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USING BILINGUALISM AS A TOOL TO STUDY RECOGNITION MEMORY FOR  
GRAMMAR AND MEANING

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## ABSTRACT

Findings from two different lines of research in psycholinguistics provide conflicting answers as to whether the retention of form takes precedence over the retention of meaning in memory. To reconcile this ongoing debate as to whether the retention of form takes precedence over the retention of meaning in memory, an eye tracking reading study was conducted on bilingual Puerto Rican participants at the University of Puerto Rico, Rio Piedras. Participants read unilingual Spanish and codeswitched sentences and answered short comprehension questions which were always in unilingual sentences. The task was subject to two conditions (1.) where there could be no delay between sentence and question or (2.) where participants completed a simple math problem between sentence and question. The results found a significant main effect of Switch and a significant interaction between Switch and Delay. These results suggest that form (i.e., the language) of the critical noun is retained and results in interference. However, a simple math problem—lasting only a few seconds—was enough for this interference to disappear.

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## Chapter 1

### Introduction

Two friends are sitting outside a cafe enjoying coffee and light conversation. One friend ends their conversation with the sentence: *'We gave Paul a red car for his birthday'*. Will the other friend remember the exact order of the words in the sentence or the general meaning of the sentence? (that is, that Paul's birthday gift was a red car). Findings from two different lines of research in psycholinguistics provide conflicting answers to this question. Results from psycholinguistic experiments in the domain of sentence comprehension suggest that the word order of a sentence (commonly referred to as 'the form' of the sentence) is often not retained in memory, even when speakers are asked to repeat a sentence that they just heard (Sachs, 1967); that is, when speakers hear or read sentences, they are not always accurate at recognizing or producing its form exactly, although they can easily paraphrase its meaning. For example, in Sachs (1967), monolingual English speakers reading the sentence *'There he met an archeologist who urged him to join in the research'* were at chance repeating the sentence exactly, although they had no trouble paraphrasing its meaning. This is, in fact, a common experience for many language users.

However, a second, also well-replicated finding, this time from the monolingual language production literature, is that speakers retain in memory the form of the sentences that they hear other speakers say, and in fact use that very same form when they themselves speak (Pickering & Ferreira, 2008), suggesting that individuals do in fact remember the exact form of sentences. For example, if an individual hears the sentence *The nurse gave the boy a candy*, and is asked to

describe an unrelated event involving, a teacher, a student, a book, and a giving action, the speaker is more likely to produce a sentence similar using a form identical to the sentence previously heard (i.e., *The teacher gave the student a book*) than to produce an alternative structure (*The teacher gave a book to the student*). This phenomenon is known in the psycholinguistic literature as a ‘priming’ effect. Recent priming studies have suggested that these syntactic priming effects can actually have longer-lasting impact on memory (Branigan, Pickering, Stewart, et al. 2000), a finding that stands in stark contrast with the finding from Sachs (1967).

The goal of the experiment presented here is to clarify the two conflicting but long-standing findings regarding the retention of the grammatical form of the sentence and the retention of meaning in sentence recall. The goal is to test how remembering the form of a word (in this case, the language in which the word is presented to participants) interacts with remembering its meaning during bilingual language processing. Previous approaches to this question primarily used monolingual speakers as the test participant, which has not provided an adequate solution to this problem. This study will use bilingualism as a tool to answer this question. The advantage of using bilingual speakers is that in bilingualism there are often two word forms associated with one meaning; for example, “casa” and “house” both mean *a building that serves as living quarters for one or a few families* but their forms are different. This creates an ideal situation for testing how word form interacts with meaning because variation can be achieved by switching the languages (form) and keeping the meaning identical. This process cannot be easily achieved with monolingual speakers.

In order to clarify these conflicting findings, an eye-tracking reading study was conducted using Spanish-English bilingual participants at the University of Puerto Rico-Rio



Piedras (where there is a large population of Spanish-English bilinguals who are highly proficient in the two languages). The focus on bilinguals not only provides a novel approach to investigate this contradiction in the psycholinguistic literature, but bilingualism is more representative of the typical speaker in the world because more than half of the world's population is bilingual (Bialystok, Craik, & Luk, 2012); therefore, the findings will be interpretable for a larger portion of the population.

The bilingual speakers recruited for this study were highly proficient Spanish-English bilinguals who also engage in code-switching. Code-switching, “the ability on the part of bilinguals to alternate effortlessly between their two languages” (Bullock & Toribio, 2009), might impose processing demands. We recruited bilinguals who code-switch to ensure that the experimental manipulations in the present study were representative of the linguistic repertoire of the bilingual speakers that we recruited.

The remainder of this literature review is organized as follows: a case made for meaning as taking precedence over form in sentence recall from two monolingual comprehension studies (Sachs, 1967) and (Sachs, 1974), followed by a contradicting argument in priming literature that makes the case for the persistence of syntactic information (form) in memory (Bock, 1986; Branigan, H.P., Pickering, M.J., Stewart, A.J. et al. 2000); Finally, background on code-switching and the costs associated with this linguistic tool will be discussed in relation to this study.

## **Chapter 2**

### **Literature Review**

#### **2.1 The persistence of meaning and form in memory**

This chapter reviews the psycholinguistics and priming literature the attempt to reconcile whether the form or the meaning of a sentence will persist longer in recall. The first section reviews the literature that makes the case for the persistence of meaning in sentence recall based on evidence extracted from an audio sentence recall based on evidence extracted from an audio sentence recall study and an audio and visual sentence recall study both conducted by Sachs (1967;1974). The next section reviews priming literature that makes the case that the form of the sentences persists as well and that its persistence may be long-lasting. The section on form explores first the salience of syntactic priming effects in a production study conducted by Bock (1980) and then follows literature that attempts to understand how long the syntactic priming effects persist.

#### **2.2 The persistence of meaning**

One argument as to whether form or meaning takes greater precedence in sentence retention suggests that only the meaning of the sentence is stored in the long-term memory. The form, or syntactic elements of the sentence, may persist in the immediate comprehension of the sentence but will be lost once the individual partakes in semantic interpretation of the sentence (Sachs, 1967; Sachs, 1974). This assertion is derived from two studies conducted by Sachs (1967, 1974). In the 1967 study, Sachs presented 96 participants with 24 taped recorded passages and test sentences in order to investigate three main research questions: (1) whether syntactic

information was stored after comprehension, (2) if some syntactic information was stored better than other, and (3) how long the syntactic information persisted in memory (as measured with sentence recall task). Participants were presented with a block of connected discourse followed by a recognition test sentence that either appeared in an identical form and meaning to a sentence in the original narrative (the *base sentence* in all further mentions) or was manipulated slightly. For further clarification, a presentation of a sample passage from the original auditory study (Sachs, 1967, p. 438) is presented below:

“There is an interesting story about the telescope. In Holland, a man named Lippershey was an eye-glass maker. One day his children were playing with some lenses. They discovered that things seemed very close if two lenses were held about a foot apart. Lipperryshay began experimenting with his “spyglass” attracted much attention. *He sent a letter about it to Galileo, the great Italian scientist.* Galileo at once realized the importance of the discovery and set about to build an instrument of his own. He used an old organ pipe with one lens curved out and the other in. On the first clear night he pointed the glass toward the sky. He was amazed to find the empty dark spaces filled with brightly gleaming stars! [80 syllables from “*scientist*”] Night after night Galileo climbed into a high tower, sweeping the sky with his telescope. One night he saw Jupiter, and to his great surprise discovered near it three bright stars, two to the east and one to the west. On the next night, however, all were to the west. A few nights later there were four little stars. [160 Syllables from “*scientist*”] [Bell rings]”

The participant would listen to an audio recording of a short excerpt from a passage (presented above), and the ringing of a bell indicated the end of the passage. The participants were then instructed to listen for a sentence (the base sentence) from the passage that would be repeated after the sounding of the bell. A potential base sentence is represented by the italicized font in the sample passage, e.g., *He sent a letter about it to Galileo, the great Italian scientist.* After the ringing of the bell, the participant would hear a test sentence that could exhibit four possible relationships to the base sentence. In one set, the test sentence was identical to the base sentence.

1. *He sent a letter about it to Galileo, the great Italian scientist.*

The test sentence could also appear in an altered version of the base sentence. Sachs employed three variations of the base sentence: A semantic variation, achieved either by changing its meaning via negation, changing the subject or object, or substituting words, as shown in example (b):

2. *Galileo, the great Italian scientist, sent him a letter about it.*

In a third possibility, the base sentence could be altered by changing the voice of the sentence from active to passive or vice-versa. This is shown in example (c):

3. *A letter about it was sent to Galileo, the great Italian scientist.*

Finally, the base sentence could be altered “formally”, by altering syntactic structural elements, such as word order, without changing its meaning.

4. *He sent Galileo, the great Italian scientist, a letter about it.*

Passive/ Active voice test sentences and formal test sentences were classified as changes in syntax (form), and were compared in order to investigate whether some syntactic changes were stored better than others.

The test sentences could be separated from the base sentence in the passage by 0 syllables, 80 syllables (around 27 seconds), and 160 syllables (around 46 seconds) of “interpolated material”, which would appear as a continuation of the passage (refer to excerpt above). For example, a bell signaling the onset of the test sentence could appear directly after the base sentence, “*He sent a letter about it to Galileo, the great Italian scientist.*[Bell Rings]” In another instance, the bell signaling the onset of the test sentence could appear after the passage continued past the base sentence for a few lines of discourse, “*He sent a letter about it to Galileo, the great Italian scientist Galileo at once realized the importance of the discovery and set about to build an instrument of his own. He used an old organ pipe with one lens curved out and the other in. On the first clear night he pointed the glass toward the sky. He was amazed to find the empty dark spaces filled with brightly gleaming stars!* [Bell Rings]”

The participants could hear test sentences exhibiting any of the four aforementioned relationships to the base sentence at varying intervals of interpolated material. For each trial, participants were then to asked to indicate whether the test sentence was “*identical*” to or “*changed*” from the base sentence heard in the previous passage. If the participant marked the sentence as “*changed*” then they also had to identify the type of manipulation that had occurred, classified as either a change in “meaning” or a change in “form”. An excerpt from the instructions that preceded the experiment defined changes in “meaning” and changes in “form” to the participant as such:

“For example, if you had heard ‘*He gave her a doll*’ and then ‘*She gave him a doll*’ this would be a change in meaning. If you had heard ‘*He looked the number up*’ and then ‘*He looked up the number*’ this would be a change in form. In

English, we often have alternative ways of saying the same thing. That is, the meaning is the same but the form is different.” (Sachs, 1967, p. 440)

Finally, participants indicated the confidence of the responses of either “*identical*” or “*changed*” on a five-point scale.

