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ASSESSING HOW BILINGUALISM AFFECTS AND INFLUENCES IDIOMATIC
PROCESSING

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ABSTRACT

Figurative language embodies the use of expressions that convey a message outside of what the individual words mean, and is widely used in daily discourse. Therefore, attaining figurative competence by improving the learning of multi-word expressions is a critical component to second language acquisition. Specifically, in this study, the bilingual processing of idiomatic expressions is examined. The research is centered around the idea that bilinguals may use their native language (L1) to aid idiomatic processing in their second language (L2). The study investigates how congruency of idioms influences processing. A congruent idiom is defined as an idiom that not only conveys the same meaning between two languages, but also uses the same words to do so in each language. An incongruent idiom is an expression in which the meaning is the same across the two languages, however the words used to express that meaning are not equivalents across languages. Additionally, the time points of literal and figurative activation were observed by manipulating the Interstimulus interval (ISI) between the prime and target in a Cross Modal Priming Task. 26 Spanish-English late bilinguals at the *Universidad de Granada* in Granada, Spain participated in the study. They were presented with a prime (English idioms) and prompted to make a lexical decision on the target word that appeared at an ISI of either 300ms or 600ms following the presentation of the prime. It was hypothesized that congruent idioms would facilitate bilingual processing, while incongruent idioms would pose a greater challenge to language learners. Overall, the data show that congruency does in fact facilitate bilingual idiomatic processing by providing a “boost” that triggers the activation of both the literal and figurative meanings at 600ms ISI. For incongruent idioms, without this “boost,” only the literal meaning was activated at 600ms ISI. In addition, the data show that participants relied on their L1 while processing an idiom in their L2.

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Chapter 1

Introduction

Speakers of any language can attest to the importance of being pragmatically competent in their language. Pragmatic competence can be defined as the ability to communicate a message in the social context for which it is intended. This concept becomes very important in day-to-day interactions with others. In fact, we do not realize the significance of pragmatic competence until communication breaks down, and we are left feeling perplexed by the words of another person. Although speakers of the same language can generally understand each other, comprehension becomes more difficult when certain social circumstances require an understanding of the language beyond standard grammar and syntax, in order to determine the message being conveyed through the words. This type of situation may arise with the use of figurative language. Some speakers of a language are unable to decipher what is truly meant by figurative expressions, as the words used in the expressions often take on a different meaning than when they stand alone in standard discourse. That being said, it is no surprise that non-native speakers of a language grapple with these expressions, as it adds an additional dimension to language learning.

The main focus of my study will be figurative competence, which falls under the umbrella of pragmatic competence. Understanding figurative expressions, specifically idioms as examined in this study, is crucial to second language acquisition. A firm grasp on common figurative expressions is necessary in order to be fluent in a second language, as this understanding eventually leads to pragmatic competence. The ultimate goal of the study is to

determine the most effective way for non-native speakers to learn multi-word expressions, so that a lack of figurative competence does not hinder the pursuit of becoming fluent in a second language.

This research study centers around whether bilinguals rely on their native language (L1) to understand the figurative meaning in their second language (L2). This deals directly with the concept of congruency. A congruent idiom is defined as an idiom that not only conveys the same meaning between two languages, but also uses the same words to do so in each language. An example of a congruent idiom between English and Spanish is: *To tighten one's belt* (English)/*Apretarse el cinturón* (Spanish). In both languages, the expression conveys the notion of spending less money. The English word *tighten* is congruent with the Spanish word *apretarse*, while *belt* is congruent to *el cinturón*. On the other hand, an incongruent idiom is an expression in which the meaning is the same across the two languages, however the words used to express that meaning are not equivalents across languages. An example of an incongruent idiom used in the study was: *To pull one's leg* (English)/ *Tomar el pelo* (Spanish). In Spanish, the word *pelo* means hair. This is not the same as the English expression which uses *leg* in place of *pelo*. However, both expressions convey the idea of teasing or joking with someone. From this information, we hypothesize that congruent idioms are easier for individuals to learn, as the meaning and vocabulary are consistent in both languages. This is in accordance with *The Parasitic View of Language* (Kroll, J.F., & Stewart, E. (1994)), which states that when processing L2 idioms, non-natives rely heavily on their already established L1 lexical and conceptual networks to arrive to the intended meaning.

The main research question addresses the idea of whether or not congruency between languages modulates the time needed to access the figurative and literal meaning of an idiom in

the L2. We test this question by manipulating the Interstimulus interval (ISI) in a cross modal priming experiment. The ISI is defined as the time interval between the prime and the target. In the experimental design, the prime is either an English congruent or incongruent idiom, and the target is one of three options: the translation of the figurative meaning of the idiom (in one word), the English translation of the last word in the prime (literal), or an unrelated word as the control target for the given idiom. The design is further manipulated by the differences in ISI: the target either appears after the prime at 300ms or 600ms. The subjects of the study were asked to make a lexical decision on the presented target by using buttons on a keyboard. By using this design, the time points at which the figurative and literal meanings of idiomatic expressions are activated will be evident.

