the car inspected so he was afraid of making the trip to Indiana.
	8	The kids wanted to go on a road trip with some friends so they packed their suitcases and got into the car to start their adventure.
carrot	1	The chef decided to garnish his dish with a carrot in order to give it some more color and texture.
	2	Bugs Bunny is a fictional character famous for eating a carrot and for always escaping the traps set by his arch-enemy the stuttering hunter Elmer Fudd.
	3	During the food competition the young chef decided to garnish the pork he prepared for the second course with a carrot in order to give it some more color.
	4	Bugs Bunny an animated rabbit who appears in the Looney Tunes and Merrie Melodies cartoons is famous for eating carrots and for his immortal phrase "What's up Doc?"
cat(s)	1	The people who moved from their apartment left their cat hoping that the new tenants would take care of it.
	2	The two sisters fought like dogs and cats during their whole childhood but once they grew up and had children they became very close.
	3	When Sammy's parents asked her what she was buying with her money she said that she was getting a cat with black and brown spots.
	4	During most of their childhood and throughout their adolescence the two sisters that lived across from us fought like dogs and cats but once they grew up and had children they became very close.
cereal	5	Because Frank is absent-minded he forgot to buy cereal for his daughters so he had to go back to the supermarket.
	6	Corn Flakes made by Kellogg's is a type of cereal with a very low caloric content and many added minerals and vitamins.
	7	While he was at the supermarket John remembered he had to buy orange juice and three different types of cereal for his

		three kids.
	8	Every morning before going to school my wife has a glass of orange juice and pours milk over her cereal for her breakfast.
cherry/ cherries	1	Due to the success of the new pie recipe cherry quickly became a highly sought after fruit at the local farmers market.
	2	She made an ice cream sundae decorated it with a cherry and then brought it to the table for everyone to share.
	3	After he published his second book on pies and tarts the pastry chef received his fifth award for the cherry pie recipe with ice cream topping.
	4	The ice-cream sundae a famous dessert dish prepared with vanilla ice spiced up with syrup and decorated with a cherry is of disputed origin.
chocolate	5	After having finished dinner the famous model got some chocolate from the cabinet and heated it in a bowl to pour it on her ice cream.
	6	To satisfy her sweet tooth she bought a bar of chocolate to eat on the school bus.
	7	Every day after returning from school the boy helped his mother prepare dinner and make a vanilla cake with strawberries chocolate and bits of almonds.
	8	The little girl pouted when her mother served her vanilla ice cream because her favorite flavor is chocolate which her mom knows.
circle	5	The boy in the drawing class needed to draw a circle for his geometry homework so he asked his bother to lend him a protractor.
	6	Patty needed a round object to draw a circle for the geometry homework that was due the next morning.
	7	While they were trying to find their friend's house they realized that they had been driving around in a circle and wasting time.
	8	The kids used their telescope and saw that the shape of the full moon that night was a perfect circle for the first night in a long time.
coconut	1	Jason went to the local supermarket and found a coconut that was much smaller than the one he had seen at the beach.
	2	Jason climbed the palm tree to grab a coconut then used an axe to cut the top off and drank the milk that was inside.
	3	The five-star beachside restaurant prepared a delicious dish made with locally caught oysters clams and a coconut sauce served on the side.
	4	During their spring break vacation to the Bahamas the guys decided to climb a palm tree to grab a coconut and drink the water that was inside.

computer	5	For her 21st birthday Linda received a new computer so she finally decided to get rid of her old typewriter.
	6	To start his homework Logan turned on his computer and did some research on the internet to find some good articles.
	7	For her birthday Ana got some books a new jacket a pair of shoes new sunglasses and a new computer with a printer and scanner.
	8	Mark needed to write his paper for tomorrow so after deciding what he wanted to write about he turned on his new computer and began working.
cookie	1	Because the oven alarm didn't go off I burnt the cookies that I had made especially for my baby daughter.
	2	The baker uses dark chocolate chips to bake his favorite type of cookies which he sells plenty of at his famous bakery.
	3	To attract more customers the restaurant offered a chicken sandwich with a side salad a glass of wine and a cookie or a plate of fresh fruit.
	4	Before going to our friend's house for dinner we stopped by the famous bakery that makes delicious cakes pies and chocolate-chip cookies and bought a chocolate cake for dessert.
crib	1	To make the dresser fit in the bedroom the crib was moved to the bedroom on the second floor that wasn't being used.
	2	When the baby fell asleep Joyce put him in his crib and then turned on her computer to try to catch up with her work.
	3	To make the dresser that the couple bought in the antique store fit in the bedroom they decided to move the crib to the room that wasn't being used.
	4	To get the baby's bedroom ready the couple went out on Sunday to buy a dresser a baby-changing station and a crib at the famous baby furniture store Bellini.
dentist	5	Yesterday afternoon my brother received a card from the dentist reminding him that he had to go in the next day because his cleaning was due.
	6	Her tooth was hurting so Martha called the dentist and made an appointment with him for tomorrow morning.
	7	When they asked Amy what she wanted to be when she graduated she said she had plans of becoming a dentist like her father.
	8	Since Mary's tooth was hurting she didn't go to school and her mother stayed home so that she could call the dentist and make an appointment.
devil	1	I went to the costume store looking for a devil costume for my son but I did not find any.
	2	Artists have depicted Satan more commonly known as the devil as a human-like monstrous figure with horns and a tail.

	3	For their first Halloween party the twins asked their parents to drive them to the store to look for a devil costume that looked like the one in the scary movie.
	4	Satan who is believed to be a powerful supernatural being in Christianity Islam and other religions is also known as the Devil and has been depicted by many artists as a human-like monster.
dolphin	5	The kids were very excited to see the dolphin jumping through hoops and performing many different tricks in the aquarium.
	6	Sonar is used by the intelligent sea mammal called the dolphin which is closely related to the whale.
	7	When the teacher asked the class what their favorite animal was a student in the back said that hers was the dolphin because it made funny noises.
	8	Of all the mammals they saw during their field trip to the aquarium the class's favorite was a very smart dolphin that seemed to enjoy interacting with its trainers.
dress(es)	1	For my parents' wedding anniversary I bought a dress with brown and blue polka dots and a pair of brown sandals.
	3	For her 10th wedding anniversary which was going to be celebrated in Paris the famous film maker bought a dress with brown and blue polka dots.
	4	The girl was so excited about being asked to the prom that she immediately went to the store to pick out her dress and jewelry for the big night.
	2	Ana likes pants skirts and shorts but often wears a dress when she goes to events that require formal attire.
elephant	5	While the cameraman was filming the special on an elephant he tripped over a rock and got so hurt that they had to stop the production.
	6	Defined as a mammal with a large trunk the elephant is able to perform very intricate and impressive tricks with only a short amount of training.
	7	After the trip to the Museum of Natural History the kids said that they were impressed with how much the elephant has changed since prehistoric times.
	8	During the show at the circus both children and adults gave a standing ovation after the largest mammal there the elephant performed very intricate tricks.
eyebrow	1	While the baby was crawling he hit his eyebrow on the corner of the end table in the living room and had to be rushed to the hospital.
	2	Many women use tweezers to shape each eyebrow but some are following Hollywood's new trend of waxing them because that lasts longer.
	3	Yesterday the baby was rushed to the hospital because while

		he was crawling in the living room he hit his eyebrow on the corner of the end table.
	4	According to a new poll carried out by a prestigious women's magazine many women use tweezers to shape each eyebrow but some are following Hollywood's new trend to wax them.
fish	1	When I was a child my mother rarely prepared fish for dinner because she knew that nobody really liked it.
	2	Cod tilapia and salmon are types of fish commonly sold in supermarkets as well as in the best fish markets across the country.
	3	After dinner we sat around the table to tell stories about our childhood and I remembered that my mother rarely prepared fish because my brothers didn't like it.
	4	The Atlantic salmon named scientifically by zoologist and taxonomist Carolus Linnaeus in 1758 is one of the many species of fish that undergo their greatest feeding and growth in salt water.
flute	5	The girl asked her mother if she could get flute lessons for her birthday because she really liked listening to classical music during her spare time.
	6	A long cylindrical woodwind instrument similar to the clarinet is the flute which produces its sound from the flow of air against an edge.
	7	Hannah did not want to go to school yesterday because she could not remember where she had left her flute and could not leave until she found it.
	8	In order to mimic the sound of a bird in the theater production a member of the orchestra played her flute very skillfully and convincingly.
fork	1	As I was getting ready to start eating my fork fell on the floor so I asked the waiter to bring me a clean one.
	2	Katie learned to use a knife and fork when she was two years old because her babysitter got tired of having to feed her.
	3	My youngest son set the dinner table but because it was his first time he forgot to put the fork on the left side of the plate.
	4	Because the baby-sitter got tired of having to feed Jimmy she taught him how to use a knife and fork when he was only 16 months old.
freckles	1	When I spend much time in the sun my face gets many freckles so I am careful to always put sunscreen on during sunny summer days.
	2	Pippi Longstocking whose face is covered with freckles and who has long red braids is a fictional children's literature character of Swedish author Astrid Lindgren.
	3	Even though some people tend to be self-conscious about

		having them Mary has grown more comfortable with her freckles particularly over the past few years.
	4	Pippi Longstocking a fictional kid's character created by Swedish author Astrid Lindgren has long braids a round face covered with freckles and a very big smile.
frog	1	To feed the snake the zookeeper brought out a frog and gave it to him while everyone was watching through the glass.
	2	The wicked witch turned the prince into a frog and only the kiss of a beautiful loving princess could turn him back into a human.
	3	The young accountant was completely surprised when she came home from work early that evening and found a live frog in her shower.
	4	In a famous fairytale best known through the Brothers Grimm's written version a wicked witch turned a prince into a frog but the kiss of a princess magically transforms him into a handsome prince.
fruit(s)	5	My aunt added to the cake several types of fruit even though the recipe only called for strawberries and blueberries.
	6	To stay healthy people should eat five servings of vegetables and fruits a day and eat dairy for healthy teeth and bones.
	7	Because he had gained a few pounds during his vacation to Greece the aerobics instructor decided to eat only some fruit at dinner time.
	8	The dietician warned that many young kids are overweight or obese and advised parents to give them five servings of vegetables and fruits a day to stay healthy.
garage	5	The tennis player found the rackets in the garage and decided to call his friends so that they could go to play tennis tomorrow morning.
	6	Anticipating the snowstorm Janelle pulled her car into the garage to keep it from being covered in ice the next morning.
	7	Last weekend the guys decided not to do their math and chemistry homework and instead cleaned out and organized the garage to make room for their new motorcycle.
	8	The newscaster said that last week's dangerous storm did not damage any cars because they were parked in a garage which protected them from the winds.
glasses	1	My roommate spent the entire morning looking for her glasses and finally found them under the cushion of our sofa.
	2	My eyesight got worse so I bought glasses at the nearby pharmacy but I still can't see that well.
	3	The bank manager with whom I had an appointment at 0.416666666666667 arrived 45 minutes late because she couldn't find her glasses and can't see anything without them.
	4	Because I was having trouble reading I made an appointment

		with the ophthalmologists to get a new pair of glasses but he called at the last minute to reschedule it.
globe	1	The teacher went to the store to buy a globe for her geography class but couldn't find one so she ended up buying a world map.
	2	Defined as a three-dimensional model of the Earth a globe is normally found in geography and earth science classrooms.
	3	With the funds given by the high school to the teachers the new teacher planned to buy several books and a globe for her geography class.
	4	Defined as a three-dimensional scale model of the Earth that has exaggerated elevations to make them easily visible and identifiable a globe is normally found in geography and earth science classrooms.
guitar	5	For his birthday party Ben received a brand new guitar just like the one he had seen many years ago at the music festival.
	6	Jimi Hendrix who died in 1979 played the guitar with such creativity and sophistication that he is considered the father of modern rock.
	7	My youngest niece said that she did not want anything in particular for her birthday but her parents got her a guitar so she could start taking lessons.
	8	Everyone who is a rock fan and enjoys rock music knows that Jimi Hendrix who died in 1979 played the electric guitar with incredible creativity and sophistication.
hamburger	5	The construction worker from Mexico City bought a hamburger while his friend had a spinach salad that was prepared by his wife.
	6	The girl went to McDonald's and ordered a hamburger with bacon cheese lettuce tomatoes and a strawberry milkshake.
	7	Every Friday after school Bill and his three best friends go to a restaurant in their neighborhood and he orders a hamburger with Swiss cheese and a large beer.
	8	Because Bill didn't like cheese when he went to McDonald's with his grandmother he ordered a hamburger and a small order of fries.
hammer	1	John asked me to bring him the hammer so that he could hang the painting that we bought at the Art Festival.
	2	Nailing a hook on a wall without a hammer is an impossible task even for the most creative of home decorators.
	3	After the moving company delivered the furniture and the family put everything away John decided to look for a hammer so that he could hang the painting on the wall.
	4	I don't know what Peter was thinking when he tried to nail a hook on a wall without using a hammer because he normally doesn't do such things.