Sachs found that when the test sentence immediately followed the passages (0 syllables of additional material) participants had little to no trouble recognizing and identifying the changes. However, with the introduction of either 80 or 160 syllables of additional material between the original passage and the test sentence, participants were only able to recognize syntactic changes at chance. Under these conditions, participants were still able to identify and recognize semantic changes and alterations that affected the general meaning of the sentence. These relationships are demonstrated in Figure 1 (taken from Sachs 1967).

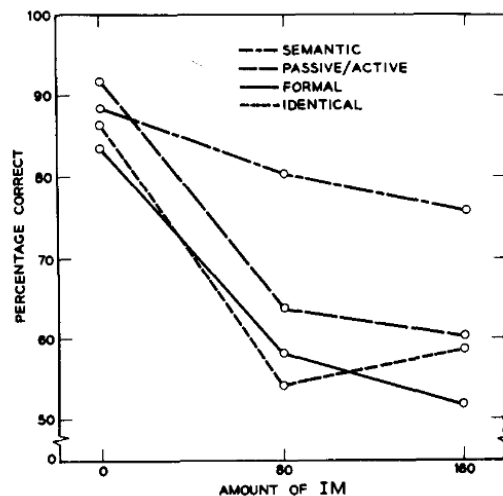


Figure 1. "Percentage of judgements identical and changed that were correct for each test type." (Sachs, 1967, p. 441)

Even though participants could still recognize changes in meaning under these conditions, they often did not retain properties of the sentence that were not necessary for comprehension of the meaning, i.e., the syntactic information. Sachs (1967) interpreted these findings as suggesting that the original form of a sentence (its syntactic order) is only stored for the short time necessary for initial comprehension. Once the sentence is interpreted semantically, the meaning is stored but the syntactic form fades. Considering this, storing the meaning and storing the form are not dependent on one another in processing and the portions of the sentences associated with the meaning will persist longer than that of the form.

To investigate these findings further, Sachs conducted a follow-up study (1974) where participants read passages in addition to listening to audio recordings in order to complete the tasks. In this study, Sachs sought to investigate two additional questions left unanswered from the previous study: (1.) Do the retention effects seen in the first study persist in a visual setting (through a reading exercise) as they did in an auditory setting? (2.) When does the retention of syntactic (dealing with form) or contextual (dealing with meaning) elements begin to decay? In order to detect a more precise point at which retention of syntactic material began to dissipate, Sachs introduced intervening sentences of 0, 20, and 40 syllables in addition to the original intervention of 80 syllables.

Figure 2 shows the results for both the auditory and visual condition for each type of sentence change (Semantic, Active/Passive, Formal, and Lexical) at the four levels of interpolated material. The results replicated the findings of the 1967 study in that by at 20 syllables (after 4-7 seconds) in both the auditory and reading studies participants had difficulty remembering the exact words of the original passages and had completely forgot after 40

syllables. However, participants still were generally able to retain the meaning of the original passages even when faced with at least 80 syllables of intervening information.

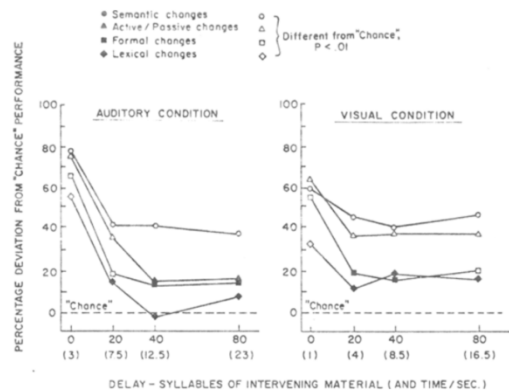


Figure 2. "Accuracy in judging changes, expressed as percentage of deviation from 'chance' performance at the four levels of intervening material for auditory and visual conditions." (Sachs, 1974, p. 97)

### 2.3 The persistence of form

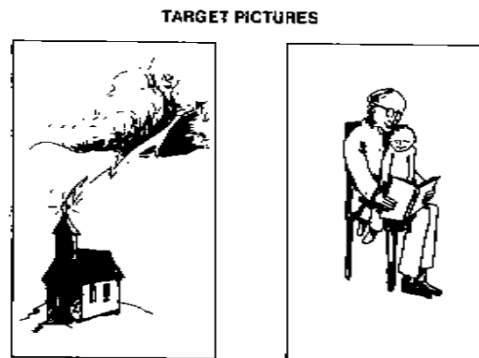
The results in Sachs (1967) and (1974) suggest that recalling meaning (conceptual information) takes precedence over recalling form (syntactic information). However, evidence from the psycholinguistic priming literature (e.g., Bock, 1986; Bock & Griffin, 2000; Hartsuiker and Kolk, 1998; Branigan et al., 2000) challenges this notion through demonstrating the existence of syntactic priming effects (defined below), that make the case for the persistence of form. Additionally, studies conducted by Bock and Griffin (2000) and Branigan et al. (2000) have argued that the persistence of this syntactic information in memory might be long-lasting (Bock & Griffin, 2000; Branigan et al., 2000).

Syntactic (or structural) priming occurs when people repeat the basic structural elements of sentences that they have recently produced or experienced (the previously produced or experienced sentence would be the 'primed sentence') (Pickering and Ferreira, 2008, p. 1). For example, if a person is primed with a sentence "one of the fans punched a referee" then when



asked to describe an unrelated picture they would be more likely to describe the picture as 'X punched a Y' than 'a Y was punched by X' (Bock, 1986).

The first experimental evidence for syntactic priming is described in a language production study conducted by Bock (1986). Bock (1986) presented participants with a series of sentences trials where participants repeated sentences and described pictures. The experiment consisted of a production task involving a participant and a confederate (the experimenter). The production task required the participant and the confederate to take turns describing pictures displayed on a computer monitor, Figure 3. provides an example of pictures presented in the experiment.



**Figure 3. Examples of target pictures used in Experiment 1 (Bock, 1986, p. 361)**

In Bock 1986, participants were presented with two types of structures: (A) Transitive, in the form of active voice e.g., *One of the fans punched the Referee*, or passive voice, e.g., *The referee was punched by one of his fans*; (B) Datives in the form of a prepositional phrase (consisting of a verb followed by a noun phrase and preposition), e.g., *A rock star sold some cocaine to an undercover agent* and a double object phrase (consisting of a verb and two noun

phrases), e.g., *A rock star sold an undercover agent some cocaine* as displayed in Figure 4. (Bock, 1986 pg. 361).

<b>TRANSITIVE</b>	<b>DATIVE</b>
<b>PRIMING SENTENCES</b>	
<b>ACTIVE:</b> <b>ONE OF THE FANS PUNCHED THE REFEREE.</b>	<b>PREPOSITIONAL:</b> <b>A ROCK STAR SOLD SOME COCAINE TO AN UNDERCOVER AGENT.</b>
<b>PASSIVE:</b> <b>THE REFEREE WAS PUNCHED BY ONE OF THE FANS.</b>	<b>DOUBLE OBJECT:</b> <b>A ROCK STAR SOLD AN UNDERCOVER AGENT SOME COCAINE.</b>

Figure 4. Example of transitive and dative priming sentences (Bock, 1986, p. 361)

When participants were primed a passive sentence (e.g., *The referee was punched by one of the fans*), they were more likely to describe the following unrelated transitive target picture using passive syntax. Likewise, when participants were primed with an active sentence e.g., (*One of the fans punched the referee*.) then they were more likely to use active syntax when describing the unrelated transitive target picture that followed. The same was found for the dative structures. That is, when participants were primed with a dative double-object sentence (e.g., *A rock star sold an undercover agent some cocaine*), they were more likely to use a double-object phrase when describing the unrelated dative target picture that followed. Finally, when participants were primed with a dative prepositional sentence (e.g., *A rock star sold an undercover agent some cocaine*) then they were more likely to use a prepositional phrase when describing the unrelated dative target picture that followed.

The results of this study provided evidence in support of the existence of syntactic repetition effects. “Speakers tend to repeat the syntactic forms of sentences in subsequent utterances that are minimally related in lexical, conceptual, or discourse content.” (Bock, 1986,

p. 378). Even though the pictures could be described with, for example, either an Active or a Passive, if the confederate used active voice to describe a picture the participant was more likely to also use active voice to describe the picture.

The participant's repetition of the structure of the primed sentence in their own language production suggests that the syntactic form does persist to some degree in memory. These results were replicated across a series of modalities: written sentence completion, spoken sentence completion, and additional picture description tasks (Bock & Griffin; Branigan, Pickering, & Cleland, 1999; Branigan, Pickering, Stewart, and McLean, 2000). Moving forward from the original Bock (1986) experiment, further investigations of the characteristics of syntactic priming has shifted focus towards the longevity of the priming effect.

A study conducted by Branigan, Pickering, and Cleland (1999) suggested that priming was not long-lasting, but subject to rapid-decay effects. However, subsequent studies (Bock & Griffen, 2000; Branigan et al. 2000) provide evidence that syntactic priming is long-lasting. Bock and Griffin (2000) conducted a study, in which participants repeated dative sentences that, as before, were either prepositional datives e.g., *A rock star sold some cocaine to an undercover agent* or double object datives e.g., *A rock star sold an undercover agent some cocaine*. Participants then described target pictures unrelated to the primed sentences. However, in this version of the experiment, the primed dative sentences (either in the form of a prepositional object sentence or a double object sentence) and the target pictures could be separated by either 0, 1, 4, or 10 intransitive sentences e.g., *a woman is ironing* (Bock & Griffen, 2000, p. 180) in order to measure the longevity of the priming effect. Bock and Griffin found that regardless of the number of intervening intransitive sentences (up to 10 sentences) between the primed dative sentence and target image that the priming effect persisted.

Additional evidence for the long-lasting persistence of syntactic priming effects was explored in a study conducted by Branigan, Pickering, Stewart, and McLean (2000) in response to the written sentence completion study conducted by Branigan et al. (1999). This study sought to respond directly to the findings in Branigan et al. that suggested that syntactic priming effects were subject to rapid-decay. Similar to the Branigan et al. (1999) study the 2000 study presented participants with sentence completion tasks. However, unlike the 1999 study where participants completed sentences through writing down their responses, this study required participants to verbally produce their responses to the prime fragments. The prime fragment and target could either immediately follow one another, be separated by an intervening sentence, or by a time delay. The spoken sentence completion study found that syntactic priming effects persisted similarly across all conditions, making the case that syntactic priming is not a short-lived phenomenon (Branigan et al., 2000, 1301). This study suggests that the rapid decay effect experienced in the Branigan et al. 1999 study may have occurred due to the written nature of the task.