Why study figurative language?

Figurative language is a commonly used aspect of human language that can pose great challenges to second language acquisition. The challenges presented through figurative language arise due to the fact that the meanings of the figurative expressions are different than what the words literally express. In social settings, figurative expressions are used on a daily basis to convey messages beyond literal context, and therefore, it is vital that the receiver of the message can decipher the true meaning of what is presented. This is precisely the reason why figurative competence, an underlying subset of pragmatic competence, is imperative in learning and acquiring a second language. In fact, according to Danesi (1992), a lack of metaphorical competence is a major reason why foreign language learners fail to attain native-like fluency (Cieślicka, 2015).

One of the defining elements of language is that words can be combined in ways in which the meaning the expression conveys is not the literal meaning of the words that comprise the expression. The representational dimension of language allows us to combine words to express an idea that might have nothing to do with the literal meaning of the words, and this is the basis of figurative language. It is crucial to study how second language learners process these expressions, and thus, pending the results of the study, determine the ways in which figurative language is most effectively learned and acquired in the human brain.

What are idioms?

In this particular study, I examine idiomatic expressions, which are a form of figurative language. Cacciari & Tabossi (1988) define an idiom as being a string of words whose semantic interpretation cannot be derived compositionally from the interpretation of its parts. Many other researchers in this field define idioms in similar ways, with slight differences in the choice of words (i.e., Cieślicka (2015) uses *figurative interpretation* rather than *semantic interpretation*, where figurative and semantic allude to the same concept). In other words, these definitions capture the idea that when considering idioms, the meaning of the expression at hand cannot simply be understood by the individual word component meanings. This is where a barrier forms for second language learners that poses great difficulty in attaining fluency, and being able to effectively communicate among native speakers.

Idioms are commonly used in daily discourse, and as native speakers, we may not even realize we speak so often in this type of speech. For example, if an individual is planning a European vacation one might suggest that she “tighten her belt” in order to save money for the

various travel expenses that accrue over the course of a European get-away. When you literally tighten a belt, the belt cinches and becomes smaller around the waist. But in the example above, the expression conveys the necessity to save money before embarking on an expensive vacation. Considering a native English speaker who is accustomed to this type of expression and its true meaning, deciphering the intent of the message does not pose an issue, or create a barrier in the communication. However, a learner of the English language may not be able to grasp the intent of the expression, leaving the individual confused about why tightening a belt would have anything to do with a European vacation. This is an example of where the communication breaks down, and the barrier only gets taller.

How are idioms processed in the brain?

There is an array of hypotheses that describe idiom processing. While some hypotheses on this matter include the literal processing of the words to arrive to the figurative meaning, some hypotheses outright refute the necessity of the literal interpretation in determining the meaning of an idiomatic expression. It is important to note that while some idioms are not easily decomposed, others do allude to a literal meaning, that despite being incorrect, offers ambiguity to the expression and adds difficulty to arriving to the true meaning (Cieślicka, 2018). This can be seen with the idiom *Break a leg* where the reasonable literal deduction of the expression as actually breaking a leg can lead to confusion and misunderstanding in communication, as the intended meaning of the expression is *good luck*.

I will begin with a review of various models that have been proposed by leading researchers in this field of study to ensure a firm understanding of the different theories on idiom

processing. From there I will discuss the logistics of my specific study and the data collection process. That will lead to the presentation of the data, the analysis, and finally the discussion.

Theoretical Frameworks for Monolinguals

The Literal First Model

This model, otherwise referred to as the *Three-Stage model*, or the *Multi-stage model* is based on the fact that there are three stages in the process of arriving at the intended meaning of the expression. 1) The listener initially computes the literal meaning of the sentence at hand. Then, 2) this interpretation is placed up against the context to determine whether it is reasonable or not. The final step, after concluding that the literal interpretation does not match what is intended, 3) is to reject it, and thus to arrive at the more plausible meaning of the expression (Clark & Lucy, 1975). According to this model, the figurative meaning of the expression is only available once the literal computation is rejected. Therefore, the failure of the literal interpretation acts as a trigger for figurative processing to be carried out (Cieślicka, 2018). This model also proposes that literal processing is carried out faster than figurative processing. The time points at which each process is carried out is a variable in my own study that I will discuss in a later section. Another crucial point of this model is that idioms are stored in a unique lexicon that is separate from the main word lexicon and this idiom lexicon is only accessed when the analysis of the literal meaning fails (Cieślicka, 2018). Bobrow & Bell (1973) allude to processing an idiom as a word. In other terms, idioms are processed just as any word, but rather, from the special idiom lexicon.