harp	5	The musician that lives next door played her harp every day for about an hour so that she would know the score for the Christmas concert.
	6	The woman loved the painting of an angel playing the harp which was painted two-hundred years ago.
	7	Instead of going outside to play with his friends the boy decided he would use his free time to practice the harp for an hour.
	8	In her orchestra's Christmas concert Cari got the part of an angel playing the harp which was much too large for her body.
helmet	1	The girl went to look for her helmet in the garage because she wanted to go bike riding with her friend.
	2	To protect his head the boy put on a helmet got on his bicycle and went riding with his friend around the neighborhood.
	3	The pretty little girl wanted to play with her friends so she went to her garage to look for a helmet that she could wear while riding her bike.
	4	In the class being offered by the Bicycle Safety Institute the cycling instructor stressed that everyone must wear a helmet to protect the head against serious injuries.
hockey	5	Before the game began the sports commentator said that hockey is a very rough sport and that very few players are able to avoid the injuries.
	6	Defined as a team sport played on ice hockey is a fast-paced and physical sport most popular in areas that are sufficiently cold.
	7	A few minutes before the final match between the two teams began the sports commentator who was from Canada said that hockey is a very rough and dangerous sport.
	8	Defined by many as a very fast-paced and physical sport played on ice in areas that are sufficiently cold hockey has become a year-round pastime at the amateur level.
hook	1	Sue asked her husband to remove the hook that was behind the bathroom door because it was broken and it needed to be replaced.
	2	The kids put the bait on the hook threw their fishing poles into the lake and waited patiently until they caught a fish.
	3	Sue wanted to get her two children's bicycles off the garage floor so she asked her husband to put a hook on the garage ceiling.
	4	While we were on our fishing trip in Canada the kids would help us by putting the bait on the hook and casting the fishing lines into the lake.
kangaroo	5	John was inspecting the zoo when he saw that a kangaroo jumped out of its cage and began playing with all the children that were close by.

	6	The most common marsupial in Australia is the kangaroo which jumps up and down to go from one place to another.
	7	During the end-of-the-year school trip to the zoo the two girls who want to become doctors decided to watch a kangaroo while it was giving birth to its young.
	8	When the kids were studying the unit on Australia they learned that the most common marsupial there is the kangaroo followed by the koala.
key	1	The concierge told me not to forget the key that opens the entrance because the door is normally locked after 11:30PM.
	2	Sue couldn't open the door because she forgot the key on the kitchen countertop of her boyfriend's summer house on the mountain.
	3	At the hotel we stayed at during our visit to Amsterdam the concierge reminded us to always bring with us the key that opens the entrance because the door is normally locked after 11:30PM.
	4	When Sue arrived to her boyfriend's summer house she realized that she couldn't open the door because she forgot the key on her kitchen countertop.
kiwi	5	Michelle was preparing a dessert dish so she cut the kiwi in small cubes so that it would be easier to eat with the rest of the fruit salad.
	6	Of all the green fruits from New Zealand the kiwi which is originally from northern China is the most delicious one.
	7	The pediatrician told the new parents that their baby could start eating solid foods so the father cut up a kiwi in small cubes and fed it to his daughter.
	8	During the tour through the agricultural areas the guide told us that of all the green fruits from New Zealand the kiwi is the only one originally from northern China.
lamp	5	Mary put in the corner a tall and black lamp which created shadows on the ceiling that scared her son.
	6	David couldn't see so he turned on the small lamp that was in his room so that he could read a book before going to sleep.
	7	Ali didn't go to the party with her friends because she went to the store with her mom to find a lamp for her dormitory room.
	8	Tina didn't have enough light for when she wanted to read in her bed so she went to buy an antique lamp to put on her night table.
leaves	1	I had planned to pick up the leaves in the garden on Saturday but the weather forecast predicted rain so I had to wait another week.
	2	Italian basil is a plant with green leaves that grows in warm climates in South America and some parts of Asia.
	3	Before the departmental party which we plan to host at the

		beginning of next semester we need to pick up the leaves in the back yard.
	4	Sweet basil a tender low-growing herb that is grown as a perennial in warm tropical climates normally has large green leaves and is commonly used in Italian cooking.
leg	1	Kerry went to the doctor because her leg had been hurting for several weeks and she was having a hard time walking.
	2	During the race the horse fell and broke a leg so badly that the vet said there was no choice but to euthanize him.
	3	Although the tourist looked forward to reaching the summit of the mountain he was unable to get the top because his leg began to hurt.
	4	In the last Kentucky Derby one of the horses favored to win the race fell down and fractured its right leg so badly that the vet decided it had to be euthanized.
lemon(s)	5	The inexperienced flight attendant forgot to put a lemon in the businessman's drink so he was reprimanded by his supervisor.
	6	To add flavor to the fish the chef squeezed a lemon and served it to his customers along with a side of potatoes.
	7	During the party Jessica told Mary that her favorite of all of the foods there was the lemon and almond cake.
	8	The kids in the neighborhood wanted to raise a little money during the summer so they decided to squeeze a few lemons into water with some sugar to make lemonade.
lion	5	In the Disney movie that opened last week the lion jumped out of his cave and chased the hunters away from his territory.
	6	In the Wizard of Oz the cowardly lion asks the wizard to give him courage.
	7	While she was watching the movie with her friends the girl got very scared during the scene with the lion and didn't want to keep watching it.
	8	The teacher read the kids a story about animals in the jungle which said that the king of the jungle is the lion and all the other animals are scared of him.
lip	1	The girl fell from the swing and cut her lip but fortunately the injury was not serious so she did not need any stitches.
	2	When Kate fell her teeth went through her top lip so she was rushed by her aunt to a nearby hospital for surgery.
	3	While the kids were playing on the swings at the adventure park my sister's daughter fell and cut her lip but fortunately the injury was not serious so she did not need any stitches.
	4	When Kate fell she didn't put her hands forward to break her fall so her top teeth went through her lower lip and she was rushed to a nearby hospital for surgery.
map(s)	7	My nephew rented a new apartment with a couple of friends and decided to decorate the walls with posters and a map of the

		places he had visited.
	8	During the search of a hidden treasure in the forest the pirates studied the landmarks depicted on their map so they would find the gold.
	5	The teacher asked each child to color the map that she gave each of them and to take the map home to show her or his parents.
	6	The New Mexican cartographer studied the topographic map carefully for various months before starting his search for the hidden river.
monkey	1	Laura was coloring in the drawing of the monkey when her mother came into her room to tell her it was time to go to bed.
	2	A baboon is a common type of monkey that lives primarily in some parts of West and Central Africa.
	3	When they went to the pet store the boy told his parents that instead of buying a frog he wanted a monkey to keep him company.
	4	A baboon which has a long muzzle close-set eyes a heavy powerful jaw and thick fur is a common type of monkey that lives in the jungles of Africa.
painter	5	Because he was depressed and lacked inspiration the French painter went for a trip around the world in search of a person that would be his model.
	6	With his large canvas and paintbrushes ready the painter began his masterpiece for the weekend exhibit.
	7	After having contemplated for a long time the boy decided that he wanted to move to Italy and be a painter for the rest of his life.
	8	Rather than applying the new coat of paint themselves the newlywed couple hired a painter to do the job.
pan	1	The bride and groom decided to include a pan in their bridal registry list because they enjoyed making omelets.
	2	To fry some eggs Mary looked for a pan in her mother's kitchen and opened every single cabinet door until she found one.
	3	When they went to the store to choose the items for their wedding registry the bride and groom agreed to include a pan because they enjoyed making omelets.
	4	Mary wanted to fry some eggs but because she was unfamiliar with her mother's kitchen she looked all over for a pan and found a Teflon skillet.
panda(s)	5	During the school's visit to the zoo a panda managed to escape from his cage and scared the visitors that were in front of the exhibit.
	6	At the Chinese zoo the zookeeper fed bamboo to the panda that was climbing up a tree into the shade.

	7	The kids were bored at their house so they decided to watch a documentary on the Discovery Channel about panda and other animals.
	8	During their trip to the zoo in China the kids noticed an animal munching on bamboo and realized it must be a panda which is known for its distinctive appearance.
pants	5	Before the wedding ceremony began the little boy dirtied his pants and was scolded by his parents.
	6	The groom wore a white shirt and a black pair of pants a black jacket and a black bowtie; everyone said that he looked very handsome.
	7	The man who owns the winter sports store called his distributors to buy light ski boots titanium skis and pants for skiing
	8	For the wedding the groom went to the Armani store on Fifth Avenue and bought an Armani white shirt pants and a black jacket.
peach	1	The fruit basket in the kitchen had one peach that was rotten and it ended up spoiling the rest of the fruits around.
	2	A pitted fruit with a fuzzy skin the peach is a great summer fruit that grows in warm climates.
	3	When the kids stopped playing basketball to have a snack one of them noticed that the fruit basket had one peach that was rotten so it was spoiling the fruit around it.
	4	Apricots which were first introduced to Greece by Alexander the Great in 319 B.C.E. look a lot like a peach except that they are smaller.
pear	5	For my daughter's mid-morning snack I peel a pear cut it into small slices and sprinkle some sugar on top.
	6	Sold at fruit stands Anjou and Bartlett are two very different types of pears available in the summer months.
	7	My oldest sister's favorite meal is breakfast so each morning before heading out to work she cuts up a pear mixes it with a vanilla yogurt and puts honey on top.
	8	Even though the Bartlett variety is his favorite Andrew loves to eat any variety of pear much more than he likes any type of apple.
pedal(s)	7	The famous cyclist who was born in California came to my store because he was looking for a particular type of pedal for the bicycle he was fixing.
	5	Mark couldn't play with his friends because the pedal of his bicycle was broken the seat was torn and the brakes were not working.
	6	A bicycle has two wheels handlebars a chain and on each side a pedal that is used to move the chain that turns the rear wheel.
	8	During the last part of the race the cyclist lost control of his

		bike after his feet slipped off of the pedals and his bike fell over.
pen	1	The attorney asked his secretary to bring him a pen so that his client could sign the trust that he had created for his children.
	2	The lawyer wanted to sign the contract using a pen that was given to him on his graduation day by his grandfather.
	3	The attorney who is defending the famous football player is a very superstitious man so he brought his favorite pen to sign the papers for the trial.
	4	The brother of the actress who lived in Hollywood for some years wanted to sign the contract using a pen that was given to him on his graduation day by his grandfather.
pencil	1	The students were asked to use a pencil when filling out the forms that were distributed to evaluate their classes.
	2	Instead of using a pen the applicant used a pencil to fill out his application thus disqualifying him.
	3	The students were given a set of written instructions for the exam among which they were asked to use a pencil so that the tests could be automatically scored.
	4	When filling out forms applications or any other type of document legal advisors strongly recommend that people use a pen instead of a pencil because information can be easily altered with the latter.
piano	5	In order to be a better musician Sam took piano lessons from the concert pianist that lives in his town.
	6	The famous composer sat on the bench of his piano and he thanked the audience for being present at the concert.
	7	The man invited the woman to dinner and a movie but she said she had to go to her sister's piano concert that evening.
	8	The composer who was giving a concert whose proceeds would be used for cancer research sat at the bench and began to play the piano until late in the evening.
picnic	5	The two families who were neighbors were planning a picnic for the weekend but the weather forecast predicted rain so they cancelled the outing.
	6	They took a basket of food to the park to have a picnic last Monday Evening.
	7	Although not everyone did the same thing during the long weekend the reporter said most people went on a picnic with their friends and families.
	8	One of the family's favorite things to do during the summer was to take a basket of food to the park for a picnic and they tried to go once per week.
picture	1	The construction worker decided to take a picture of the damage created by floods and high winds last Monday.
	2	At the crime scene I had my cell phone so I snapped a picture

		and sent it to the local newspaper that very day.
	3	After last week's torrential rains which destroyed a number of businesses and residences the construction worker decided to take a picture of the damage caused to his house for insurance purposes.
	4	After returning from our trip to Europe I asked my husband to put a nail on the wall to hang a picture that I bought in Italy from a local artist.
pillow	1	Before embarking on our road trip I put a pillow on the back seat so that my daughter could lean on it when she gets tired.
	2	He bought sheets a blanket a comforter and a pillow for the new bed in his apartment.
	3	Before embarking on their road trip the mother thought that it would be a good idea to bring a pillow for her daughter to lean on when she got tired.
	4	For the bed I purchased for the guest room on the second floor I bought sheets a comforter and a feather-filled pillow that was on sale.
pineapple	5	The Spanish girl taking cooking lessons baked a pineapple cake but as she was leaving her house she dropped it on the garage floor.
	6	Piña colada is a cocktail made with rum coconut and pineapple juice usually served in a tall glass either blended or on the rocks.
	7	Last night at my friend's house he made a delicious dinner and a fabulous cake with bits of pineapple and nuts in the middle.
	8	In an attempt to be different the university organization advertised free Hawaiian pizza at their event which comes with ham and slices of pineapple on top.
pipe	5	For Father's Day the two brothers decided to buy a pipe that was made from Chinese ivory at the tobacco store close to their house.
	6	Sherlock Holmes a famous fictional detective known for smoking a pipe was the creation of Scottish-born author and physician Sir Arthur Conan Doyle.
	7	My brother wanted to buy something unique for my father so he went to a Chinese store and bought him a pipe made from ivory.
	8	A brilliant London-based detective Sherlock Holmes is famous for his skillful use of deductive reasoning and for smoking a pipe while solving criminal cases.
pirate	5	Seth said that he would dress up as a pirate for the Halloween party that his fraternity was having.
	6	According to the legend the ship was attacked by a pirate and all the passengers remained prisoners for a week.