In summary, priming literature, spearheaded by Bock's 1986 experiment, demonstrates that a person is more likely to produce a structure similar to one that they had produced or experienced most recently. The priming effect observed in this study has in some cases (Bock & Griffin, 2000; Branigan et al. 2000) persisted after intervals of time, suggesting that syntactic priming can have long-lasting effects. This supports the argument for the persistence of the structural/ syntactic form of a sentence in recall. The priming literature described above directly contrast the findings of the Sach's studies (1967;1974) where retention of form dissipated after just 4-7 seconds. The current study will seek to reconcile this discrepancy utilizing an eyetracker

reading task and code-switched stimuli. The following section will explore the nature of code-switching, an integral element of the experimental stimuli.

## Chapter 3

### Why Code-switching?

The findings from Sachs (1967,1974) and the priming literature point to different directions, but each has largely considered the question of the persistence of form or the persistence of meaning from the perspective of the monolingual speaker. Given that it is difficult to separate the form from the meaning of words within one language, the present study will investigate the persistence of form and meaning from the bilingual perspective. As mentioned earlier, bilinguals are a unique population to investigate this question because the bilingual speaker's mastery of two languages allows for the presence of two different forms (i.e., *casa* and *house*) and one shared meaning (i.e., the concept of house) in their linguistic repertoire. For example, a participant could be presented with a unilingual stimulus such as, (a) "*El astronauta vio el cielo desde la ventana pequeña*" followed by a unilingual comprehension question "*¿Podía ver el cielo desde la ventana?*" where the form and meaning of the critical word, in this case "cielo", are identical. The participant can also be presented with a code-switched stimulus such as (b) "*El astronauta vio el sky from the window*" followed by a unilingual comprehension sentence, "*¿Podía ver el cielo desde la ventana?*" where the critical word "cielo" is expressed in two different forms "sky" and "cielo" with the shared meaning. The fact that form and meaning can be separated in this way allows for a way to readily investigate of the independent contribution of each during sentence comprehension.

The following section provides an overview of code-switching, through highlighting the varieties of code-switching, constraints that guide its practice, the costs associated with its use, and finally exploring the sociolinguistic elements as to why speakers code-switch.

### 3.1 Typology of code-switches

Code-switching is a linguistic behavior characterized by the bilingual speaker's ability to "alternate effortlessly between their two languages" (Bullock & Toribio, 2009, pg.1). Bilinguals employ code-switching from a variety of different linguistic backgrounds, use a broad range of styles, motives, and exhibit varying levels of language proficiencies. Additionally, there are many misconceptions about its practice. A common misconception in regards to its use is that code-switching is produced at random and does not adhere to a set of solidified rules, when in fact, code-switching is rule-governed, follows concrete patterns, and is confined by a variety of constraints.

There are two types of codeswitches, inter-sentential codeswitching and intra-sentential codeswitching. Inter-sentential codeswitching occurs at the boundaries of sentences, and intra-sentential codeswitching occurs inside the same sentence (e.g., Macnamara, 1971, Poplack, 1980). Examples of each typology are presented below:

(1) *Intersentential Switch*

That's too much. *Sina pesa.*

"... I don't have [much] money."

[*Swahili-English* (Myers-Scotton 1993a, pg. 41)]

(2) *Intrasentential Switch*

Sometimes I'll start a sentence in Spanish [*sic*] y termino en español

"... and I finish in Spanish"

[*Spanish-English* (Poplack, 1980)]

Intra-sentential switches are performed by speakers with an advanced level of bilingual proficiency. Additionally, intra-sentential switches are studied more often in investigations of grammatical interactions of the code-switched languages at the sentence level (Bullock and Toribio, 2009, pg. 3). In the current study, intra-sentential switches will be used as stimuli.

Drawing on structural linguistic and sociolinguistic studies, Muysken (2000) identified three different processes that bilingual speakers employ when they code-switch. Each process is “constrained by different structural conditions, and are operant to a different extent and in different ways in specific bilingual settings.” Muysken, 2000, pg. 3). Muysken identifies the three different patterns as: (3) *Insertion* “which involves the embedding of a constituent—usually a word or a phrase—in a nested A-B-A structure” (Bullock & Toribio, 2009, pg.3). Insertion is at times compared to “lexical borrowing” in which “an alien lexical or phrasal category is inserted into a given structure”. (4) *Alternation*, “where the two languages remain relatively separated in an A-B configuration” Bullock & Toribio, 2009, pg.3) usually occurring at clause boundaries. Switches characterized by alternation involve a switch from both the grammatical and lexicon of the languages involved. (5) *Congruent lexicalization* occurs when “the two languages share a common grammatical structure that can be filled with lexical elements from either language.” (Bullock & Toribio, 2009, pg.3). Examples of these three patterns are provided below:

(3.) *Insertion*

xob pas *falsk-an* pesa-â

“Well then boys are false”

[Persian-Swedish (Naseh Loftabadi, 2002, pg. 41)]

(4.) *Alternation*

That’s too much. *Sina pesa.*

“That’s too much. *I don’t have much money.*”

[Swahili-English (Myers-Scotton 1993a, pg. 41)]



(5.) *Congruent Lexicalization*

wan heri *gedeelte* de ondro *beheer* fu *gewapende machten*

“One whole part is under control of the armed forces.”

[Dutch-Sranan (Bolle, 1994:75)]

Muysken sought to categorize the typology of code-switches in order to build upon past studies (Poplack, 1980; Myers Scotton, 1993; Clyne, 1967) that gave credence to the fact that code-switches do not occur at random but follow a series of constraints.

Poplack (1980) provided a model based upon studies of Spanish/English code-switching in the Puerto Rican community that outlined these constraints at intra-sentential levels. Poplack introduced the importance of “linear equivalence” where the “order of the sentence constituents immediately adjacent to and on both sides of the switch point must be grammatical with respect to both languages involved simultaneously” (Sankoff and Poplack, 1981, pg. 5). Poplack states that there are two major constraints that account for intra-sentential codeswitches (alternations) and follow the idea of linear constraint.

The first constraints that governs intra-sentential code-switches is the *free morpheme constraint*, in which “codes may be switched after any constituent in discourse provided that constituent is not a bound morpheme” (Poplack, 1980, pg. 585). For example, an invented term such as “EAT-*iendo*” would not follow the *free morpheme constraint* because the Spanish bound morpheme *-iendo* (‘ing’) is affixed to the English root ‘eat’, which has not been integrated into the Spanish language. An example such as this has not been “attested in this or any other study of codeswitching” (Poplack, 1980, pg. 586). However, the *free morpheme constraint* has faced criticism in that it is not supported cross-linguistically, for example, this constraint does not apply to agglutinative languages such as Arabic (Azuma, 1993, pg. 362).

The other constraint that Poplack introduces is the *equivalence constraint* where “code-switches will tend to occur at points in discourse where juxtaposition of L1 and L2 elements does not violate a syntactic rule of either language, i.e., at points around which the surface structures of the two languages map onto each other” (Poplack, 1980, pg. 586). Poplack provides the following example of a violation of the *equivalence constraint*:

(6). El MAN que CAME ayer WANTS JOHN comprar A CAR nuevo.

‘The man who came yesterday wants John to buy a new car’

(Poplack, 1980, pg 588)

This example violates the *equivalence constraint* at many loci. One violation occurs at the object noun phrase “A CAR nuevo” due to the non-equivalence rules that both the English and Spanish language exhibit. In English, the head noun usually follows the attribute adjective whereas the Spanish language usually exhibits the reverse, the attribute adjective following the head noun. However, some Spanish adjectives may also precede the head noun. Thus, this construction of a “A CAR nuevo” would not be acceptable by bilingual informants as it would rarely occur in discourse (Poplack, 1980, 588).

### **3.2 Code-switching and switch costs**

The typology of code-switching strategies outlined by Muysken (2000) and the constraints provided by Poplack’s model (1980) demonstrate that codeswitching is not a haphazard exchange between two languages, but is in fact rule governed and an exhibition of a level of language proficiency. However, although the practice of code-switching is indicative of a high level of language proficiency, bilinguals may have difficulty recognizing or anticipating switches in comprehension. In other words, “bilingual comprehenders do not *a priori* know when a code-switch will occur in speech.” (Guzzardo Tamargo, Valdés Kroff, Dussias. 2016, 139). Code-switches are often unexpected in comprehension and in turn may incur processing

costs. Although bilinguals for the most part exhibit little difficulty comprehending code-switched discourse, they often have difficulty remembering which language was used at any certain point within said discourse (Gumperz, 1982). This section will explore the types of switch-costs experienced by bilinguals who employ code-switching.

Although evidence suggests that code-switches occur at certain syntactic junctures more often than at others, and that bilingual speakers may use certain cues to anticipate when a code-switch may occur in discourse, processing costs still exist for the bilingual “relative to staying within the same language.” (Guzzardo Tamargo et al., 2016) Evidence for switch costs is demonstrated across literature involving language switching, (Grainger & Beauvillian, 1988; Grainger O’Regan, 1992; Thomas & Allport, 2000; von Studnitz & Green. 1997), and involving switching at the sentence-level (Altarriba et al, 1996; Moreno, Federmeier, and Kutas, 2002; Proverbio et al. 2004; Chan, Chau, and Hoosain, 1983). Evidence from language switching studies involving lexical decision tasks find that the bilingual comprehender faces a processing cost after confronting (through recognition and integration) a linguistic code different from the linguistic code that they encountered most recently. The findings from language switching studies however, do not mirror the real-world implementation of code-switching which presents itself within discourse rather than in an isolated state. The language-switching studies incorporate “decontextualized language switching tasks involving words presented in isolation and where the target language is determined by the experimenter” (Guzzardo Tamargo, Valdés Kroff, Dussias. 2016, 140), whereas in natural bilingual communication, both languages are involved, and the speaker has control of when the code-switching occurs.