	7	The girl told her brother that he should dress up as an Indian because she wanted to dress up as a pirate for the costume party.
	8	As it was sailing the Caribbean on its way to Haiti and the Dominican Republic the ship was attacked by a band of pirates and had to abandon its route.
pizza	5	The girl told her parents she wanted to eat pizza for dinner so they called Domino's and ordered two with peppers and olives.
	6	At the Italian restaurant the family ordered pepperoni on their pizza with plenty of cheese so that everyone could share.
	7	After a long day at the university the group of friends decided that it would be fun to have some pizza and then go out to see a movie.
	8	When they went to the famous Italian restaurant the family decided to order a salad with a balsamic vinaigrette and a large pizza with mushrooms and green peppers.
plant	5	For her anniversary the teacher received a small plant and some flowers from her best friend so that she could use it to decorate her office.
	6	Instead of flowers the florist sent a decorative plant to Mary's sister for her birthday
	7	Stacy needed to water her garden so she stepped out turned on the water hose and watered everything except for a plant that was hiding in a corner.
	8	Because Stacey went away on vacation and forgot to tell the housesitter to water the plant it was dead when she got home.
plates	5	The couple wanted to make sure that every plate had been washed after the party so that they wouldn't have anything to do the next morning.
	6	We have forks and knives but need plastic cups and paper plates for the 4th of July party that is being held at the park.
	7	After going to the supermarket Mary brought back plenty of vegetables and fruits and arranged them on plates for her friends to see.
	8	For the 4th of July celebration my neighbors brought cutlery and napkins for the picnic but forgot to buy cups and plates so I ran home to get some.
pocket(s)	1	The traveler put his passport and wallet inside the pockets of his travel bag to make sure he would not lose them.
	2	To keep pens handy John only buys shirts with pockets that are large enough to fit his cell phone as well.
	3	The traveler wanted to avoid the unpleasant experience he had last time he traveled so he put his passport and wallet in the pockets of his travel bag to make sure he would not lose them.
	4	John doesn't like to carry backpacks or computer bags so to keep pens handy he only buys jeans with pockets that are large

		enough to fit everything he needs to carry.
puppet	1	When Joan went to Sweden she bought a puppet for her daughter because she collects puppets from all over the world.
	2	Before Pinocchio turned into a boy he was a puppet made from wood whose nose grew longer every time he lied.
	3	I didn't know what to bring back for my niece from my vacation in Sweden so I bought her a puppet that she could add to her collection of puppets from all over the world.
	4	According to the Italian fable written by Carlo Collodi before Pinocchio was turned into a boy he was a puppet made from wood whose nose grew longer every time he lied.
puzzle	1	The two young girls put together the puzzle and then called the whole family so that they could see their accomplishment.
	2	Jane found the missing piece of the puzzle under her bed so she was finally able to finish putting together the US map.
	3	The two sisters did not want to go outside so they decided to stay home and began working on a puzzle with more than a thousand pieces.
	4	When Mary removed the cushions from the couch she found a marble a coin and the missing corner piece of a puzzle so she was able to finish putting it together.
radio	5	My mother-in-law and her sister plugged in the radio so that they could enjoy some of their favorite music while they relaxed and had a few drinks.
	6	While driving his car Mark turned on the radio to find out which candidate was winning the presidential election.
	7	After the twins finished doing all the food shopping with their father and put it away they looked for their radio to see what was playing.
	8	While driving to work Liz wanted to know which candidate had won the election so she turned on her radio and tried to find out.
rain	1	The meteorologist announced that on Monday there would be rain for most of the day and that the rest of the week would be sunny.
	2	Mary brought her umbrella because she didn't want the rain to ruin her hairdo.
	3	The students who live in the fraternity had planned to play basketball in their front yard but they couldn't because the rain left the pavement wet and slippery.
	4	Before leaving her house Mary watched the Weather Channel and got her umbrella out because she didn't want the rain to ruin her hairdo.
rat	5	Lisa was disgusted to see that a huge rat was eating all the trash that was in the garbage can in her kitchen.

	6	A rodent similar to the mouse the rat is a nuisance in major cities everywhere.
	7	While they were going for a walk in their neighborhood the girl screamed because she thought she saw a rat run in front of them.
	8	When they rented the cottage for the summer they expected to see mice but they never thought they would see a big and ugly rat running across the kitchen floor.
road	1	To go to my hometown we traveled a road that was so narrow that two cars could not fit at the same time.
	2	Traffic was slow because workmen were repairing the gravel road that intersected the main highway from the suburbs to downtown.
	3	One of the most memorable experiences during our trip to Italy and Greece this summer was that some of the roads we traveled were so narrow that two cars could not pass at the same time.
	4	This morning it took me two hours to go from my home to work because they were repaving the road that connects the suburbs to downtown.
robot	5	Although it was designed to be helpful and efficient the robot was a total disaster and began doing whatever it wanted to do around the house.
	6	In Star Wars the character R2D2 was a robot created by the Australian firm Petric Engineering and was made to meet very high standards.
	7	When they asked each of their children what they wanted for Christmas the little boy told his parents he wanted a robot and a rocket ship.
	8	As technology develops the advancement of artificial intelligence will be crucial in developing life-like machines such as a robot capable of doing household chores.
rocket	1	The toy store sold a very expensive rocket so for Christmas I could only buy my grandson an electric car.
	2	Commonly used as a spaceship or a missile the rocket is also used in fireworks.
	3	During one of their summer vacations the two cousins attended an engineering summer camp to learn how to build a rocket that would be fuel-efficient.
	4	After the NASA scientists finished building their new satellite they decided to put it into space by launching it on a rocket that will leave next week.
rope	1	The survivors of the plane crash used some rope to tie together the branches that they were using to make a raft.
	2	A harness secures a person to a piece of rope and comes in many designs to give greater comfort and security and more

		options for carrying equipment.
	3	The New York Times published an article this morning about how the survivors of the plane crash used some rope to tie together the branches that they used to build a raft.
	4	Used in rock climbing or other activities requiring safety precautions a harness secures a person to a strong piece of rope and comes in many designs to give greater comfort and security.
rose	5	While walking through the garden Betty saw a rose that reminded her of one that a close friend gave her on Valentine's Day a year ago.
	6	For Valentine's day Betty received chocolate and a rose to put in her vase from her two best friends.
	7	Around the time she was getting out of work my sister went to a nearby store to buy a rose and a box of chocolates for her best friend.
	8	For Valentine's Day the boy decided to give his friend a box of her favorite chocolates a teddy bear and a red rose to make her happy.
salad	5	My friend the cardiologist usually eats a large salad made with cherry tomatoes lettuce olives Greek cheese and cucumbers.
	6	The man bought some fresh lettuce so he could make a salad and went home so that he could start making his dinner.
	7	Some students did not know what to bring to the lab's potluck party so each decided to prepare a salad with tomatoes cucumbers and olives.
	8	Because the meteorologist announced intense heat for tonight Betty rushed to the market to buy tomatoes and lettuce to make a salad for dinner.
scar	1	Because my sister did not want her scar to show she bought a one-piece swimming suit for her vacation in the Greek Islands.
	2	The surgery incision left a very small scar on the lower part of her abdomen hardly visible with the naked eye.
	3	A few months after the surgery the patient expressed some concern to the doctor about the fact that the scar left by the incision was becoming more visible.
	4	Prior to agreeing to the surgery the patient wanted to make sure that the surgery incision would only leave a small scar on the lower part of her abdomen.
seal(s)	1	The trainer brought some fish to feed the seal in the water tank that he had been training for the marine show.
	2	Sea World crowds love the beachball trick performed by the seal which is one of the most popular attractions.
	3	During the training session the marine biologist told his assistant to always have available a bucket of fish to reward the seal that was in the water tank.

	4	Because it could balance a big ball on its nose the children were very excited to go to Sea World to see the seal which performed in a daily show.
shower	1	When we arrived at the hotel room the shower was not working so I called the reception desk to ask them to come to fix it.
	2	Brian was sweating so he stepped into the shower right before going to his meeting with the Mayor at the City Council.
	3	Although the dorm room was spacious the bathroom was a mess so we cleaned the sink the toilet and the shower before moving in.
	4	After a very long workout session at the gym this morning Jennifer debated whether to take a bath or a shower to relax her muscles.
snow	1	Before the guests arrived Tom cleaned the snow off the sidewalk so that the guests would not fall and get hurt.
	2	Precipitation that forms in clouds below 32° F usually becomes snow and long-lasting snow storms with intense snowfall and high winds are called blizzards.
	3	To make sure that the guests do reach the house entrance when they arrive Kristin asked her husband to clean the snow off the sidewalks and the front door.
	4	As defined in the online dictionary of weather terms precipitation that forms below 32 degrees Fahrenheit is usually snow and long-lasting snowstorms with intense snowfall and high winds are called blizzards.
soup	5	Every time they eat at Panera the family orders soup and buys sourdough bread and wheat bagels to take home.
	6	The lunch special for today was a small cup of soup a house salad and a large coffee all for only \$3.99.
	7	During her lunch hour Lisa went to the coffee shop close to work and bought a cup of tea and some soup to keep warm.
	8	Being a thrifty person my friend always tries to order the lunch special which consists of a small cup of soup a house salad and a large coffee for \$3.99.
spaghetti	5	The students attending summer school did not like the spaghetti served in the cafeteria so they decided to go out for dinner.
	6	The young Italian chef prepared a plate of meatballs and spaghetti for the TV show that was about to air on the Food Network that evening.
	7	The woman took over twenty minutes to decide what she wanted to eat for dinner but she finally ordered some spaghetti and a glass of wine.
	8	For the main course at the banquet the chef prepared meatballs that were to be served over spaghetti as well as a salad.

spider	1	When the nurse put on her shoe a spider that was inside of it bit her toe and caused her foot to swell.
	2	Charlotte's Web a story about a pig and a spider was written by acclaimed American author E.B. White in 1952
	3	As the poker player was pulling the deck of cards out of the box to start the game a spider that was inside of it bit his finger and he was rushed to the hospital.
	4	Charlotte's Web written in 1952 by acclaimed American author E.B. White is a kid's story about a pig and a spider who became best friends.
stairs	1	Because there was some mud on the stairs we asked the cleaning lady to bring her mop so that she could wipe it off.
	2	Knee surgery usually prevents people from going up the stairs but if the surgery is arthroscopic it provides faster recovery than traditional open surgery.
	3	A few weeks after Ronnie and Vivian moved into their new home they realized that they had to fix the stairs that led to the kids' bedrooms.
	4	Due to the significant pain that many patients experience after knee surgery they are unable to go up the stairs but if the surgery is arthroscopic it provides faster recovery than traditional open surgery.
stamp(s)	1	The secretary told the apprentice that the stamp he put on the envelope was not enough to mail the letter.
	2	To mail the card you need to buy a stamp at the post office place it on the right-hand corner and then drop it in any US drop box.
	3	As the diligent secretary was double checking the outgoing mail she noticed that one of the letters was missing a stamp so she added them and put them in the mail.
	4	While I was on vacation I wrote a postcard but was unable to go to the post office to buy a stamp so I hand-delivered it when I returned home.
statue	5	The kids in the park drew pictures of the statue so that they could have some ideas of what they could do for their art homework.
	6	The sculptor dedicated plenty of time to chisel his statue so that it could be ready to place in the plaza the next day.
	7	While they shopped at the mall in search of some furniture for their apartment the couple found the perfect statue for their living room.
	8	The man in the plaza was standing so still that passersby thought that he was actually a statue on display.
sweater	5	During the semi-annual sale my mother bought a sweater that was just like one she used to wear many years ago when she was younger.