Switch costs have also been investigated at the sentence-level. Evidence from an eye-tracking reading study conducted by Altarriba et al. (1996) showed that participants fixated

longer on noun switches between languages than on synonyms of “within-language words.” Additionally, Proverbio et al. 2004) found that bilingual participants exhibited longer reaction times when processing code-switched words. Both of these studies provide evidence for the existence of switch costs. However, there is evidence that these costs can be reduced. For example, Chan, Chau, and Hoosain (1983) found that reading times for participants presented with long stretches of mixed-language passages were about the same as when presented with unilingual passages. Additionally, the bilingual listener can utilize certain phonetic cues to confront a codeswitched item. Together, the literature suggests that there are switch-costs associated with processing of code-switched discourse, but these costs can be alleviated or reduced. For the present eye-tracking study, the presence or absence of switch-costs, measured by gaze-duration, will serve as an indicator for the persistence of form in sentence recall.

### **3.3. Why do speakers code-switch?**

As discussed above, code-switching is a linguistic behavior exhibited by bilingual speakers that is rule-driven, yet costly in terms of processing demands; given this, it is important to consider why bilingual speakers code-switch in the first place. Bilingual speakers choose to code-switch for a variety of social and discursive reasons. Language serves as an important indicator and heuristic to define and construct communities. In this respect, bilingual speakers code-switch to demonstrate solidarity and as a group marker (Bullock & Torribo, 2009, pg. 10). In some cases, bilinguals codeswitch in order to demonstrate prestige within their communities. Sankoff (1980) observed the prestige of codeswitching in the lowlands of New Guinea where some members of the community are trilingual. Switching between the three languages in this region serves as designator of importance within the community. Bilingual speakers also code-switch to enhance situational communication. For example, for a Spanish-English bilingual

speaker there might be some words in English that better encapsulate a situation than could a Spanish word of a similar meaning and vice versa. Heredia and Altarriba (2001) provide the Spanish word “cariño” as an example of this, which “implies a combination of liking and affection” that an English lexical counterpart could not provide.

## **Chapter 4**

### **Methods**

#### **4.1 Participants**

The participants of this study consisted of 12 Spanish-English bilingual students (L1 Spanish- L2 English) at the University of Puerto Rico, Rio Piedras (9 females and 3 males). Participants were formally educated in Spanish, born and raised in Puerto Rico. They were highly proficient in English with many demonstrating skills in reading, writing, and speaking English at the university level. As students at the University of Puerto Rico, Rio Piedras, although their classes are taught in Spanish, the textbooks that accompany their classes are written in English. Due to this, the participants demonstrated English reading abilities at the university level.

To assess the participant's language proficiency and language use in Spanish and English by self-report, a language history questionnaire was administered. The questionnaire was composed of 10 items that asked the degree to which participants used English and Spanish in their daily lives. In addition, to obtain an objective measure of proficiency of Spanish and English, a verbal fluency task and picture naming task were administered. Each task is described below.

#### **Language History Questionnaire**

Participants responded either “never”, “very infrequently”, “occasionally”, “frequently”, or “always” to a set of twelve items asking the participant to self-report the extent and level to which they used both Spanish and English in their daily lives (full questionnaire and results included in Appendix A). Drawing from responses of the questionnaire, the majority of participants reported that they tended to switch languages during conversation (switching from Spanish to English or vice versa) and that they made these switches consciously. All participants reported that they tended to at least occasionally or frequently switch between English and Spanish during specific situations, and that there are certain topics or issues in which switches between languages are more likely to occur.

## Verbal Fluency Task

In order to measure language proficiency in both English and Spanish, a verbal fluency task was administered. In this task, participants were asked to name as many items as they could within 30 seconds that pertained to a given category. After completing a practice session, participants were given four categories in English (instruments, vegetables, clothing and animals) followed by four categories in Spanish (fruits, furniture, colors, and body parts). For each participant, the categories remained constant, but could be administered in any given order within their respective blocks, English or Spanish. At the sound of a bell, participants listed as many items as they could, while avoiding repetition and fillers such as “eh” or “um”. The results were coded using a reference to an index of acceptable items for each category that accounted for regional dialects of English and Spanish. On average, participants were able to name 38 items in English and 47 items in Spanish. The results of the verbal fluency task are included below in Table 1. This suggests that participants were slightly more proficient in Spanish than in English.

**Table 1 Spanish and English Verbal Fluency Results**

Task	Mean	Standard Deviation
English Verbal Fluency	38	8.75
Spanish Verbal Fluency	47	7.6

## Bilingual Picture Naming

Participants completed a picture naming task. They were presented 66 drawings of simple objects first Spanish and then in English (a total of 132 items). Participants recorded their responses in two different microphones. The first, a headset which recorded the verbal responses of the participants. The second microphone recorded the reaction times of participants. A new picture would appear on the screen only if the second microphone picked up the vocal waves of the participant’s response. Responses to this task were coded by ensuring the accuracy of the response of the participant to

each picture, only a specified set of responses to each picture were deemed accurate accounting for regional dialects in Spanish and English. For example, for a picture displaying an image of a “kite,” Spanish responses such as “papalote”, “cometa”, or “chiringa” would all be considered accurate. Results of this frequency considered the relative reaction times and level of accuracy for each participant. Results are provided in Table 2 below.

**Table 2 Bilingual Picture Naming Accuracy**

Language Response	Accuracy	Standard Deviation
<b>Spanish</b>	94%	0.0479
<b>English</b>	89%	0.065

## 4.2 Materials

The eye-tracking portion of the experiment required that participants read sentences and respond to comprehension questions. The stimuli included 128 experimental sentences, with 128 critical nouns embedded within the sentences (see Appendix B). The 128 Spanish critical nouns included 64 feminine and 64 masculine nouns matched for lexical frequency, each translated into English. Two conditions were created for the critical nouns. The first condition included unilingual sentences-- where the entire sentence including the critical noun appeared in Spanish. In the second condition the sentence began in Spanish and switched into English at the critical noun. For example, for the Spanish critical noun *aceite*<sup>masc</sup>, which translates into English as *oil*, two conditions were created:

(1a) Condition 1: La cocinera usó el **aceite** que compró en Italia.

(1b) Condition 2: La cocinera usó el **oil** that she bought in Italy.

A comprehension questions pertaining to the experimental sentences always appeared in unilingual Spanish and always included one of the 128 critical nouns. For example, the sentences given in (1a) and (1b) were followed by the question:

(1c) ¿La cocinera usa **aceite** italiano para cocinar?



Half of the comprehension questions had a “yes” answer and half of the comprehension had a “no” answer. Examples (1a) and (1b) illustrate a sentence and question set that required a “yes” response. The following examples (2a), (2b), and (2c) illustrate a sentence and question set that would require a “no” response.

(2a) La fotografía vio el **avión** a través de su cámara.

(2b) La fotografía vio el **plane** through her camera.

(2c) ¿La fotografía miró el **avión** con un telescopio?

The comprehension question followed the experimental sentences immediately for half of the sentences during the eye-tracking portion of the experiment. In the other half of the task, a very simple math problem was interpolated between the sentence and comprehension question. The math problems consisted of a simple addition or subtraction equation that included one digit, such as  $5 + 4 = 9$ . The interpolation of the math problem between the sentence and the comprehension question was introduced to create a delay that would allow the examination of whether both the form and the meaning of the critical noun in the comprehension question was recalled. The manipulation in which the comprehension question immediately followed the experimental sentence is known as “no delay” (ND). The manipulation in which a math question was interpolated between the experimental sentence and the comprehension sentence is known as “math delay” (MD). The order and examples of sentences and comprehension question conditions are presented in Table 3 below.

**Table 3 Materials**

Condition	Format
<i>NS, ND</i>	El astronauta vio el <u>cielo</u> desde la ventana pequeña. ¿Podía ver el <u>cielo</u> desde la ventana?
<i>NS, MD</i>	El astronauta vio el <u>cielo</u> desde la ventana pequeña. 5 + 4 = 9 (TRUE or FALSE) ¿Podía ver el <u>cielo</u> desde la ventana?
<i>CS, ND</i>	El astronauta vio el <u>sky</u> from the small window. ¿Podía ver el <u>cielo</u> desde la ventana?
<i>CS, MD</i>	El astronauta vio el <u>sky</u> from the small window. 5 + 4 = 9 (TRUE or FALSE) ¿Podía ver el <u>cielo</u> desde la ventana?

### 4.3. Procedure

The current study took place over a two-hour session. At the start of the session participants filled out a consent form indicating their awareness and agreement to the collection of data and potential use of the recordings from their sessions for future studies. Next, the participant filled out the Language History Questionnaire. After filling out the questionnaire the participant completed the Spanish Verbal Fluency task, recording their responses into a microphone.

After the completion of the Spanish Verbal Fluency the participant moved to a different work station where a monitor equipped with software compatible with the SR Eye-Link 1000 and E-prime software, the SR Eye-Link 1000, and chinrest were set up. The SR Eye-Link tracks the gaze of participants as they read simple sentences that appear on a computer monitor which was set up directly behind the Eye-Link camera. This began the eye-tracking portion of the experiment where participants would read sentences, and answer short comprehension questions pertaining to the presented sentences.

The researcher first sanitized the chinrest using anti-bacterial wipes and then explain to the participant that they would be reading a set of simple sentences that would appear on the screen in front of them. The researcher explained that the participant would read the sentences silently as if they were reading a book to themselves and that the Eye-Link 1000 camera would track their gaze and eye-movements. Before reading each sentence, the participant was instructed to fixate on a black dot to

initiate the appearance of the next sentence. In the first condition, each sentence was followed immediately by a simple comprehension question. Participants were instructed to answer each comprehension question with either “sí” (indicated by pressing the “S” key on the keyboard) or “no” (indicated by pressing the “K” key on the keyboard).

After the researcher finished their initial instruction the researcher adjusted the height of the chin-rest and chair to ensure the comfort of the participant and then instructed the participant to place their head inside of the chin-rest. The next step was to calibrate the participant’s eye in order to ensure an accurate gaze-measurement. The Eye-Link camera fixates on the right eye of the participant and displays an image of the right eye on the monitor. The researcher then used the computer mouse to focus on the participant’s pupil and adjusted camera lens manually to focus directly on the participant’s right pupil. Next, the researcher highlighted the pupil using the up and down arrows on the keyboard. To calibrate the Eye-Link camera the participant was then instructed to follow a black dot with their eyes as it moved across the screen at nine different points across the monitor. The participant was told to not anticipate the movement of the black dots but to follow the movements of the dots as naturally as they could. Next, the researcher validated the calibration by repeating the calibration activity performed in the previous step. Once calibrated and validated, the participant read 10 practice sentences and answered 10 comprehension questions until they were prompted to continue reading sentences and responding to questions for a set of 80 sentences until a message on the monitor indicated that they had completed this portion of the task. The participants completed this task across 4 blocks mentioned in Table 3. Additional instruction was provided by the researcher before the second block (No switch, Math Delay (NS, MD)).

Before beginning the ND, MD condition the research explained to the participant, as before, that they would read simple sentences and respond to comprehension questions. However, this time a simple math problem and solution, for example  $5 + 4 = 9$ , would appear as a delay between the sentence and the comprehension question for approximately 3 seconds. The participants were instructed to respond to the math problem as a “TRUE or FALSE” question, where they would indicate that the math problem and

solution were correct using the “S” key on the keyboard and incorrect using the “K” key on the keyboard. After responding to the math question, the participant responded to a simple comprehension question corresponding to the sentence that had appeared before the math problem using the “S” key for “Sí” and the “K” key for “no”. The participant then continued this practice for two more blocks that included code-switched sentences for both the “no-delay” and “math delay” manipulations. The eye-tracking reading task lasted between 45 minutes to an hour depending on the speeds of the participant.

After the completion of the 4 eye-tracking blocks the participant returned to the lap-top station where they completed the English version of the Verbal Fluency task. Next the participant completed the Bilingual Picture Naming task where the participant was instructed to use a microphone to name a series of drawings as quickly and accurately as possible first in Spanish and then in English. Finally, the participant signed a receipt form to confirm their completion of the experiment and compensate their work. Each participant was paid \$20.

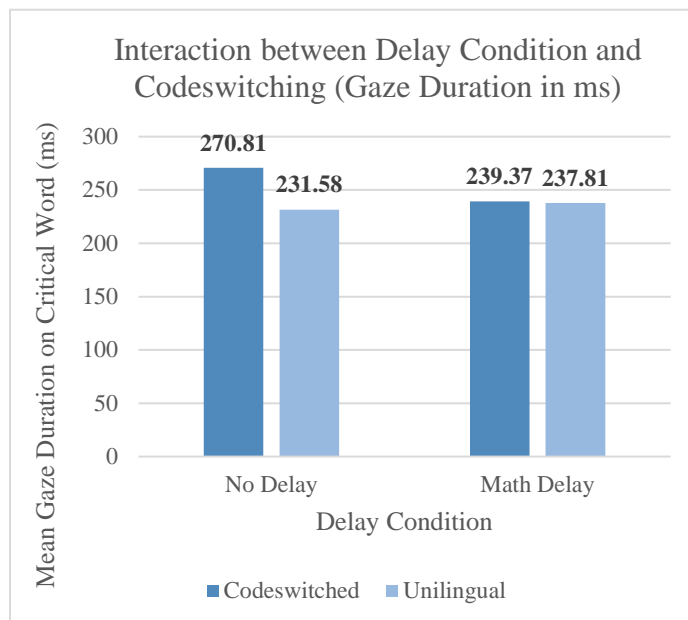
#### **4.4 Results**

To analyze the results of the eye-tracking reading portion of this study, gaze duration measurements were extracted looking specifically at the critical noun in the question. The gaze duration is the sum of all fixations on a word when it is read for the first time. Statistical analysis was conducted using R software. Outliers were removed using the Median Absolute Deviation method (MAD). The reading times were normalized by using a log function. Maximal linear mixed-effects models in R using the lmer function in the lme4 package were created. The ANOVA function was used in the car package to make leave-one-out comparisons and test for significance. The model predicted gaze durations by Switch (Unilingual or Codeswitched, referring to the previous sentence not the comprehension question), Delay (No Delay or Math Delay), and their interaction.

## Gaze Duration

The model comparisons revealed a significant main effect of Switch ( $\chi^2 = 4.51, p = 0.03$ ), and a significant interaction between Switch and Delay ( $\chi^2 = 9.16, p < 0.01$ ). The main effect of Switch showed that gaze durations on the critical noun in the question were significantly longer following a codeswitched sentence ( $x = 251.18\text{ms}, sd = 81.35$ ) than a unilingual sentence ( $x = 234.12\text{ms}, sd = 94.08$ ).

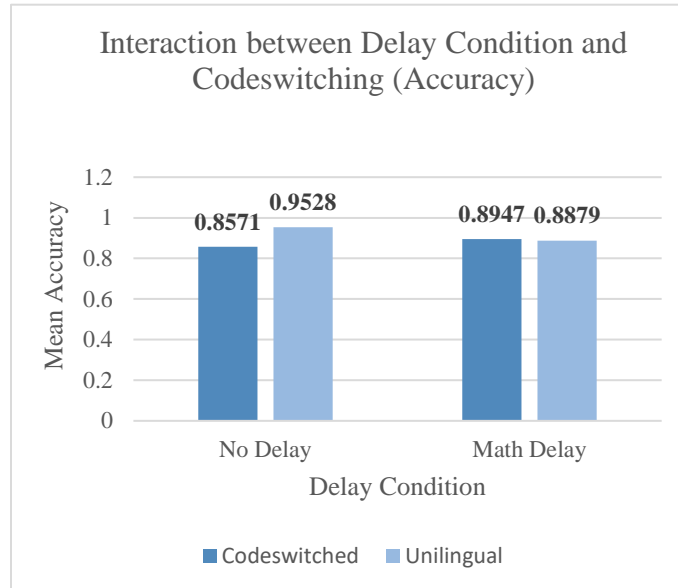
The interaction showed this was true only for the items in the No Delay block: that is, the switch effect was only seen in the No Delay condition, while gaze durations on the critical noun in the Math Delay did not differ between unilingual and code-switched conditions. These results are illustrated in Figure 5 below.



**Figure 5 Interaction between Delay Condition and Codeswitching**

## Accuracy

A generalized linear mixed-effects model was run using the `glmer` function in the `lme4` package, and again tested using the `ANOVA` function in the `car` package. While there were no significant main effects or interactions, the pattern follows that of the gaze durations: we see a switch cost for accuracy (that is, decreased accuracy following a code-switched compared to a unilingual sentence) only in the No Delay block, while accuracy is basically identical in the two conditions in the Math Delay block. These results are illustrated in Figure 6 below.



**Figure 6 Interaction between Delay Condition and Codeswitching**

## **Chapter 5**

### **Discussion**

The purpose of this study was to reconcile two conflicting but longstanding findings regarding the retention of form and meaning in sentence recall. One finding is derived from the memory recall literature and the other is derived from the priming literature. The memory recall literature (Sachs 1967; 1974), demonstrates that in long-term memory, the meaning persists longer than the form. The syntactic priming literature, on the other hand, tells us that the form is what remains in memory in sentence recall. In order to investigate the independent contributions of meaning and form, this study incorporated bilingualism because it allows for the possibility to have two different forms for one shared meaning. Considering this, this study addressed the following research question: Does retention of meaning take precedence over form in sentence recall?

The experimental manipulations consisted of two conditions. A unilingual Spanish condition in which Spanish sentences were followed by comprehension questions (No-Switch condition); in this condition, a critical word appeared in both the sentence and the comprehension question. A second condition involved code-switched sentences in which the code-switch was from Spanish to English, where the code-switch occurred at the point of the critical word (Code-Switched condition), followed by a comprehension question in unilingual Spanish.

Example 1 demonstrates a unilingual sentence (1a) and its corresponding comprehension question (1b). The critical word “**pájaro**” is underlined and emboldened in both sentences for the sake of illustration. The comprehension question in this example requires a response of “yes”.

(1a) El anciano vio un **pájaro** volando alto.

(1b) ¿Vio un **pájaro** volando alto?

Example 2 demonstrates a code-switched sentence (2a) and its corresponding comprehension question (2b). The critical word appears in its English form, “**bird**” in the experimental sentence and in its Spanish form in the comprehension question, “**pájaro**”. Allowing for an isolation of two different forms with one shared meaning. The comprehension question in this example requires a response of “yes”.

(2a) El anciano vio un **bird** flying high.

(2b) ¿Vio un **pájaro** volando alto?

The experimental manipulation described above was employed because in the first condition (No-Switch, examples 1a and 1b), the form and meaning were the same in the sentence and the comprehension question (**pájaro**, **pájaro**), while in the second condition (Code-Switched, examples 2a and 2b) the form of the critical word was different (**bird**, **pájaro**) but the meaning remained the same.

Due to the fact that the original studies focused on what remained in the memory of the participant after reading sentences an additional manipulation was added. In the additional manipulation, the comprehension question either occurred immediately following the experimental sentence or occurred after the participant solved a math problem where the participant was given a pre-determined amount of time. The inclusion of the simple math problem created a delay. The “No Delay” and “Math Delay” manipulations each appeared within



both unilingual and code-switched conditions. The example below presents the order of materials that a participant would have to complete for the code-switched and Math Delay block.

3a. El anciano vio un bird flying high.

3b.  $5+4=9$  (TRUE or False)

3c. ¿Vio un pájaro volando alto?

The predictions were that participants were expected to exhibit faster reading times on the critical word in the comprehension question (i.e., pájaro) when the critical word shared the same form and meaning as the sentence preceding it (i.e., pájaro, pájaro demonstrated in examples 1a and 1b) for both “No Delay” and “Math Delay” manipulations. In the code-switched condition, participants were expected to exhibit slower reading times on the critical word “pájaro” in the comprehension sentence when the critical word appeared in the form of “bird” in the experimental sentence that preceded it for both “No Delay” and “Math Delay” manipulations. These predictions were made considering the fact that added activation of the critical word occurs when the meaning and form is overlapped in the unilingual condition (example 1a and 1b). This added activation, which occurs for both form and meaning, when the participant reads the word “pájaro” in the experimental sentence and then reads it again as “pájaro” in the comprehension question facilitates its recognition, leading to faster reading times.

In the code-switched condition, participants would be slower at reading the critical word, “pájaro” in the comprehension question when it was immediately preceded in the experimental question by its translation equivalent “bird”. Although the meaning of the two words are the same, their forms are different and thus lacks the added advantage of the activation period for the form, which allows for the expectation of a slow-down in reading times. In this case, there is activation in meaning but the same activation is not experienced in the form of the word. In

summary, it is predicted that the combined activation of both form and meaning will be conducive to the facilitation of recognition, which should not be changed with an added delay. For the code-switched condition, there is not activation for the form of the critical word relative to the unilingual condition which would create the expectation of a slow-down in reading times. This should disappear overtime because of evidence in the Sachs' (1967; 1974) studies that demonstrate that meaning take precedence in long-term memory.