	6	To match her scarf and hat Jane decided to knit herself a sweater that would keep her warm during the months of winter.
	7	While Nancy shopped with her mother and grandmother she bought a new shirt a pair of leather boots and a sweater to stay warm during the winter.
	8	I could tell that it was going to be very cold this morning so I decided that underneath my jacket I should wear a sweater to keep warm.
teapot	1	For my wedding my grandmother gave me a teapot and a tray that that been in our family for four generations.
	2	The tea set had a cup saucer and a teapot with pretty yellow pink and green flowers and a porcelain case to store it.
	3	A few weeks after her grandmother passed away Teri asked her mother whether she could take home the lovely teapot that had been given to her grandmother on her wedding day.
	4	Almost every Sunday afternoon my old grandmother pours tea from her beautiful white porcelain teapot which has been in our family for generations.
tiger	5	During last month's safari everyone thought that the tiger would attack the tourists even though the tour guide told them that wouldn't happen.
	6	With his orange and black stripes the fearsome tiger roamed around the African jungle in search of some food.
	7	The explorer went into the jungle and after walking there for several hours he was surprised to see that the tigers did not chasing him.
	8	Everyone that went on the African safari had a fun time trying to find the orange and black stripes of the tiger as he ran around the trees.
toaster	5	To make room in her garage Mary threw away a toaster that she bought many years ago while she was still in college.
	6	The recipe said the following: toast bread in a toaster cut it into small pieces and put them in the soup right before serving it.
	7	The college students bought new appliances for their kitchen so to make some room they threw away an old toaster that they bought in a garage sale.
	8	To prepare one of her son's favorite afternoon snacks the mother bought some sandwich bread toasted it in a toaster and then spread cream cheese and jam.
toilet	1	The kids knew not to throw paper in the toilet because the pipes were narrow and it clogged very easily.
	2	Frank cleaned the bathroom sink the shower the bathtub and the toilet before he started to dust the shelves and ornaments.
	3	When Kyle woke up he decided to help his mother with the household chores so he started cleaning the toilet and the

		kitchen.
	4	To get the house ready for the company party Frank and his friend cleaned the bathroom sink the shower the bathtub and the toilet and then mopped the floor.
tomato	5	When she eats out my friend only orders tomatoes and cucumbers because she says that she does not like any other type of salad.
	6	For her salad Anna shredded lettuce and cut up a tomato and some onions that she bought at the market that was next to her house.
	7	The man was already in his driveway when he realized that he had forgotten to go buy bread and a large tomato for supper.
	8	The girl wanted to prepare a salad for dinner so she went to the market and bought onions and a ripe tomato to mix with the lettuce.
train	5	While the passengers were anxiously waiting for the train they saw two men running out of the bank and getting into a black car.
	6	The traffic stopped at the railroad tracks to allow the train to pass through the small town.
	7	The young girl was very nervous because she was going to have to go to Italy and be on the train by herself for seven hours.
	8	In the Harry Potter books by J. K. Rowling the students were instructed to go to platform 9.75 to catch the train that would take them to Hogwarts School of Wizardry.
trashcan	1	After eating an ice-cream the boy looked for a trashcan so that he could throw away the napkin and an empty bottle of coke.
	2	The secretary threw the crumpled paper at the trashcan but missed the target and hit her boss.
	3	Once the kids finished eating the ice cream that their father had bought the youngest girl asked her mother to find a trashcan so that she could throw away the napkin.
	4	After hours and hours of working the frustrated writer balled up his manuscript and threw it at the trashcan and went out for a drink.
tree	1	Because it was unbearably hot we looked for a tree opened our portable chairs and sat in the shade until the sun came down.
	2	To create some shade in the backyard the gardener planted a tree and several tall bushes but also suggested that the couple buy a retractable awning.
	3	During our excursion to the top of the mountain it was unbearably hot so we decided to look for a tree and sit under it until the sun went down.
	4	Because the couple was complaining about the lack of shade in the backyard the gardener decided to plant a tree and several

		tall bushes but also suggested that the couple buy a retractable awning.
tunnel	5	Last Saturday the early afternoon traffic leading to the tunnel was so heavy that it took us almost three hours to get to the movies.
	6	Going to Manhattan by car through the Lincoln tunnel can take from 20 minutes to two hours depending on the traffic.
	7	Although we left our house early to arrive at the dinner on time the afternoon traffic leading to the tunnel was so heavy that it took us almost three hours to get there.
	8	Although I love New York and don't miss any opportunity to visit it going to Manhattan by car through the Lincoln tunnel can be extremely irritating.
turkey	1	Although Lisa was very worried because the turkey she prepared didn't seem to be enough to feed all the guests there was plenty for everyone to have seconds.
	2	For Thanksgiving we cooked the turkey in my neighbor's oven because ours was too small and could not fit the pan.
	3	My little brother and his friend Amy decided to eat pasta at the party because they did not like the turkey or the beef that was in the buffet.
	4	Right before the guests were to arrive on Thanksgiving Mary opened the oven and began basting the turkey to insure it would be moist.
violin	5	The students in the conservatory wanted to try a new violin but discovered that she didn't really enjoy playing it as much as her current one.
	6	The man in the quartet had to replace a string on his violin before the concert that night.
	7	When they asked him what he wanted for his birthday the teenage boy asked his parents for a new violin so that he could play more difficult songs.
	8	The man in the string quartet did not make any mistakes during the two hours of the concert while he played his violin in front of a large audience.
volcano	5	Yesterday the kids learned about the formation of a volcano in Hawaii and were intrigued to learn that lava could come out during an eruption.
	6	Hot lava came out of the recently erupted volcano covering the surrounding village and burning all the vegetation in the village.
	7	The student studying geology told her husband that she needed to go to the library to research a volcano that had just erupted in Hawaii.
	8	The surrounding village and trees were covered in boiling hot lava as it continued to come out of the volcano that erupted

		that morning.
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Appendix D: Filler sentences and comprehension questions from Experiment 1

Filler Word	Condition	Sentence and Respective Comprehension Question
apples	9	The children in the orchard picked apples to take home with them so that they could bake a few pies. Did the children pick pears?
ballerina	9	The little girl decided to be a ballerina for Halloween because she didn't want to dress up as something scary. Did the little girl want to dress up as a ballerina?
basket	9	Since it was a nice day for a picnic in the park the family packed some sandwiches drinks and dessert into a basket which they used for all of their picnics. Did the family pack sandwiches?
bear	9	Every summer the family takes a trip to the zoo mainly to see their favorite animal which is the bear that has lived at the zoo for many years. Is the zebra the family's favorite animal?
bone	9	Late that night after the family ate dinner the dog went to the backyard and buried a bone so that he could chew it while sitting by the fireplace. Did the dog sit by the couch?
books	9	While the young girls were out at the store they bought books to take with them to read while they were on their trip. Did the young girls buy pencils?
boots	9	John saw it was snowing so he put on boots to keep his feet dry. Did John put on a scarf?
cheese	9	The hungry mouse that had gotten into the house made its way into the kitchen because it smelled cheese that had fallen onto the floor. Did the mouse smell cheese?
church	9	Lucy and her boyfriend made an appointment to see the priest because she wanted to get married in the same church that her mother got married in. Did Lucy talk to a nun?
coffee	9	The tired woman drank a large cup of coffee to wake up in the morning before she got in her car to drive to work. Did the woman drink coffee?
door	9	The boy ran to the door because he thought he heard a knock. Did the boy hear the doorbell?
eggs	9	Sam went shopping to buy some eggs to make an omelette for his girlfriend for breakfast the next morning. Did Sam drink tea?
flowers	9	At the art show the famous artist sold many of his more recent paintings of flowers for thousands of dollars each. Did the artist sell sculptures of flowers?
glasses	9	At the restaurant the woman had trouble seeing the menu so she put on her glasses but took them off as soon as she decided what she wanted to order. Did the woman take off her glasses?
gloves	9	Sally put away her gloves because it was getting warm outside and she no longer wanted to wear them. Did Sally put away the blankets?
ice cream	9	The boy was hungry so he got some more ice cream even though his

		mother said he wasn't allowed. Did the boy get another bowl of popcorn?
jeans	9	While the girl was cleaning her bedroom she decided she had too many jeans so she took some of them out of her closet to give to the Salvation Army. Is the girl stressed out?
kittens	9	Maria and her boyfriend wanted to spend the day taking care of her cat that had just given birth to kittens so she decided not to go into work. Did Maria's dog give birth to puppies?
leaves	9	In the fall the ground is always covered with lots of leaves and everyone in the neighborhood spends lots of time raking the leaves up to get rid of them. Is the ground covered in snow in the fall?
necklace	9	For her birthday Elizabeth asked her parents if they would buy her a new coat some books and a necklace she had seen the last time she was shopping at the mall. Did Elizabeth ask for new books?
newspaper	9	The woman's umbrella was broken so she tried to keep herself dry by using a newspaper to cover her head. Was the woman's umbrella broken?
pacifier	9	The baby was usually quiet but she started crying loudly last night when she couldn't find her pacifier that her mother had given her to suck on. Did the baby cry?
cell phone	9	Christine was taking a trip to her cousin's house but she was very upset because she didn't remember to bring a phone with her while she was packing. Did Christine remember her cell phone?
salad	9	When the family went out for Sue's birthday John ordered his favorite meal which is salad and a large bowl of soup. Did John order his favorite food?
shells	9	The children at the beach were excited to collect shells that they found as they were walking on the sand. Were the children walking on the sand?
ship	9	The Titanic was a famous ship that sank on its maiden voyage even though it was thought to be unsinkable. Was the Titanic thought to be unsinkable?
snakes	9	Sarah was unsure about going camping and when she was asked why she said that she has avoided being around snakes ever since she was very young. Did Sarah confess her fear of spiders?
stars	9	Robin used her telescope to look at all the stars in the distance and she was excited because she had never seen one that was so bright before. Did Robin use a telescope?
sweater	9	Every winter the woman knitted gloves a hat a scarf and a sweater for her grandson who lived in Minnesota. Did the woman knit a sweater for her daughter?
television	9	After a long day at work the man was ready to relax and watch a news program on television while enjoying some snacks and a soda. Did the man have a long day of work?
tie	9	After the man got his pay check he decided to go shopping at a department store to buy a new tie that he could wear to his company's

		Christmas party. Did the man buy a tie?
tree	9	After taking off the hot air balloon got stuck on a tree near the center of the town. Did the balloon get stuck?

Appendix E: Conditions and critical sentences from Experiment 2

Condition	
1	Cognate- High Constraint
2	Cognate- Low Constraint
3	Non-Cognate- High Constraint
4	Non-Cognate- Low Constraint

Target	Condition	Sentence
alphabet	1	The young children practiced the letters of the alphabet for an hour during class.
	2	The young children practiced the song about the alphabet that they learned in school.
anchor	3	To keep a ship at a specific point an anchor is the best tool.
	4	To decorate his beach house the architect hung an anchor on the front door.
angel	1	Eva bought fake wings to dress up as an angel for the Halloween party.
	2	After spending hours in the store Eva bought an angel for her sister's birthday.
apple	3	In the fairy tale Snow White ate from an apple that her stepmother had poisoned.
	4	The man drove to the store to buy the apple he ate for breakfast.
arrow	3	The legendary hero split an apple with his bow and arrow while everybody was watching.
	4	While the boys were exploring the forest they found an arrow buried near the lake.
attic	1	Martha climbed the stairs from the second floor to the attic to store a box.
	2	Martha unpacked her books and put the boxes in the attic before leaving the house.
baby	1	After the birth the whole family wanted to meet the baby and congratulate the parents.
	2	The actress bought plenty of clothes and food for her baby who was at home.
bag	3	After scanning the bread the cashier put it in a bag with the other groceries.
	4	Hannah was cleaning her room but could not find a bag for her favorite toys.
balcony	1	To appreciate the spectacular view he stepped out on the balcony of his friend's apartment.
	2	After lunch the family decided to have dessert on the balcony where it was warm.

balloon	3	For the birthday party Susie bought helium to fill a balloon for her sister.
	4	Before the party Susie went to buy a balloon to tie around the mailbox.
banana	1	The little monkey at the Miami zoo ate the banana the tourist gave it.
	2	The girl wanted to have dessert so she had a banana and ice cream.
bathtub	3	The mother put a rubber duck inside the bathtub for her son to play with.
	4	Jane was renovating her house and bought a bathtub and furniture for the living room.
battery	3	Luke's camera stopped working because he forgot to charge the battery for it last night.
	4	When Luke was grocery shopping he remembered he needed a battery for his new flashlight.
beak	3	The pelican was diving for a fish and opened its beak to catch it.
	4	The young boy was having trouble coloring the beak of the bird in his drawing.
beaver	3	Best known for its natural trait of building dams the beaver is native to Europe.
	4	The student wrote in his diary that he saw a beaver during his camping trip.
bicycle	1	For the Tour de France Harry bought a new bicycle and started training every day.
	2	Harry did not have enough money to buy a bicycle so he walked to school.
bikini	1	Sarah lost some weight so she could wear a bikini when visiting the beach.
	2	Sarah went shopping and was happy she found a bikini to replace her old one.
blanket	3	While watching TV I felt cold so I got a blanket to keep me warm.
	4	Because my closet was too full I threw away a blanket that I never used.
boat	3	To cross the river we had to use a boat so we just went home.
	4	John was sitting on the beach and saw a boat approaching the shore too fast.
bomb	1	In the cartoon the explosion was caused by a bomb dropped by the main character.
	2	The students searched the internet for information on a bomb that destroyed an entire city.
bone	3	The skeleton in the museum was missing a bone which made the curator very upset.
	4	The scientists were excited when they found a bone but it belonged to a chicken.
boots	3	To walk through the snow every morning James bought boots that kept his feet dry.