The findings of the present study partially support the priming literature, which makes the case for the retention of form in sentence recall. Participants exhibited slower reading times for the critical word in the comprehension question in the code-switched condition relative to the unilingual condition in the "No Delay" manipulation (unilingual 231.58ms; code-switched 270.71ms). An interference effect likely occurred in the code-switched condition for the "No Delay" manipulation. Interference likely occurred because participants retained the form "bird" in their immediate memory, which caused a slow-down when the participants were read "pájaro" in the comprehension question. This makes the case for the retention of form for a short period of time.

The results also support the retention of meaning. This is so because the inclusion of the delay (Math Delay) in the unilingual and code-switched condition resulted in participants reading the critical word in both conditions at the same speed (unilingual 237.81ms; 239.37). This suggests that meaning persists because the interference effect that occurred in the "No Delay" manipulation disappeared with the interpolation of just a short math problem.

One potential drawback of this study is that there is no official baseline reading time for the critical word in the comprehension question. Meaning that, in the current study, there is a not condition that reveals the average gaze durations for the critical word an isolated setting to

compare reading times in the code-switched and unilingual conditions. In future research, an additional condition is required where the critical word in the comprehension question is preceded in the experimental sentence by a word that shares neither its direct meaning (although may appear as a synonym) or form. The three conditions are outlined as followed in Table 4. It is only with the inclusion of this third condition that we are best able to interpret these findings which will be left for future research.

**Table 4 Future Conditions (Including Baseline)**

<b>Unilingual</b>	El anciano vio un <b><u>pájaro</u></b> volando alto.
<b>Code-Switched</b>	El anciano vio un <b><u>bird</u></b> flying high.
<b>Baseline</b>	El anciano vio un <b><u>ave</u></b> volando alto.
<b>Comprehension Question</b>	¿Vio un <b><u>pájaro</u></b> volando alto?

## Appendix A

### Language History Questionnaire

Please, try to answer to what degree the following questions are representative of the way in which you talk or speak in the language you know (e.g., English-Spanish). Many of the questions ask you to report your tendency to switch or mix languages during a conversation. Switch is a characteristic of some bilingual contexts or environments. The present questionnaire outlines the switching patterns that exist in these languages.

1. I do not remember or I cannot recall some English words when I am speaking in this language:

- i. Your Answer:

Never  
Occasionally  
Frequently  
Always

2. I do not remember or I cannot recall some Spanish words when I am speaking in this language:

- i. Your Answer:

Never  
Occasionally  
Frequently  
Always

- ii.

3. I tend to switch languages during a conversation (for example, I switch from Spanish to English or vice versa):

- i. Your Answer:

Never  
Occasionally  
Frequently  
Always

4. When I cannot recall a word in English, I tend to immediately produce it in Spanish:

i. Your Answer:

Never  
Occasionally  
Frequently  
Always

5. When I cannot recall a word in Spanish, I tend to immediately produce it in English:

i. Your Answer:

Never  
Occasionally  
Frequently  
Always

6. I do not realize when I switch the language during a conversation (e.g., from English to Spanish) or when I mix the two languages; I often realize it only if I am informed of the switch by another person:

i. Your Answer:

Never  
Occasionally  
Frequently  
Always

7. When I switch languages, I do it consciously:

i. Your Answer:

Never  
Occasionally  
Frequently  
Always

8. It is difficult for me to control the language switches I introduce during a conversation (e.g., from English to Spanish):

i. Your Answer:

Never  
Occasionally  
Frequently  
Always

9. Without intending to, I sometimes produce the Spanish word faster when I am speaking in English:

i. Your Answer:

Never  
Occasionally  
Frequently  
Always

10. Without intending to, I sometimes produce the English word faster when I am speaking in Spanish:

i. Your Answer:

Never  
Occasionally  
Frequently  
Always

11. There are situations in which I always switch between the two languages.

i. Your Answer:

Never  
Occasionally  
Frequently  
Always

12. There are certain topics or issues for which I normally switch between the two languages.

i. Your Answer:

Never

Occasionally

Frequently

Always

## Appendix B

### Experimental Sentences

Item a: Unilingual Sentence/ Spanish Critical noun

Item b: Code-Switched Sentence/ English Critical noun

Item c: Corresponding comprehension questions/ response

Item	Unilingual Sentence	ESP Noun
1a	El apicultor cuida las abejas todo el año.	abejas
2a	La cocinera usó el aceite que compró en Italia.	aceite
3a	La enfermera usó la aguja para sacar sangre.	aguja
4a	La empleada limpió la alfombra de su habitación.	alfombra
5a	El granjero recogió el algodón con la máquina sofisticada.	algodón
6a	La anciana compró una almohada hecha de algodón.	almohada
7a	El joyero arregló el anillo con sus herramientas especiales.	anillo
8a	La mujer capturó la araña y la puso en el jardín.	araña
9a	La florista vio el árbol con las hojas verdes.	árbol
10a	La fotógrafa vio el avión a través de su cámara.	avión
11a	Los soldados hizaban la bandera todas las mañanas.	bandera
12a	El hombre pintó el baño en el apartamento recientemente.	baño
13a	El señor se cortó la barba porque estaba muy larga.	barba
14a	El mecánico pudo reparar el barco en su tiempo libre.	barco
15a	La muchacha sacó la basura de la casa.	basura
16a	La chica compró una blusa a su mamá.	blusa
17a	El perro rompió la bolsa cuando la mordió.	bolsa
18a	La turista visitó el bosque que está en las montañas.	bosque
19a	El herrero cortó la cadena con unas tijeras especiales.	cadena
20a	El electricista tiene una caja con herramientas.	caja
21a	Los voluntarios limpiaron la calle por la mañana.	calle
22a	El abogado se acostó en la cama después de trabajar todo el día.	cama
23a	El granjero compró un camión para su granja enorme.	camión
24a	La modelo se lavó la cara antes de ir a dormir.	cara
25a	El mago le dio un caramelo a la niña curiosa.	caramelo
26a	El ladrón estuvo en la cárcel muchos años.	cárcel
27a	La cocinera compró carne para la cena.	carne



28a	La presidenta envió la carta al senador.	carta
29a	La pareja compró la casa en el pueblo tranquilo.	casa
30a	Anoche, el profesor bebió una cerveza en el bar.	cerveza
31a	El jardinero cortó el césped de enfrente de la casa.	césped
32a	El abuelo se puso una chaqueta porque hacía mucho frio.	chaqueta
33a	El astronauta vio el cielo desde la ventana pequeña.	cielo
34a	La mujer compró un cinturón para su esposo.	cinturón
35a	El poeta visitó la ciudad por su bello paisaje.	ciudad
36a	El chofer empujó el coche cuando se quedó sin gasolina.	coche
37a	La compañía lanzó un cohete que llevaba un telescopio grande.	cohete
38a	La chica enamorada dibujó un corazón en su libro.	corazón
39a	El hombre no puede encontrar la corbata que le regaló su esposa.	corbata
40a	La profesora encontró el cuaderno para su estudiante.	cuaderno
41a	El carpintero colgó un cuadro en la pared de la sala.	cuadro
42a	El señor usó un cuchillo para cortar las verduras.	cuchillo
43a	La niña perdió un diente mientras dormía.	diente
44a	El banquero encontró un escarabajo en el cajón de su escritorio.	escarabajo
45a	La maestra buscó la escuela con las mejores aulas.	escuela
46a	La peluquera necesitaba un espejo para cortar el pelo.	espejo
47a	Los obreros construyeron el estadio para los partidos de fútbol.	estadio
48a	La chica se compró la falda que era blanca y verde.	falda
49a	El niño odiaba la fiesta porque estaba aburrido.	fiesta
50a	El guía del grupo fotografió a la foca mientras jugaba en el agua.	foca
51a	Mi papá encendió una fogata enfrente de la tienda de campaña.	fogata
52a	El atleta se golpeó la frente contra la puerta.	frente
53a	El deportista comió fresas después del partido.	fresa
54a	La chica horneó unas galletas antes de irse a dormir.	galletas
55a	El bombero rescató el gato del edificio en llamas.	gato
56a	El payaso infló un globo para la niña.	globo
57a	La dentista dejó el guante encima de la mesa.	guante
58a	La chica pintó la habitación para su hermano menor.	habitación
59a	El conductor evitó el hielo en la carretera.	hielo
60a	El minero extrajo el hierro del interior de la montaña.	hierro
61a	La cocinera encendió el horno para cocinar.	horno
62a	La muchacha tiró el hueso al perro.	hueso
63a	La chica comió un huevo temprano en la mañana.	huevo
64a	Los albañiles acabaron la iglesia en un año.	iglesia
65a	El técnico arregló la impresora que estaba en la oficina.	impresora
66a	La empleada encontró el jabón sobre el lavabo.	jabón
67a	Mi mamá arregló el jardín durante el fin de semana.	jardín
68a	El artesano construyó la jaula para pájaros exóticos.	jaula
69a	El marinero exploró el lago y sus cuevas profundas.	lago

70a	El pescador atrapó la langosta para la cena.	langosta
71a	La traductora perdió el lápiz antes del examen.	lápiz
72a	La vendedora puso las latas en el estante.	latas
73a	La niña se tomó la leche que compró su mamá.	leche
74a	La secretaria perdió la llave de la puerta de la oficina.	llave
75a	El visitante echaba de menos la lluvia de su país natal.	lluvia
76a	Las turistas vieron los loros en la selva amazónica.	loros
77a	El astrónomo vio la luna con su telescopio grande.	luna
78a	El electricista instaló la luz en la sala de espera.	luz
79a	El carpintero cortó la madera para construir la silla.	madera
80a	La abuela tiene el maíz para la nueva receta.	maíz
81a	Las flores atraen a las mariposas con sus pétalos de colores.	mariposas
82a	La empleada compró la miel para preparar la torta.	miel
83a	Los estudiantes vieron los monos en el zoológico.	monos
84a	El abuelo mató la mosca con el periódico enrollado.	mosca
85a	El artista pintó el mundo sobre un lienzo.	mundo
86a	El granjero vendió las naranjas que cultivó recientemente.	naranjas
87a	Al chico se rompió la nariz cuando se cayó.	nariz
88a	La excursionista vio un nido en el árbol.	nido
89a	La pareja miraba la nieve por la ventana.	nieve
90a	El piloto evitó la nube y sus fuertes vientos.	nube
91a	La cocinera puso las nueces en la ensalada.	nueces
92a	El cazador vio el oso en el bosque oscuro.	oso
93a	El anciano vio un pájaro volando alto.	pájaro
94a	El técnico reparó la pantalla en el aula.	pantalla
95a	La modelo perdió el pañuelo en el tren.	pañuelo
96a	La chica pintó la pared de su dormitorio.	pared
97a	El niño miró el pato nadando en el río.	pato
98a	La familia preparó el pavo para la cena de Navidad.	pavo
99a	La niña siempre tiene un peine en su bolsillo.	peine
100a	El luchador ganó la pelea en cinco minutos.	pelea
101a	El maestro leyó el periódico antes de ir a la escuela.	periódico
102a	La mujer tiró la piedra en el lago.	piedra
103a	La pintora usa el pincel que le costó cien euros.	pincel
104a	El niño se comió un plátano de postre.	plátano
105a	La madre compró un pollo en el mercado central.	pollo
106a	El pianista ganó un premio por su composición original.	premio
107a	El anciano echaba de menos el pueblo de su infancia.	pueblo
108a	Los trabajadores construyeron el puente en dos meses.	puente
109a	La abuela compró el queso que era muy delicioso.	queso
110a	El chico cortó la rama con un hacha grande.	rama
111a	El hombre encontró un ratón en su habitación.	ratón

112a	El pescador usó la red para coger los peces.	red
113a	El novio compró un regalo para el cumpleaños de su novia.	regalo
114a	La profesora usó la regla para medir una caja.	regla
115a	La vendedora encontró el reloj en el armario.	reloj
116a	Ayer, el niño dejó la revista en su mochila.	revista
117a	El caballero cruzó el río a pesar de las corrientes rápidas.	río
118a	El ciclista cambió la rueda de la bicicleta porque estaba pinchada.	rueda
119a	La enfermera limpió la sangre de la blusa.	sangre
120a	El turista escogió la selva como el destino de sus vacaciones.	selva
121a	El carpintero hizo el sillón de materiales finos.	sillón
122a	La chica perdió la tarjeta en el bar al que fue anoche.	tarjeta
123a	La escritora rompió el teclado de usarlo tanto.	teclado
124a	El granjero ató el toro a una cerca.	toro
125a	El príncipe vio la torre que era más alta del castillo.	torre
126a	La mujer planchó el traje que es de su hijo.	traje
127a	El granjero alimenta las vacas a las cuatro de la mañana.	vacas
128a	El estudiante llenó el vaso con agua porque tenía sed.	vaso

Item	Codeswitched Sentence	ENGNoun
1b	El apicultor cuida las bees all year long.	bees
2b	La cocinera usó el oil that she bought in Italy.	oil
3b	La enfermera usó la needle to take blood.	needle
4b	La empleada limpió la carpet in the room.	carpet
5b	El granjero recogió el cotton with the complex machine.	cotton
6b	La anciana compró una pillow made of cotton.	pillow
7b	El joyero arregló el ring with his special tools.	ring
8b	La mujer capturó la spider and put it in the garden.	spider
9b	La florista vio el tree with the green leaves.	tree
10b	La fotógrafa vio el plane through her camera.	plane
11b	Los soldados hizaban la flag every morning.	flag
12b	El hombre pintó el bathroom in the apartment recently.	bathroom
13b	El señor se cortó la beard because it was very long.	beard
14b	El mecánico pudo reparar el boat in his free time.	boat
15b	La muchacha sacó la trash from the house.	trash
16b	La chica compró una blouse for her mom.	blouse
17b	El perro rompió la bag when he bit it.	bag
18b	La turista visitó el forest that's in the mountains.	forest
19b	El herrero cortó la chain with special scissors.	chain

20b	El electricista tiene una box with tools.	box
21b	Los voluntarios limpiaron la street in the morning.	street
22b	El abogado se acostó en la bed after working all day.	bed
23b	El granjero compró un truck for his enormous farm.	truck
24b	La modelo se lavó la face before going to bed.	face
25b	El mago le dio un candy to the curious girl.	candy
26b	El ladrón estuvo en la prison for many years.	prison
27b	La cocinera compró meat for the dinner.	meat
28b	La presidenta envió la letter to the senator.	letter
29b	La pareja compró la house in the quiet village.	house
30b	Anoche, el profesor bebió una beer in the bar.	beer
31b	El jardinero cortó el grass in front of the house.	grass
32b	El abuelo se puso una jacket because it was very cold.	jacket
33b	El astronauta vio el sky from the small window.	sky
34b	La mujer compró un belt for her husband.	belt
35b	El poeta visitó la city for its beautiful landscape.	city
36b	El chofer empujó el car when it ran out of gasoline.	car
37b	La compañía lanzó un rocket that carried a large telescope.	rocket
38b	La chica enamorada dibujó un heart in her book.	heart
39b	El hombre no puede encontrar la tie that his wife gave him.	tie
40b	La profesora encontró el notebook for her student.	notebook
41b	El carpintero colgó painting on the wall in the room.	painting
42b	El señor usó un knife to cut the vegetables.	knife
43b	La niña perdió un tooth while she slept.	tooth
44b	El banquero encontró un beetle in the drawer of his desk.	beetle
45b	La maestra buscó la school with the best classrooms.	school
46b	La peluquera necesitaba un mirror to cut hair.	mirror
47b	Los obreros construyeron el stadium for the soccer games.	stadium
48b	La chica se compró la skirt that was white and green.	skirt
49b	El niño odiaba la party because he was bored.	party
50b	El guía del grupo fotografió a la seal while it played in the water.	seal
51b	Mi papá encendió una fire in front of the tent.	fire
52b	El atleta se golpeó la forehead against the door.	forehead
53b	El deportista comió strawberries after the game.	strawberries
54b	La chica horneó unas cookies before going to sleep.	cookies
55b	El bombero rescató el cat from the burning building.	cat
56b	El payaso infló un balloon for the girl.	balloon
57b	La dentista dejó el glove on the table.	glove
58b	La chica pintó la room for her younger brother.	room
59b	El conductor evitó el ice on the highway.	ice
60b	El minero extrajo el iron from inside the mountain.	iron
61b	La cocinera encendió el stove in order to cook.	stove

62b	La muchacha tiró el bone to the dog.	bone
63b	La chica comió un egg early in the morning.	egg
64b	Los albañiles acabaron la church in one year.	church
65b	El técnico arregló la printer that was in the office.	printer
66b	La empleada encontró el soap on the sink.	soap
67b	Mi mamá arregló el garden during the weekend.	garden
68b	El artesano construyó la cage for the exotic birds.	cage
69b	El marinero exploró el lake and its deep caves.	lake
70b	El pescador atrapó la lobster for the dinner.	lobster
71b	La traductora perdió el pencil before the exam.	pencil
72b	La vendedora puso las cans on the shelf.	cans
73b	La niña se tomó la milk that her mother bought.	milk
74b	La secretaria perdió la key for the office door.	key
75b	El visitante echaba de menos la rain of his home country.	rain
76b	Las turistas vieron los parrots in the Amazon rainforest.	parrots
77b	El astrónomo vio la moon with his large telescope.	moon
78b	El electricista instaló la light in the waiting room.	light
79b	El carpintero cortó la wood in order to build the chair.	wood
80b	La abuela tiene el corn for the new recipe.	corn
81b	Las flores atraen a las butterflies with their colorful petals.	butterflies
82b	La empleada compró la honey to prepare the cake.	honey
83b	Los estudiantes vieron los monkeys in the zoo.	monkeys
84b	El abuelo mató la fly with the rolled-up newspaper.	fly
85b	El artista pintó el world on the canvas.	world
86b	El granjero vendió las oranges that he grew recently.	oranges
87b	Al chico se rompió la nose when he fell.	nose
88b	La excursionista vio un nest in the tree.	nest
89b	La pareja miraba la snow from the window.	snow
90b	El piloto evitó la cloud and its strong winds.	cloud
91b	La cocinera puso las walnuts in the salad.	walnuts
92b	El cazador vio el bear in the dark forest.	bear
93b	El anciano vio un bird flying high.	bird
94b	El técnico reparó la screen in the classroom.	screen
		handkerchie
95b	La modelo perdió el handkerchief on the train.	f
96b	La chica pintó la wall in her room.	wall
97b	El niño miró el duck swimming in the river.	duck
98b	La familia preparó el turkey for Christmas dinner.	turkey
99b	La niña siempre tiene un brush in her pocket.	brush
100b	El luchador ganó la fight in five minutes.	fight
101b	El maestro leyó el newspaper before going to school.	newspaper
102b	La mujer tiró la stone in the lake.	stone

103b	La pintor usa el brush that cost one hundred euros.	brush
104b	El niño se comió un banana for dessert.	banana
105b	La madre compró el chicken in the central market.	chicken
106b	El pianista ganó un prize for his original composition.	prize
107b	El anciano echaba de menos el village from his childhood.	village
108b	Los trabajadores construyeron el bridge in two months.	bridge
109b	La abuela compró el cheese that was very delicious.	cheese
110b	El chico cortó la branch with a large axe.	branch
111b	El hombre encontró un rat in his room.	rat
112b	El pescador usó la net to catch the fish.	net
113b	El novio compró un gift for his girlfriend's birthday.	gift
114b	La profesor usó la ruler to measure a box.	ruler
115b	La vendedora encontró el clock in the closet.	clock
116b	Ayer, el niño dejó la magazine in his backpack.	magazine
117b	El caballero cruzó el river despite the rapid currents.	river
118b	El ciclista cambió la wheel on the bicycle because it was deflated.	wheel
119b	La enfermera limpió la blood from her blouse.	blood
120b	El turista escogió la jungle as the destination for his vacation.	jungle
121b	El carpintero hizo el chair with good materials.	chair
122b	La chica perdió la card in the bar she went to last night.	card
123b	La escritora rompió el keyboard from using it so much.	keyboard
124b	El granjero ató el bull to a fence.	bull
125b	El príncipe vio la tower that was the tallest in the castle.	tower
126b	La mujer planchó el suit that belongs to her son.	suit
127b	El granjero alimenta las cows at four in the morning.	cows
128b	El estudiante llenó el cup with water because he was thirsty.	cup