	4	I went shopping with my friend because she needed boots and a new winter coat.
bottle	1	The olive oil had a decorative label on the bottle made by a local artist.
	2	My grandfather went to Italy and bought me a bottle of wine and some grappa.
box	3	Before wrapping the present I put the figurine in a box and secured the lid.
	4	The famous actress wanted to buy her best friend a box of chocolates from Chile.
bread	3	Brenda spread some butter on a slice of bread and started reading the newspaper.
	4	Because Brenda had gained some weight she stopped eating bread and ate fruits instead.
bus	1	The guide said that students without cars catch the bus to go to the university.
	2	They tried to be on time for the bus but they were not fast enough.
cactus	1	The students studied vegetation in the desert like the cactus for a school project.
	2	The girl showed her mother a picture of a cactus with very long branches.
camera	1	The famous photographer spent a lot of money on a camera and a memory card.
	2	The parents decided to give their daughter a camera because she really loved taking pictures.
candle	3	Kate baked a cake for her son and lit the candle before singing Happy Birthday.
	4	Kate wanted to decorate her table so she bought a candle and a fruit bowl.
cannon	1	The pirates prepared to attack the ship by aiming the cannon and getting more gunpowder.
	2	At the military museum we were fascinated by the cannon used during World War II.
car	1	Before going on a road trip John inspected his car and packed his suitcase.
	2	John was sitting at the restaurant and saw the car he wanted to buy.
carrot	3	The famous rabbit Bugs Bunny loves to eat a carrot and say What's up Doc.
	4	The chef decided to garnish his dish with a carrot to give it more color.
cat	3	Ana watched a funny movie about Garfield the cat that is orange and very lazy.
	4	Ana was walking in the park when she saw a cat with her kittens.
cereal	1	For breakfast I had some Corn Flakes a type of cereal with minerals and vitamins.

	2	Because Frank was absentminded he forgot to buy cereal for his wife and daughter.
cherry	3	She made an ice cream sundae topped with a cherry for everyone to share.
	4	In his book the chef wrote about the use of cherry to create special flavors.
chocolate	1	To satisfy her sweet tooth she bought a bar of chocolate and a vanilla milkshake.
	2	His mother told the boy he could have some chocolate after finishing his dinner.
circle	1	Patty needed a small round object to draw a circle for her geometry homework.
	2	Patty had to get a pencil and draw a circle for her geometry homework.
coconut	3	Jason climbed a tall palm tree to grab a coconut and drink the milk inside.
	4	Jason went to the local supermarket and found a coconut for his cocktail party.
computer	1	Linda used the wireless internet that was on her computer to find some good articles.
	2	For her birthday Linda asked her parents for a computer with a printer and scanner.
cookie	3	The baker uses dark chocolate chips to bake a cookie for his wife and son.
	4	To attract more customers the restaurant started serving a cookie with every coffee or tea.
crib	3	When the baby fell asleep Joyce put him in his crib and started her work.
	4	To make the dresser fit in the bedroom the crib was moved to the garage.
dentist	1	Mary's tooth hurts so she scheduled an appointment with the dentist for tomorrow morning.
	2	After graduation Mary said she had plans of becoming a dentist like her father.
devil	3	Artists often depicted Satan better known as the devil as a human-like figure with horns.
	4	My grandson wanted to dress up as a devil but could not find the costume.
dolphin	1	Sonar is used by the intelligent sea mammal the dolphin to navigate under water.
	2	The children were very excited to see the dolphin in the aquarium jump through hoops.
dress	3	Because the party required formal attire Rosa wore a dress that was long and black.
	4	This morning Rosa realized she forgot to buy a dress to wear to the beach.

elephant	1	The boy saw the long grey trunk of the elephant and ran to the cage.
	2	While the cameraman was filming the special on the elephant he tripped over a rock.
eyebrow	3	These days many women use tweezers to shape each eyebrow but some women use wax.
	4	In the portrait the woman could not get the eyebrow to look more realistic.
fish	3	My mother never eats meat but sometimes she prepares fish with vegetables and potatoes.
	4	My mother liked everything on the menu but ordered the fish and a side salad.
flute	1	A cylindrical instrument similar to the clarinet is the flute which is used in orchestras.
	2	Hannah asked her mother if she could get a flute and lessons for her birthday.
fork	3	Julia taught her daughter to use a knife and fork when she was two.
	4	Julia set the table but forgot to put the fork on the left side.
freckles	3	Pippi Longstocking has long braids and a round face with freckles and a big smile.
	4	Judith never liked the fact that she gets freckles from sitting in the sun.
frog	3	The wicked witch turned the prince into a frog because she envied his beauty.
	4	The accountant was completely surprised when he saw a frog jumping into his shower.
fruit	1	Every person needs five servings of vegetables and fruit every day to stay healthy.
	2	For dinner my aunt wanted to have some fruit because she gained some weight.
garage	1	Anticipating the snowstorm Janet pulled her car into the garage to protect it against snow.
	2	Janet liked her house but wanted to have a garage so she decided to move.
glasses	3	The optometrist measured my eyesight and told me I need glasses to see better.
	4	My new roommate spent the entire day looking for her glasses but never found them.
globe	3	A three dimensional scale model of the Earth called a globe is used in geography.
	4	The new teacher did not know where to store the globe she used during class.
guitar	1	Jimi Hendrix is well known for playing the guitar with a lot of creativity.
	2	At the music festival last week Jimmy saw the guitar that he wanted to have.

hamburger	1	Ben went to visit McDonald's because he wanted a hamburger and fries for lunch.
	2	After school Ben went to a restaurant and ordered a hamburger and a large beer.
hammer	3	Peter asked me to bring him a nail and a hammer to hang the painting.
	4	Peter's friend came to his house to return the hammer he had borrowed from him.
harp	1	The elegant stringed instrument in the orchestra was the harp that was played by Cari.
	2	Cari lives next door and likes to play the harp after coming back from work.
helmet	3	To protect his head Bill put on his helmet before riding his bike to school.
	4	Bill laughed at his friend for wearing a helmet during the bike trip on Monday.
hockey	1	Pete hoped the ice was strong enough to play hockey on it with his friends.
	2	A few minutes before the final match the players of hockey were still not there.
hook	3	During the fishing trip Sue put the bait on the hook to help her father.
	4	Sue had already asked her husband twice to remove the hook from the bathroom door.
kangaroo	1	Because it jumps to move around the Australian animal the kangaroo can be very fast.
	2	George was inspecting the zoo when he saw that a kangaroo was about to escape.
key	3	Tracy could not open the door because she left the key at her parents' house.
	4	Tracy had just left the house when she realized the key was on the table.
kiwi	1	A small green fruit with fuzzy skin is the kiwi that grows in New Zealand.
	2	Michelle felt sick so she decided to eat a kiwi with a lot of vitamins.
lamp	1	Tina needed some light so she turned on the lamp that was on her desk.
	2	Tina visited the store with her mom to find a lamp for her dormitory room.
leaves	3	David likes the fall because the trees loose their leaves and the colors are beautiful.
	4	Before the party started we planned to pick up the leaves from the back yard.
leg	3	During the race Kerry fell and broke her leg so the doctor had to come.
	4	Kerry had to see the doctor because her leg had been hurting for

		weeks.
lemon	1	For the tequila party Jessica bought slices of lemon and some salt in the supermarket.
	2	The new flight attendant forgot to put a lemon in the drink of the businessman.
lion	1	In the movie about the jungle Simba is a lion who will be the king.
	2	The teacher read the young children a story about a lion that ate a mouse.
lip	3	When Meghan fell her tooth went through her lip and she went to the hospital.
	4	Meghan was playing with friends when she colored her lip with her mother's red lipstick.
map	1	To find the hidden treasure the children were given a map with clues on it.
	2	My nephew went to Europe but forgot to buy a map so he got lost.
monkey	3	At the zoo Laura bought a banana to feed the monkey she saw earlier.
	4	Laura did not want a dog because she wanted a monkey as her pet.
painter	1	To apply some color to the walls I hired a painter who is a professional.
	2	The boy decided to go to Italy and be a painter during the winter break.
pan	3	Lisa wanted to fry eggs but could not find the pan that she needed.
	4	At the store Lisa and her husband fought about which pan they would buy.
panda	1	A black and white animal that eats bamboo is the panda that lives in China.
	2	Nick chose to write his essay about the panda because he wanted to be original.
pants	1	Instead of a skirt Amanda wore her new pair of pants and her favorite shirt.
	2	Amanda and her friend wanted to wear the same pants to school that day.
peach	3	A pitted fruit with a fuzzy skin is the peach that grows in warm climates.
	4	In the fruit basket in the kitchen were one peach and a few oranges.
pear	1	Popular green fall fruits are the apple and the pear that both grow on trees.
	2	For breakfast Andrew has some vanilla yogurt and a pear every morning before work.
pedal	1	To ride a bike you place each foot on a pedal and grab the handlebars.
	2	The famous cyclist was looking for a particular type of pedal for his new bike.
pen	3	The lawyer wanted to sign the contract using the pen his father gave

		him.
	4	The manager asked his secretary to bring him the pen that she borrowed yesterday.
pencil	3	Instead of a pen the applicant used a pencil to fill out all the forms.
	4	All the students in the class were given a pencil to complete the exam.
piano	1	The famous composer sat down on the bench of his piano and started playing.
	2	Sam was searching the internet to find a piano because he started taking lessons.
picnic	1	They filled the basket with food and drinks for a picnic at the park.
	2	The news reporter said that many people went on a picnic with friends yesterday.
picture	3	To decorate my wall I decided to print a picture of a Spanish church.
	4	I left the house but forgot to bring the picture I printed for Jenny.
pillow	3	I like my bed but my neck hurts from the pillow that is too soft.
	4	My mother came to visit and brought a pillow to put on the couch.
pineapple	1	My friend loves Hawaiian pizza with ham and bits of pineapple on top of it.
	2	My best friend baked a large cake with pineapple and nuts in the middle.
pipe	1	In Native American cultures the people smoked tobacco in a pipe for a religious ceremony.
	2	As a special gift for Father's Day Seth bought a pipe made out of ivory.
pirate	1	Because of the movie Jack Sparrow who is a pirate has become very famous.
	2	Seth always loved to read the adventure books about a pirate attacking a ship.
pizza	1	At the Italian restaurant the girl bought a slice of pizza and a garden salad.
	2	The girl told her parents she wanted to eat pizza with peppers and olives.
plant	1	Stacy forgot to tell the housekeeper to water the plant so it died soon after.
	2	Stacy asked her family not to give her a plant right before her trip.
plate	1	After the delicious dinner everybody handed me their plate and I started washing the dishes.
	2	When I came home I realized I left my plate on the table after breakfast.
pocket	3	Before leaving work Gary put his wallet in his pocket and picked up his keys.
	4	Gary bought a new pair of jeans because the pocket of his old pair broke.

puppet	3	Before Pinocchio turned into a boy he was a puppet made out of wood.
	4	In a small shop in Sweden Joan found a puppet that her daughter would love.
puzzle	3	Today Caitlin found the missing corner piece of the puzzle she worked on for weeks.
	4	Caitlin asked her mother to help her with the puzzle she just started putting together.
radio	1	While driving his car Ross listened to music on the radio because he got bored.
	2	Ross was cleaning out his closet when he found a radio that was still working.
rain	3	Jess brought her umbrella because she did not want the rain to ruin her hair.
	4	The students could not play the game because the rain ruined the soccer field.
rat	1	In the laboratory the scientist had a maze for the rat he experimented with.
	2	Vicky heard something and thought it was a rat so she left the house.
road	3	Traffic was slow because workmen were repairing the road from the suburbs to downtown.
	4	The most memorable experience in Greece was that the road we took was so narrow.
robot	1	Artificial intelligence is crucial in developing machines like a robot who can clean tables.
	2	The little boy told his parents he wanted a robot as his Christmas present.
rocket	3	The new satellite was launched into space with a rocket that left last week.
	4	My grandson wanted to have an electric car and a rocket for Christmas last year.
rope	3	During the survival weekend we tied branches together with some rope to make a raft.
	4	The two brothers were trying to find a piece of rope to finish their raft.
rose	1	On Valentine's Day Mike visited the florist to buy a rose for his new girlfriend.
	2	When my sister came home after work she found the rose her boyfriend left her.
salad	1	The man bought some fresh lettuce to make a salad to have for dinner.
	2	The man realized that he still had some of the salad he made yesterday.
scar	3	My sister asked whether the surgery would leave a scar before agreeing to have it.