Item	Question	Answer
1c	¿A las abejas las cuida todo el año?	Yes
2c	¿La cocinera usa aceite italiano para cocinar?	Yes
3c	¿Usó la aguja para sacar sangre?	Yes
4c	¿Limpió ella la alfombra en su habitación?	Yes
5c	¿Recogió el algodón con una máquina?	Yes
6c	¿Compró una almohada de algodón?	Yes
7c	¿Arregló el anillo roto?	Yes
8c	¿Puso la araña afuera?	Yes
9c	¿La florista vio el árbol sin hojas?	No

10c	¿La fotografía miró el avión con un telescopio?	No
11c	¿Hizaban la bandera por la mañana?	Yes
12c	¿El baño está recién pintado?	Yes
13c	¿Se cortó la barba porque estaba larga?	Yes
14c	¿El barco funciona bien ahora?	Yes
15c	¿El papá sacó la basura de la casa?	No
16c	¿Compró la blusa para su mamá?	Yes
17c	¿Ahora la bolsa está rota?	Yes
18c	¿El bosque está en la ciudad?	No
19c	¿El herrero pudo cortar la cadena con las tijeras?	Yes
20c	¿Había herramientas en la caja del electricista?	Yes
21c	¿Limpiaron la calle por la noche?	No
22c	¿Se acostó en la cama después de trabajar?	Yes
23c	¿Compró el camión para mover muebles?	No
24c	¿Se lavó la cara por la noche?	Yes
25c	¿La niña recibió un caramelo del mago?	Yes
26c	¿Estuvo en la cárcel por sólo dos meses?	No
27c	¿El hombre compró carne para la cena?	No
28c	¿La carta la escribió la presidenta?	Yes
29c	¿La casa estaba en un pueblo tranquilo?	Yes
30c	¿Tomó una cerveza en el bar?	Yes
31c	¿Cortó el césped detrás de la casa?	No
32c	¿Se puso una chaqueta porque tenía frío?	Yes
33c	¿Podía ver el cielo desde la ventana?	Yes
34c	¿Compró un cinturón para su hijo?	No
35c	¿Visitó la ciudad por su deliciosa comida?	No
36c	¿Tuvo que empujar el coche sin gasolina?	Yes
37c	¿El cohete llevaba explosivos?	NO
38c	¿Dibujó un corazón en la pared del baño?	No
39c	¿La corbata se la regaló su hija?	No
40c	¿Tenía el cuaderno del estudiante?	Yes
41c	¿El carpintero colgó el cuadro en el baño?	No
42c	¿Usó el cuchillo para cortar fruta?	No
43c	¿Se cayó el diente mientras dormía?	Yes
44c	¿El banquero vio un escarabajo en el cajón?	Yes
45c	¿Quería la escuela con buenas aulas?	Yes
46c	¿La peluquera usa un espejo en su trabajo?	Yes
47c	¿El estadio es para los partidos de fútbol?	Yes
48c	¿Compró la falda blanca y verde?	Yes
49c	¿La fiesta le pareció aburrida?	Yes
50c	¿El guía tiene fotos de la foca?	Yes
51c	¿Había una fogata cerca de la tienda de campaña?	Yes

52c	¿Se golpeó la frente contra la puerta ?	Yes
53c	¿Comió fresas antes del partido?	No
54c	¿Horneó galletas temprano en la mañana?	No
55c	¿Rescató el gato de un río?	No
56c	¿Le dio el globo a la niña?	Yes
57c	¿Ella dejó el guante debajo de la mesa?	No
58c	¿La habitación está pintada?	Yes
59c	¿Vio el hielo en la carretera?	Yes
60c	¿Extrajeron hierro de la montaña?	Yes
61c	¿Usó el horno para cocinar?	Yes
62c	¿Le tiró un hueso al perro?	Yes
63c	¿Preparó un huevo para la cena?	No
64c	¿Construyeron la iglesia en tres años?	No
65c	¿El técnico llevó una impresora nueva?	No
66c	¿Encontró el jabón en la ducha?	No
67c	¿Arregló el jardín un miércoles?	No
68c	¿La jaula era para pájaros?	Yes
69c	¿El lago tiene cuevas?	Yes
70c	¿Atrapó una langosta para venderla?	No
71c	¿Tenía un lápiz al empezar el exámen?	No
72c	¿Puso las latas en un cajón?	No
73c	¿La leche la compró el papá?	No
74c	¿El jefe perdió la llave?	No
75c	¿El visitante odia la lluvia de su país?	No
76c	¿El loro es muy joven?	No
77c	¿Él vio la luna con binoculares?	No
78c	¿La luz está en la sala de espera?	Yes
79c	¿Usó la madera para construir una silla?	Yes
80c	¿La abuela debe comprar maíz para la nueva receta?	No
81c	¿Las mariposas vienen en el invierno?	No
82c	¿La empleada compró la miel para echársela al café?	No
83c	¿Vieron los monos en el safari?	No
84c	¿Mató la mosca con un zapato?	No
85c	¿Para pintar el mundo el artista usó un lienzo ?	Yes
86c	¿Las naranjas son muy frescas?	Yes
87c	¿Se rompió la nariz con un puñetazo?	No
88c	¿Encontró el nido en el árbol?	Yes
89c	¿Una mujer miró la nieve sola?	No
90c	¿Pudo evitar la nube peligrosa?	No
91c	¿Puso las nueces en el postre?	No
92c	¿Vio oso en el zoológico?	No
93c	¿Vio un pájaro en el cielo?	Yes



94c	¿La pantalla estaba en el aula?	Yes
95c	¿Se le perdió el pañuelo en el avión?	No
96c	¿Pintó la pared del salón?	No
97c	¿Vio el pato en el lago?	No
98c	¿La familia cenó el pavo en el cumpleaños de la abuela?	No
99c	¿Nunca tiene un peine consigo?	No
100c	¿Pudo ganar la pelea en poco tiempo?	Yes
101c	¿Leyó el periódico después de ir a la escuela?	No
102c	¿Tiró la piedra en el océano?	No
103c	¿El pincel era muy barato?	No
104c	¿Comió un plátano de postre?	Yes
105c	¿Compró el pollo en el mercado?	Yes
106c	¿Le dieron un premio al pianista?	Yes
107c	¿Al anciano le gusta el pueblo donde creció?	Yes
108c	¿Los trabajadores construyeron el puente en dos años?	No
109c	¿El queso era viejo?	No
110c	¿Cortó la rama con un hacha?	Yes
111c	¿Hay un ratón en la habitación?	Yes
112c	¿Usó la red para atrapar cerdos?	No
113c	¿El novio le dio un regalo a la chica?	Yes
114c	¿Usó una regla para medir la caja?	Yes
115c	¿La vendedora encontró el reloj en un cajón?	No
116c	¿Dejó la revista en su mochila?	Yes
117c	¿El hombre cruzó el río peligroso?	Yes
118c	¿La rueda estaba inflada?	No
119c	¿Limpió la sangre de los pantalones?	No
120c	¿Escogió la selva como lugar de trabajo?	No
121c	¿El sillón está hecho de materiales malos?	No
122c	¿Perdió la tarjeta en un restuarante?	No
123c	¿El teclado está roto?	Yes
124c	¿El toro está atado?	Yes
125c	¿Vio la torre más pequeña?	No
126c	¿La mujer planchó el traje de su esposo?	No
127c	¿Las vacas comen por la tarde?	No
128c	¿Llenó el vaso con leche?	No

### Gender of Spanish Critical Nouns

Item(a)	Gender	ESPNoun
1	F	abejas
2	M	aceite
3	F	aguja
4	F	alfombra

5	M	algodón
6	F	almohada
7	M	anillo
8	F	araña
9	M	árbol
10	M	avión
11	F	bandera
12	M	baño
13	F	barba
14	M	barco
15	F	basura
16	F	blusa
17	F	bolsa
18	M	bosque
19	F	cadena
20	F	caja
21	F	calle
22	F	cama
23	M	camión
24	F	cara
25	M	caramelo
26	F	cárcel
27	F	carne
28	F	carta
29	F	casa
30	F	cerveza
31	M	césped
32	F	chaqueta
33	M	cielo
34	M	cinturón
35	F	ciudad
36	M	coche
37	M	cohetes
38	M	corazón
39	F	corbata
40	M	cuaderno
41	M	cuadro
42	M	cuchillo
43	M	diente
44	M	escarabajo
45	F	escuela
46	M	espejo

47	M	estadio
48	F	falda
49	F	fiesta
50	F	foca
51	M	fogata
52	F	frente
53	F	fresa
54	F	galletas
55	M	gato
56	M	globo
57	M	guante
58	F	habitación
59	M	hielo
60	M	hierro
61	M	horno
62	M	hueso
63	M	huevo
64	F	iglesia
65	F	impresora
66	M	jabón
67	M	jardín
68	F	jaula
69	M	lago
70	F	langosta
71	M	lápiz
72	F	latas
73	F	leche
74	F	llave
75	F	lluvia
76	M	loros
77	F	luna
78	F	luz
79	F	madera
80	M	maíz
81	F	mariposas
82	F	miel
83	M	monos
84	F	mosca
85	M	mundo
86	F	naranjas
87	F	nariz
88	M	nido

89	F	nieve
90	F	nube
91	F	nueces
92	M	oso
93	M	pájaro
94	F	pantalla
95	M	pañuelo
96	F	pared
97	M	pato
98	M	pavo
99	M	peine
100	F	pelea
101	M	periódico
102	F	piedra
103	M	pincel
104	M	plátano
105	M	pollo
106	M	premio
107	M	pueblo
108	M	puente
109	M	queso
110	F	rama
111	M	ratón
112	F	red
113	M	regalo
114	F	regla
115	M	reloj
116	F	revista
117	M	río
118	F	rueda
119	F	sangre
120	F	selva
121	M	sillón
122	F	tarjeta
123	M	teclado
124	M	toro
125	F	torre
126	M	traje
127	F	vacas
128	M	vaso

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**The Pennsylvania State University**, University Park, PA  
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B.A. International Politics; B.A. Spanish  
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United States Senate; Office of Senator Robert Casey Jr. (Washington, D.C.)  
Legislative Intern  
July-August 2017  
Served as liaison between Pennsylvania constituents and the Washington D.C. federal office., drafted letters to respond to constituent concerns to communicate Senator Casey's positions on immigration, education, Medicare, and LGBT policy, and attended briefings on education and immigration policy.  
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Fundraising and Development Intern  
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Assisted in the organization of campaign events in the Philadelphia community, conducted donor research, conducted phone-banking calls  
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Summer 2015; Summer 2017  
Synthesized articles dealing with the public's perception of science and technology, analyzed the rhetorical choices and bias used in the presentation of scientific



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