	4	My sister was very worried because she had a scar that became more visible lately.
seal	3	Because it could balance a ball on its nose the seal became a popular attraction.
	4	The boy wanted to get a fish to feed the seal in the water tank.
shower	3	When Ashley came back from the gym she stepped into shower before starting her work.
	4	After Ashley bought the house she saw that the shower in the bathroom was broken.
snow	3	On Christmas day the whole family hoped there would be snow but there was not.
	4	Before the guests would arrive Thomas wanted to remove the snow that fell last night.
soup	1	The lunch special for today was a cup of soup and a cheese sandwich.
	2	Every time the family goes out for lunch they order soup and bagels with butter.
spaghetti	1	The chef poured sauce over the long thin strings of spaghetti and added some vegetables.
	2	The woman went to a restaurant to have some spaghetti and a glass of wine.
spider	3	An insect with eight legs that people fear is the spider although it is harmless.
	4	When the nurse put on her shoe a spider that was inside bit her toe.
stairs	3	Because the elevator was broken we climbed the stairs up to the fifth floor.
	4	Kelly did not yet have the tools to fix the stairs in her house.
stamp	3	To mail the card you need to put a stamp in the right corner.
	4	Ronnie told his secretary that she should put a stamp on the important letter.
statue	1	The man was standing so still he looked like a statue that was on display.
	2	The children had to draw pictures of the statue they saw in the park.
sweater	1	He did not like that his mother-in-law knit him a sweater as a present.
	2	Joelle told her mother she should buy a sweater because it would get cold soon.
teapot	3	The tea set had six small cups and a teapot made out of porcelain.
	4	When my grandmother passed away Tara gave me the teapot she knew I liked.
tiger	1	On Safari the orange and black stripes of the tiger were bright and very beautiful.
	2	The guide told the tourists to stay away from the tiger because it was dangerous.
toaster	1	To make a sandwich she put bread in the toaster and washed the lettuce.

	2	When she was still in college she bought a toaster that she never used.
toilet	3	The least favorite bathroom chore is cleaning the toilet because it is always dirty.
	4	The children were told not to use the toilet because it clogged very easily.
tomato	1	Audrey was preparing a red soup so she sliced a tomato and added herbs.
	2	Audrey wanted to eat more healthy so she mixed a tomato with some cucumber.
train	1	While we were running to platform five to catch the train I dropped my bag.
	2	The young girl was nervous because she would take the train all by herself today.
trashcan	3	The secretary meant to throw the crumpled paper in the trashcan but hit her boss.
	4	His new room was complete except for the trashcan he still had to buy.
tree	3	To create some shade in the garden we planted a tree and several tall bushes.
	4	We walked for a long time before we found a tree to sit down under.
tunnel	1	You can drive from France to England through the tunnel that is build under water.
	2	We did not take the road leading to the tunnel because of all the traffic.
turkey	3	On Thanksgiving Jennifer was working on the stuffing for the turkey when the guests arrived.
	4	Jennifer made some pasta because she did not like the turkey her mother was serving.
violin	1	The professional string quartet had lost the bow of a violin after the concert.
	2	The boy took more classes because he liked playing his violin every day after school.
volcano	1	The surrounding village was covered in lava because the volcano had erupted that morning.
	2	The children were scared when their teacher said a volcano erupted early that morning.

Appendix F: Filler sentences and comprehension questions from Experiment 2

Filler Word	Condition	Sentence
airplane	5	The boy looked up at the sky and saw the airplane that was passing by. Did the boy see a bird?
ball	5	The little girl went inside to get the ball her mother had bought for her. Did the girl get a doll?
beach	5	On a sunny day many people go to the beach to swim in the sea Do people swim in the sea?
bed	5	Natalia was very tired yesterday so she went to bed early instead of going out. Did Natalia go out yesterday?
beer	5	Every Thursday after work Nicole goes out for a beer at the local pub. Does Nicole go the pub on Thursday?
book	5	My sister and I bought my mother a book because she loves to read. Did I buy my sister a book?
bridge	5	We had walked for hours when we finally found the bridge we were looking for. Did we find the bridge?
chair	5	I never sit at my desk because the chair I have is so uncomfortable. Do I like my chair?
chicken	5	Judy went to visit a farm and liked the chicken that she saw there. Did Judy see a horse?
church	5	Every Sunday the family would go to the church together and have breakfast afterwards. Does the family go to church?
clock	5	Last week Beth's family decided to give her a clock because she was always late. Did Beth buy a clock?
coffee	5	When Claire woke up she made herself a cup of coffee and a sandwich. Did Claire make herself a sandwich?
coin	5	Katie was walking down the street when she saw a coin and picked it up Did Katie pick up the coin?
desk	5	Josh turned on his computer and sat down behind his desk to write a report. Did Josh write a book?
dog	5	Jade was very happy when her father gave her a dog for her birthday. Did Jade get a cat?
door	5	Jasper lost his key and could not open the door to his own house. Did Jasper loose his key?
doorbell	5	Because the door was locked Kat rang the doorbell and waited until her sister came. Was the door locked?
eye	5	Jared finds it really hard to close one eye while keeping the other one open. Does Jared think it is easy to wink?
fire	5	The family was camping in the woods and built a fire because it was cold. Did the family go camping?
giraffe	5	An animal with a very long neck is the giraffe that lives in arid regions. Does the giraffe live in arid regions?
glove	5	When Ally walked home yesterday she lost the glove that was in her pocket. Was the glove in Ally's bag?

hand	5	His mother was happy when the boy held up his hand and waved at her. Did the mother wave at the boy?
house	5	After getting married the couple wanted to buy a house and decorate it together. Did the couple want to buy a car?
island	5	During the summer break Daniel wanted to visit an island for at least two weeks. Did Daniel want to visit an island?
lettuce	5	At the market Noelle bought a bag full of lettuce and other fresh vegetables. Did Noelle buy vegetables?
mirror	5	Before leaving the house Juliana always looks in the mirror to check her hair. Does Juliana look in the mirror?
money	5	Aaron went to the ATM because he ran out of money but needed some. Did Aaron go to the ATM?
neck	5	I went to the gym yesterday and hurt my neck because I fell down. Did I hurt my back?
newspaper	5	When Dan woke up he started reading the newspaper and drank a cup of tea. Did Dan drink a cup of coffee?
nun	5	Christy and her friends like to dress up as a nun and sing songs. Does Christy like to sing songs?
nut	5	Connie is allergic to a specific type of nut so she cannot eat everything Can Connie eat everything?
orange	5	Because she wanted fresh juice Karen squeezed an orange and a grapefruit this morning. Did Karen squeeze a grapefruit?
oven	5	Susan wanted to bake brownies so she preheated the oven and mixed the batter. Did Kelly want to bake a cake?
painting	5	I spent a long time working on the painting because it needed to be perfect. Did I work on the painting?
park	5	I took my dog for a walk in the park because he needed exercise. Did I take my dog for a walk?
paw	5	The dog stepped on a sharp rock and hurt its paw on its right leg. Did the dog hurt its paw?
pistol	5	Adam moved to the city and bought a pistol to keep in his house. Did Adam buy a pistol?
prince	5	The princess found out she was betrothed to a handsome prince that she loved. Was the princess betrothed?
rabbit	5	The little girl asked her mom and dad for a rabbit for her birthday. Did the little girl ask for a pony?
rain	5	Because there was a tiny hole in the roof the rain damaged our house. Was there a hole in the roof?
river	5	Mathilda lost her new expensive camera in the river when she was canoeing with friends. Did Mathilda lose her cell phone?
safe	5	Johnny keeps his money and valuable belongings in a safe in case of a robbery. Does Johnny keep his money in a safe?
sausage	5	Because I do not like bacon my mother cooked sausage and eggs for breakfast. Did my mother cook bacon?
sea	5	The pirates lost their map and were lost at sea for three long days. Did the pirates lose their compass?

skull	5	The car accident caused a serious injury to his skull and damaged his brain. Did the accident damage his leg?
snake	5	Chris is embarrassed that he screamed when he saw a snake in the garden. Did Chris scream in the garden?
sock	5	Jackie was cleaning her room and realized she lost a sock in the laundry. Did Jackie lose a sock?
straw	5	The girl drank her apple juice through a straw until it was all finished. Did the girl drink orange juice?
strawberry	5	A small red fruit with tiny black seeds is the strawberry which is my favorite. Is the strawberry my favorite fruit?
swan	5	The ugly duckling in the lake turned into a beautiful swan when it grew up. Did the goose turn into a swan?
table	5	Before dinner the boy was told to set the table and wash his hands. Did the boy set the table after dinner?
taxi	5	My brother did not want to take a taxi because he preferred to drive. Did my brother prefer to walk?
teacher	5	I had to make an appointment with my teacher because I needed help in class. Did I have to make an appointment?
telephone	5	Because the old one stopped working I bought a new telephone for my bedroom. Did I buy a telephone for the living room?
tent	5	My friends and I went camping and pitched a tent to sleep in overnight. Did my friends and I go camping?
tiara	5	For my sixth birthday my mother bought me a tiara since I loved princesses. Did my father buy me a tiara?
tie	5	For the wedding the man wore a suit and tie and black dress shoes. Did the man go to a wedding?
toothbrush	5	At my dentist appointment I got dental floss and a toothbrush to clean my teeth. Did I get dental floss?
towel	5	I went on vacation and realized I forgot a towel to take on the beach. Did I go on vacation?
trumpet	5	My friend wanted to learn how to play the trumpet so she took lessons. Did my friend take clarinet lessons?
wall	5	My nephew found crayons and colored all over the wall in the living room. Did my brother color on the wall?
water	5	After my run I needed a cold glass of water to keep myself hydrated. Did I need a glass of milk?
window	5	I heard a noise outside so I looked out the window and saw construction workers. Did I hear a noise?
witch	5	The girl drew a detailed picture of a witch for an assignment for art class. Did the girl draw a picture for math class?

Appendix G: Critical sentences from Experiment 3

Condition	
1	Cognate- High Constraint
2	Cognate- Low Constraint
3	Non-Cognate- High Constraint
4	Non-Cognate- Low Constraint

Target	Condition	Sentence
alphabet	1	The young kids happily practiced the letters of the alphabet that they learned.
	2	The young kids happily practiced the song about the alphabet that they learned.
angel	1	Eva bought fake wings to dress up as an angel for the custom party.
	2	After spending hours in the store she bought an angel for her son's birthday.
apple	3	In the fairy tale Snow White ate from an apple that her stepmother had poisoned.
	4	The man drove to the store to buy an apple that he ate for breakfast.
arrow	3	Robin Hood split an apple with his bow and arrow while everybody was watching.
	4	The boys were exploring the forest and found an arrow buried near the lake.
artichoke	3	The vegetable known for its thistle-like head is the artichoke which is delicious.
	4	My grandmother said that in order to eat the artichoke I need to cook it first.
attic	1	My sister stored her daughter's toys up in the attic because she did not use them.
	2	The history and chemistry books were stored in the attic next to the old toys.
baby	1	After the birth, the family wanted to see the baby and congratulate the parents.
	2	The actress bought enough clothes and food for her baby at the store.
bag	3	The cashier scanned and put the bread in a bag with the other groceries.
	4	The boy tried to help his mom move the bag of potatoes but it was heavy.
balcony	1	Juliet was courted by the handsome Romeo from a balcony of her house.
	2	The couple was looking for a house with a balcony because they

		enjoyed the view.
balloon	3	Before the party I bought helium to fill a balloon for my sister.
	4	Susie went to the surprise party and got a balloon for her niece.
banana	1	The cute chimp at the famous zoo ate the banana that the tourist gave it.
	2	The girl wanted a snack so she prepared a banana and strawberry smoothie.
bathtub	3	The mother put a yellow rubber duck inside the bathtub for her son to play with.
	4	The woman that was renovating her house bought a bathtub for the master bathroom.
battery	3	Luke's phone stopped working because it ran out of battery while he was driving.
	4	When Luke was shopping he remembered he needed a battery for his new flashlight.
beak	3	The pelican dove for the crab it opened its beak to catch it.
	4	The artist had a lot of trouble drawing the beak of the bird in the nest.
bicycle	1	For the Tour de France, the athlete bought a bicycle and then trained every day.
	2	The boy did not have money to buy a bicycle so he walked to school.
bikini	1	Sarah lost weight so she could wear a two-piece bikini at the pool.
	2	Sarah went shopping and was happy she found a bikini to replace her old one.
blanket	3	Last night I was cold so I grabbed a blanket to keep me warm.
	4	My closet was full so I threw away a blanket that I never used.
boat	3	To cross the river we had to use a boat so we just went home.
	4	My best friend was sitting when he saw a boat approaching the shore too fast.
bomb	1	In the cartoon, the explosion was caused by a bomb that was dropped by the villain.
	2	The students searched the internet for information on a bomb that damaged a city.
bone	3	The old skeleton in the museum was missing a bone which made the curator upset.
	4	All the scientists got excited when they found a bone that belonged to a dinosaur.
bottle	1	The French wine had a decorative label on the bottle made by a local artist.
	2	My grandfather went to Italy and bought me a bottle of wine and some grappa.
bus	1	Students who do not own vehicles normally catch the bus to get to class.

	2	All my students were here so I rented a bus to take them on a field.
cactus	1	Among the vegetation of the desert habitat, is the cactus the most common.
	2	The girl showed her mother a photo of a cactus with very long branches.
camera	1	The famous photographer bought a new lens for a camera and a tripod.
	2	The generous parents decided to give their daughter a camera for her graduation.
candle	3	My aunt baked a lemon cake and lit the candle before congratulating her son.
	4	The new secretary adorned her office and bought a candle that smelled like pines.
cannon	1	The pirates attacked the enemy's ship by aiming the cannon after loading it.
	2	At the military museum we were fascinated by the cannon used during World War II.
car	1	Before going on a family trip, John inspected his car and packed his suitcase.
	2	While eating at a restaurant the man saw the car he wanted to buy.
carrot	3	The famous rabbit Bugs Bunny loves to eat a carrot and say What's up Doc.
	4	The chef decided to garnish his dish with a carrot to give it more color.
cat	3	His friend watched a funny movie about Garfield the cat that is orange and lazy.
	4	My little nephew was playing when he saw a cat so he took it home.
cereal	1	For breakfast I had Corn Flakes, a type of cereal with minerals and vitamins.
	2	The college student forgot to buy a box of cereal on his way home.
chapel	3	My best friend's wedding ceremony was held at the chapel that was near my house.
	4	My brother did not come with us because the chapel was far away from his work.
cherry	4	The baker who is my friend usually adds a cherry on top of the cheesecake.
	3	She made an ice cream sundae topped with a cherry for everyone to share.
chocolate	2	His mother told her son he could have some chocolate after finishing his dinner.
	1	To satisfy her craving she bought a bar of chocolate and a vanilla milkshake.

circle	2	Patty had to get a marker and draw a circle for her geometry homework.
	1	Patty needed a small round object to trace a circle for her geometry homework.
coconut	4	Jason went to the local supermarket and found a coconut for his cocktail party.
	3	Jason climbed a tall palm tree to grab a coconut and drink the water inside.
computer	2	For her birthday Linda asked her parents for a computer with a printer.
	1	Linda used the wireless internet that was on her computer to send an e-mail.
cookie	3	The baker mixed oatmeal and raisins to bake a cookie for his son.
	4	To attract more customers the cafeteria started serving a cookie with every meal.
cricket	4	The science teacher asked the kids to bring a cricket to school during the spring.
	3	Pinocchio was always accompanied by his small friend the cricket that wore a hat.
dentist	2	After her graduation my aunt planned to become a dentist like all her friends.
	1	His daughter's tooth hurt before she went to the dentist since it had a cavity.
devil	4	My youngest grandson wanted to dress up as a devil but could not find a costume.
	3	Many artists often depicted Satan better known as the devil as a human.
dolphin	2	The children were very excited to see the young dolphin jump through the hoop.
	1	Sonar is used by the intelligent sea mammal the dolphin to navigate under water.
dress	4	My friend told me she would lend me a dress to wear at the inauguration.
	3	Because the party required formal attire Rosa wore a dress that was black.
elephant	2	While the director was filming the special on the elephant he tripped over a rock.
	1	The boy saw the long grey trunk of the elephant and ran towards his mother.
envelope	4	My brother forgot that I needed to buy an envelope to send a check.
	3	I asked for a stamp to put on the envelope but the person did not hear.
flute	2	The little girl asked if she could get a flute and lessons for her birthday.

	1	A cylindrical instrument similar to the clarinet is the flute found in orchestras.
fork	4	Linda set the table but forgot to put the fork on the left side.
	3	Linda taught Jennifer to use a knife and a fork when she was two years old.
frog	4	The accountant was completely surprised when he saw a frog in his shower.
	3	The wicked witch turned the charming prince into a frog because she envied him.
fruit	2	For dinner my oldest aunt wanted to have some fruit because she gained weight.
	1	My favorite vegetable is the corn and my favorite fruit is the mandarin orange.
garage	2	Janet liked her house but wanted to have a garage so she decided to move.
	1	Expecting the snowstorm John parked his motorcycle in the garage to protect it.
glasses	4	My new roommate spent four hours looking for her glasses but never found them.
	3	The optometrist wants me to try to wear my glasses when I drive at night.
globe	4	The new teacher did know where to store the globe because we told him.
	3	A 3D scale model of the Earth called a globe is used in geography.
guitar	2	At the music festival last week Jimmy saw the guitar that he wanted to have.
	1	The famous Jimi Hendrix is known for playing the guitar with a lot of creativity.
hamburger	2	Ben went to the new restaurant and ordered a hamburger and a large beer.
	1	Her boss went to McDonald's because he wanted a hamburger and fries for lunch.
hammer	4	The man visited his friend's house to return the hammer he had borrowed.
	3	Susan asked me to bring a nail and a hammer to help her hang the painting.
harp	2	Cari lives next door and likes to play the harp after coming back from work.
	1	The elegant stringed instrument in the orchestra was the harp played by Cari.
headphones	4	My sister and I needed a new pair of headphones for our iPods.
	3	I have an iPod but need a pair of headphones to listen to music.
helmet	4	Bill resented that his friend did not wear a helmet during Monday's bike trip.

	3	To protect his head Lance Armstrong puts on his helmet before the race.
hockey	2	A couple of minutes before the final match of hockey the crowd was excited.
	1	Peter thought the ice was strong enough to play hockey but we was wrong.
kangaroo	2	George was cleaning cages when he saw that a kangaroo was about to escape.
	1	The marsupial that jumps around the Australian desert the kangaroo can be fast.
king	4	My friend could not believe that she met a king on her trip to Europe.
	3	A golden crown can only be worn by a king or a queen.
kiwi	2	My husband felt sick and decided to eat a kiwi to feel better.
	1	A small green fruit with fuzzy skin is the kiwi which grows in. New Zealand.
knuckles	4	I was walking when I fell and scratched my knuckles of my right hand.
	3	People who need mobility in their fingers crack their knuckles very often.
lamp	2	Tina went to the store because she wanted a lamp for her dormitory room.
	1	Tina needed some light so she turned on the lamp that was on her desk.
leg	3	During the soccer game I fell and broke my leg so the doctor had to come.
	4	Kerry had to go to the doctor because her leg had been hurting for weeks.
lemon	1	I served the tequila but forgot the slices of lemon and the salt in the kitchen.
	2	The new flight attendant completely forgot to put a lemon in the drink.
letter	3	The handsome guy sent my youngest sister a love letter to our new address.
	4	My cousin told me that she would send a letter of complain to the manager.
lion	1	Everyone knows that the king of the jungle the lion is a ferocious animal.
	2	The teacher told the children a story about a lion that ate a mouse.
lip	4	Meghan was playing with me when she split her lip open by falling down.
	3	When I unexpectedly fell my tooth went through my lip and I went to the hospital.
mail	3	My sister received her order of books on the mail early this week.
	4	The students forgot to put a hold on the mail before their trip.

map	1	To find the treasure the children were given a map with clues on it.
	2	Charles went to Europe but forgot to buy a map so he got lost.
painter	1	To apply color to the walls I hired a painter who is a professional.
	2	To fix up the house my aunt called a painter who lives close by.
panda	1	A big bi-color animal that eats bamboo is the panda which lives in China.
	2	The boy decided to write his essay about the panda that lived in a Zoo.
pants	1	Instead of a skirt Amanda wore a pair of pants with her favorite shirt.
	2	Amanda and her friend wanted to wear the same pants to school that day.
parachute	3	Before jumping off the plane please make sure the parachute is in good condition.
	4	My art teacher showed us an image of a parachute so that we could draw it.
parrot	3	The green bird that can imitate human speech the parrot can learn many words.
	4	My neighbor moved but he could not take his parrot with him so he gave it to me.
pea	3	The small round and green vegetable in soups the pea is rich in vitamin k.
	4	Although I am vegetarian I dislike any type of pea because they are soft.
peach	3	A juicy fruit with sweet yellowish skin is the peach which grows in warm climates.
	4	In the fruit basket in the kitchen was a peach and a few oranges.
peanut	3	Every morning I have a sandwich with jelly and peanut butter for breakfast.
	4	While I was eating I almost choked on a peanut that went the wrong way.
pear	1	Popular green fall fruits are the apple and the pear which both grow on trees.
	2	For breakfast I had some vanilla yogurt and a pear because I do not like milk.
pecan	3	A pie that contains nuts is known as the pecan pie which is served on holidays.
	4	When I arrived my grandmother welcomed me with a pecan pie that she baked for me.
pedal	1	To ride a bike place each foot on a pedal and grab the handlebars.
	2	The professor was looking for a particular type of pedal for his new bike.
pencil	3	Instead of a marker the student used a yellow pencil to fill out all the forms.

	4	All the students in the class were given a pencil to complete the exam.
piano	1	The musician sat down at the bench of his piano and began to play.
	2	My mother's uncle searched the internet looking for a piano made in Europe.
picnic	1	Filled with food and drinks the basket for the picnic was very heavy.
	2	The reporter said that many people went on a picnic with friends yesterday.
picture	3	To decorate my wall I decided to print a picture of a Spanish church.
	4	I left the house but forgot to bring the picture I had printed out for Jenny.
pillow	3	In the morning my neck hurt because of my pillow which was way too hard.
	4	My mother came to visit and brought an old pillow to put on the couch.
pineapple	1	They love Hawaiian barbecue with ham and bits of pineapple on top of it.
	2	My best friend baked a large birthday cake with pineapple and vanilla custard.
pipe	1	In Native American cultures people smoked tobacco in a pipe during ceremonies.
	2	As a gift for Father's Day we bought a pipe made out of ivory.
pirate	1	Because of the movie Jack Sparrow who is a pirate has become very famous.
	2	Louis loved to read the adventure books where a pirate would attack a ship.
pizza	1	At the Italian restaurant she bought a slice of pizza and a bowl of pasta.
	2	I wanted to cook something so I baked a pizza with peppers and olives.
plant	1	Stacy forgot to tell the housekeeper to water the plant so it died.
	2	Stacy asked her whole family to buy her a plant right after her trip.
plate	1	After the delicious dinner my brother handed me his plate with nothing on it.
	2	I came home and realized I had left my plate on the table.
pocket	3	Before leaving work he put his wallet in his pocket and made his lunch.
	4	Gary bought a new pair of jeans because the pocket of his old pair broke.
puppet	3	Before Pinocchio turned into a boy he was a puppet made out of wood.

	4	In a small shop in Sweden I found a puppet that my daughter would love.
puppy	3	My dog was adorable when it was a little puppy because it did not chew my shoes.
	4	On my twenty-fifth birthday my fiancé gave me a puppy that was two months old.
puzzle	3	Caitlin found the pieces that were missing of the puzzle she had been working on.
	4	Caitlin asked her mother to help her with the puzzle she started putting together.
radio	2	While cleaning out his closet my uncle found a radio that still worked.
	1	In his vehicle we listen to music on the radio because he does not have an iPod.
rain	4	The students could not play the game because the rain ruined the soccer field.
	3	I brought an umbrella I did not wanted the rain to ruin her hair.
rat	2	My niece heard something and thought it was a rat so she called me.
	1	All the scientists had a small maze for the rat they had in the laboratory.
road	4	In my trip the most memorable experience was the road we took to go to the park.
	3	Traffic was very slow because workmen were repairing the road to the suburbs.
robot	2	The little boy told his parents he wanted a robot as his Christmas present.
	1	Artificial intelligence is crucial in creating machines like a robot that cleans.
rocket	4	Albert wanted to get an electric bike and a rocket for his birthday last year.
	3	The new satellite was launched into space with a rocket last weekend.
rope	4	My best friend and I were looking for a rope to tie our raft.
	3	During the weekend we tied branches together with a rope to make a raft.
rose	2	When Susan came home after working she found a rose that her boyfriend left her.
	1	A red fragrant flower with various thorns is the rose which is a popular gift.
salad	2	The man realized that he did not finish the salad that he made yesterday.
	1	The man bought some fresh lettuce to make a salad for dinner.
sausage	4	My sister likes to have a piece of the sausage that my father bought for lunch.

	3	Earlier today I had a McMuffin with egg and sausage and an orange juice.
scar	4	My sister was very worried because she had a scar that had become more visible.
	3	My sister asked whether the surgery would leave a scar on her face.
seal	4	The boy went with his parents to feed the seal in the water tank.
	3	It can balance balls on its nose thus the seal is a popular attraction.
snow	4	Before the guests arrived he wanted to remove the snow that fell last night.
	3	During winter the family hoped there would not be snow but there was plenty.
soup	2	When the family goes out for lunch they order soup and bagels with butter.
	1	The lunch special for today was a cup of soup and a grilled cheese sandwich.
spaghetti	2	The woman went to a restaurant to have some spaghetti and a glass of wine.
	1	The famous Italian chef added meat balls to the spaghetti and some vegetables.
spider	4	The nurse put on her white shoe and a spider that was inside bit her toe.
	3	Arachnophobia known as the fear to any type of spider is a very common disorder.
stairs	4	Kelly did not have the tools to fix the stairs in her house.
	3	Because the main elevator was broken we climbed the stairs to the fifth floor.
statue	2	The children had to take various photographs of the statue they saw in the park.
	1	Paul was standing so still he looked like a statue on display in a museum.
sweater	2	Joelle told her best friend she should buy a sweater since it would get cold soon.
	1	Joseph did not like that his grandmother knitted a sweater for him on Christmas.
teapot	4	When my grandmother died my aunt gave me the teapot because she knew I liked it.
	3	The tea set had six small cups and a teapot made out of porcelain.
tiger	2	Sam told the tourists to stay away from the tiger because it was dangerous.
	1	In Asia the orange and black stripes of the tiger were bright and beautiful.
toaster	2	When Ann was still in college she bought a toaster that she used seldom.
	1	To make a sandwich she put bread in the toaster and washed the

		lettuce.
toilet	4	My cousin's kids were told not to use the toilet because it clogged very easily.
	3	My mom's least favorite bathroom chore is cleaning the toilet since it is smelly.
tomato	2	Audrey wanted to eat healthier so she cut a tomato and several cucumbers.
	1	To prepare a red sauce my mother sliced a tomato and added some herbs.
train	2	The girl was nervous because she would take the train all by herself today.
	1	While we ran to platform five to catch the train my sister dropped her purse.
trashcan	4	His new room was completely furnished except for the trashcan that forgot at home.
	3	The clerk meant to throw the paper in the trashcan but she hit her boss instead.
tunnel	2	We did not take the road leading to the tunnel because of all the traffic.
	1	Workers were drilling through the mountain to build a tunnel close to the city.
turkey	4	Jennifer made pasta because she did not like the turkey her mother was serving.
	3	On Thanksgiving my mother prepared the stuffing for the turkey and a pumpkin pie.
vessel	4	In kindergarten my best friend used to have a vessel that his father bought him.
	3	The captain ordered passengers to unload cargo from the vessel before departing.
violin	2	The boy took classes because he liked playing his violin every day after school.
	1	The professional string quartet lost the bow of the violin after the concert.
volcano	2	The children got scared when their teacher said a volcano erupted in the morning.
	1	The surrounding village was covered in lava because the volcano had erupted.
voyage	4	The whole amateur salsa team joined us on our voyage to the Caribbean Islands.
	3	Almost a century ago the great Titanic began its voyage across the ocean.

Appendix H: Filler sentences and comprehension questions from Experiment 3

Filler Word	Condition	Sentence
airplane	5	The boy looked up at the sky and saw the airplane that was passing by. Did the boy see a helicopter?
ball	5	The little girl went inside to get the ball her mother had bought for her. Did the little girl go outside to get the ball?
beach	5	On a sunny day many people go to the beach to swim in the sea. Do people go to the forest on a sunny day?
bed	5	Natalia was very tired yesterday so she went to bed early instead of going out. Did Natalia go out?
beer	5	Every Thursday after work Nicole goes out for a beer at the local pub. Does Nicole go out for a beer on Thursdays?
book	5	My sister and I bought my mother a book because she loves to read. Does my mother love to read books?
bridge	5	We had walked for hours when we finally found the bridge we were looking for. Did we find the bridge we were looking for?
chair	5	I never sit at my desk because the chair I have is so uncomfortable. Is the chair uncomfortable?
chicken	5	Judy went to visit a farm and liked the chicken that she saw there. Did Judy like the pigs when she visited the farm?
church	5	Every Sunday the family would go to the church and have breakfast afterwards. Did the family have lunch before going to church on Sunday?
clock	5	Last week Beth's family decided to give her a clock because she was always late. Was Beth always late?
coffee	5	When Claire woke up she made herself a cup of coffee and a sandwich. Did Claire have a cup of coffee when she woke up?
coin	5	Katie was walking down the street when she saw a coin and picked it up. Did Katie pick up the coin?
desk	5	Josh turned on his computer and sat down behind his desk to write a report. Did Josh sit down to write a report?
dog	5	Jade was very happy when her father gave her a dog for her birthday. Was Jade happy because her father gave her a cat?
door	5	Jasper lost his key and could not open the door to his own house. Did Jasper lose his key?
doorbell	5	Kat rang the doorbell and waited until her sister came. Did Kat ring the doorbell?
eye	5	Jared finds it really hard to close one eye while keeping the other one open. Is it easy for Jared to close one eye while keeping the other one open?
fire	5	The family was camping in the woods and built a fire because it was cold. Did the family build a fire?

giraffe	5	An animal with a very long neck is the giraffe that lives in arid regions. Does the animal with a long neck lives in arid regions?
glove	5	When Ally walked home yesterday she lost the glove that was in her pocket. Did Ally lose the glove that was in her purse?
ham	5	Because I do not like bacon my mother cooked ham and eggs for breakfast. Did my mom cook bacon for me?
hand	5	His mother was happy when the boy held up his hand and waved at her. Was the mother happy?
house	5	After getting married the couple bought a house and decorated it together. Did the couple want to buy a house before they got married?
island	5	During the summer break Daniel wanted to visit an island for at least two weeks. Did Daniel want to visit an island during spring break?
lettuce	5	At the market Noelle bought a bag full of lettuce and other fresh vegetables. Did Noelle buy a bag of chips at the market?
mirror	5	Before leaving the house Juliana always looks in the mirror to check her hair. Does Juliana check her hair before leaving the house?
money	5	Aaron went to the ATM because he ran out of money but needed some. Did Aaron run to the bank to get money?
neck	5	I went to the gym yesterday and hurt my neck because I fell down. Did I hurt my arm at the gym?
newspaper	5	When Dan woke up he started reading the newspaper and drank a cup of tea. Did Dan drink a cup of coffee?
nun	5	Christy and her friends like to dress up as a nun and sing songs. Do Christie and her friends like to dress up as clowns?
nut	5	Connie is allergic to a specific type of nut so she can not eat everything. Is Connie allergic to a specific type of nut?
orange	5	Karen squeezed an orange and a grapefruit this morning. Did Karen squeeze an orange and a lemon this morning?
oven	5	Susan baked brownies so she had to preheat the oven and mix the ingredients. Did Susan preheat the oven to make brownies?
painting	5	I spent a long time working on the painting because it needed to be perfect. Do I spend a lot of time working on a painting?
park	5	I took my dog for a walk in the park because he needed exercise. Did I take my dog to the beach?
paw	5	The dog stepped on a sharp rock and hurt its paw on its right leg. Did the dog hurt its left leg?
pistol	5	Adam moved to the city and bought a pistol to keep in his house. Did Adam buy a pistol to keep at his work?
prince	5	The princess found out she was betrothed to a handsome prince that she loved. Is the princess in love?
rabbit	5	The little girl asked her mom and dad for a rabbit for her birthday. Did the girl want a rabbit?
river	5	Mathilda lost her new camera in the river when she was canoeing with friends. Did Mathilda lose her camera in the river?

roof	5	Because there was a tiny hole in the roof the rain damaged our house. Did the rain damage our house?
safe	5	Johnny keeps his money in a safe box in case of a robbery. Does Johnny keep his money in a safe box in case of a fire?
sea	5	The pirates lost their map and were lost at sea for three long days. Were the pirates lost?
skull	5	The car accident caused a serious injury to his skull and damaged his brain. Did the accident damage his skull?
snake	5	Chris is embarrassed that he screamed when he saw a snake in the garden. Did Chris scream when he saw a snake in the patio?
sock	5	Jackie was cleaning her room and realized she lost a sock in the laundry. Did Jackie lose a sock in the laundry?
straw	5	The girl drank her apple juice through a straw until it was all finished. Did the girl drink orange juice?
strawberry	5	A small red fruit with tiny black seeds is the strawberry which is my favorite. Is strawberry my favorite fruit?
swan	5	The ugly duckling in the lake did not turn into a beautiful swan when it grew up. Did the ugly duckling turned into a swan?
table	5	Before dinner the boy was told to set the table and wash his hands. Did the boy have to wash his hands before dinner?
taxi	5	My brother did not want to take a taxi because he preferred to drive. Does my brother prefer to take a taxi?
teacher	5	I had to make an appointment with my teacher because I needed help in class. Did I have to make an appointment with my physician?
telephone	5	Because the old one stopped working I bought a new telephone for my bedroom. Did I buy a telephone because the new one was not working?
tent	5	My friends and I went camping and pitched a tent to sleep in overnight. Did my friends and I go rafting?
tiara	5	For my sixth birthday my mother bought me a tiara since I loved princesses. Did my mother buy me a tiara when I was fifteen?
tie	5	For the wedding the man wore a suit and tie and black dress shoes. Did the man wear a suit?
toothbrush	5	At my dentist appointment I got dental floss and a toothbrush to clean my teeth. Did I get floss and a toothbrush at my dentist appointment?
towel	5	I went on vacation and realized I forgot a towel to take on the beach. Did I remember to bring a towel?
trumpet	5	My friend wanted to learn how to play the trumpet so she took lessons. Did my friend take trumpet lessons?
wall	5	My nephew found crayons and colored all over the wall in the living room. Did my nephew colored all over the wall in the kitchen?
water	5	After my run I needed a cold glass of water to keep myself hydrated. Did I have to keep my self hydrated?

window	5	I heard a noise outside so I looked out the window and saw construction workers. Did I look out the window?
witch	5	The girl drew a detailed picture of a witch for an assignment for art class. Did the girl draw a witch?

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QUALIFICATIONS

Motivated and detailed oriented undergraduate student seeking position in graduate cognitive psychology program. Related research experience includes two years in a psycholinguistic lab helping others with projects and conducting own honors thesis.

EDUCATIONAL BACKGROUND

Pennsylvania State University, University Park, PA 16802 Expected Dec. 2010

Bachelor of Arts in Spanish

Bachelor of Arts in Psychology

Minor in Linguistics

Interdisciplinary honors thesis: *Mixing languages: An investigation of codeswitching in proficient bilingual readers*

ACADEMIC HONORS AND AWARDS

- Member, Phi Beta Kappa 2010
- Scholar, Schreyer Honors College 2008-current
- Dean's List (every semester) 2006-current

RELATED RESEARCH EXPERIENCE

- Applicant, National Science Foundation Graduate Fellowship 2010
- Presenter, Undergraduate Exhibition April 2010
Pennsylvania State University
Poster titled "Mixing languages: (Towards) An investigation of codeswitching in proficient bilingual readers"
- Attendee, Undergraduate Workshop in Cognitive Science and Neuroscience June 2009
University of Pennsylvania, Philadelphia, PA
- Recipient, Undergraduate Summer Discovery Grant 2009
Pennsylvania State University
- Undergraduate Research Assistant 2008-current
Center for Language Science, Pennsylvania State University
Supervisors: Dr. Judith Kroll & Dr. Paola E. (Giuli) Dussias
 - Trained on event related potential (ERP) experiment methodology
 - Recruit and run subjects on ERP and behavioral studies
 - Filter and compile data for analysis
 - Attend weekly research seminars presented by members of the Center

- Undergraduate Research Assistant
Political Science Department, Pennsylvania State University.
Supervisor: Professor Burt Monroe
 - Read legislative documents from Central and South American countries which were dated as early as 1800
 - Documented the content of the articles in English in preparation of a future quantitative analysis

RELATED WORK EXPERIENCE

- Foreign Language Tutor 2008-current
Penn State Learning Center, Pennsylvania State University
Supervisor: Leigh Anderson
 - Assist peers in their elementary Spanish courses 6 hours a week
 - Review class assignments for systematic errors
 - Provide peers with high-achieving studying methods
- General Subject Tutor 2008-current
Penn State Learning Center, Pennsylvania State University
Supervisor: Leigh Anderson
 - Assist peers in better understanding the concepts from Nutrition 100 and Psych 100
 - Help organize peers' methods of note taking
 - Help prepare peers for exams by implementing strategic study skills
 - Hold end of the semester sessions in which freshmen can ask what to expect of their first finals week
- Summer Tour Guide Summer 2008
Admissions Office, Pennsylvania State University
Supervisor: Melissa Doberstein
 - Led campus tours for prospective students and their families, transfer students, summer enrichment programs, and visiting scholars 20 hours a week
 - Participated in question and answer panels for prospective students and families

ACTIVITIES

- Principal flutist and piccolo player, Sinfonietta Orchestra 2009-2010
- Flutist, Concert Band 2007-2008
- Member, Flute Ensemble 2007
- Piccolo player, Penn State Marching Blue Band Fall 2006, 2007, 2008

GENERAL SKILLS

- Computer skills
 - Proficient at Microsoft Word, Powerpoint, and Excel
 - Experienced user of E-Prime and R
- Foreign language skills
 - Advanced in reading and writing in Spanish, proficient in speaking Spanish