The Figurative First Model

As the name suggests, literal processing is not the default in this model. In fact, it suggests that the literal meanings of the words do not need to be accessed at all. Also known as the *Direct access model*, Gibbs (1980, 1985) proposes the direct access of the figurative meaning of idioms, without depending on the literal computation first. As Cieślicka points out, “this is true of highly conventional idioms whose figurative meanings are quickly accessible from the mental lexicon” (Cieślicka, 2018). Support for this model comes from studies where the figurative meaning of a phrase was accessed faster than the literal interpretation. For example, in a study that examined the deciphering of sarcastic remarks, it was found that “speakers can comprehend sarcastic remarks as fast as, if not faster, than literal utterances” (Gibbs, 1986), which conveys the non-necessity of the literal meaning of the utterances before the non-literal. In the quote above, the literal utterances denote the literal equivalents to the sarcastic remarks, and hence, are non-sarcastic. However, Gibbs (2001) points to the idea that figurative language processing is more dynamic and in that case, a hybrid- type model was created that bridges the gap between the two extremes of the *Literal First Model* and the *Figurative First Model*.

The Parallel Processing Model

The main idea of this type of models is that figurative and literal processing are no different from one another, and can occur at the same time. Hence, usage of the word parallel in the title is very fitting to convey the simultaneous nature of the figurative and literal processing,

which prior to this category of models was thought to be very separate. The following four models are derived from the Parallel Processing model, as they encompass the idea of literal and figurative processing occurring at the same time.

The *Lexical Representation Hypothesis* “holds that idioms are stored and retrieved from the lexicon in the same manner as any other word” (Swinney & Cutler, 1979). This model enforces the idea that literal and figurative processing occurs simultaneously, and that there is not a special idiom lexicon as suggested in the *Literal first model*. It is believed that idioms are treated as long words, and processed as such (Swinney & Cutler, 1979). In line with considering idioms as long words in the lexicon, the figurative meaning is accessible faster than the time it takes for the semantic and syntactic processing needed to complete the literal analysis of the expression (Cieślicka, 2018).

The *Idiom Decomposition Model* is another model, proposed by Gibbs & Nayak, that falls under the Parallel Processing category. This model is centered around the decomposability of idioms. Decomposability describes the extent to which the literal meanings of the individual word components contribute to the intended figurative meaning. A highly decomposable idiom is therefore one in which the word components contribute to the overall figurative meaning. An example of this is drawn out by Gibbs, et al (1989) with the expression *Pop the question*. This expression can be analyzed in the following way: *pop* meaning to suddenly make, and *question* meaning a marriage proposal (Gibbs, et al., 1989). While some compositional analysis with decomposable idioms allows for arrival at the intended figurative meaning, when presented with non-decomposable idioms speakers who rely on the analysis of the individual word parts will see that this analysis fails, and thus direct retrieval of the figurative meaning from the lexicon is necessary (Gibbs, et al., 1989).

The *Configuration Hypothesis* brings into play the idea of an idiomatic key. The idiomatic key represents the point in the string of words that signals the conversion from literal processing to figurative processing. With this model the figurative items are made up of “the same lexical items that need to be activated during the comprehension of literal discourse” (Cacciari & Tabossi, 1988). Therefore, literal processing occurs up to the key of the idiom, and from there on out, figurative processing occurs. The remaining lexical items after the key are no longer processed literally (Cacciari & Tabossi, 1988). Where the key occurs in the string has a big impact on the activation of the intended meaning (i.e. a key that occurs as the second word and a key that occurs as the second to last word).

Hybrid Models describe idioms that behave both compositionally and non-compositionally.

The Graded Salience Model

Thus far the models I have examined have been centered around the idea of literal versus figurative processing. However, this model introduces a whole new concept called *salience*. *Salience* refers to the “prototypicality, frequency, familiarity, and conventionality of a given linguistic unit” (Cieślicka, 2018). Salient meaning can be thought of as the lexicalized meaning which is retrieved directly from the mental lexicon and not from the context (Giora, 1999). To grasp the concept of *salience*, consider the highly conventional idiom *to kick the bucket* (i.e one that is used frequently, easily retrieved from the lexicon). For this type of idiom, the intended figurative meaning is the salient meaning (*to die*). The less salient meaning in this case (*to strike a pail*) is the literal interpretation of the idiom. When the intended meaning of the phrase is the

figurative interpretation, the salient meaning is accessed without the need for accessing the less salient meaning. However, when it is the less salient meaning that is intended we see initial activation of the salient meaning (figurative *to die*), followed by activation of the less salient (literal *to strike a nail*), contextually based meaning (Cieślicka, 2018). Following this hypothesis with the above example, it can be deduced that the figurative interpretation would be accessed faster than the literal, even in cases where the literal interpretation is intended over the figurative. Salient meanings are processed before the less salient meanings because they have priority.

How do bilinguals process idioms in their second language (L2)?

Idioms can be viewed as long words stored in the mental lexicon. Therefore, bilingual processing of idioms employs much of the research that has been done in second language acquisition (L2). Take for example the *Parasitic Hypothesis*. The *Parasitic Hypothesis* is based on the simple nature of parasites. Parasites infect their host, and proceed to live at the expense of the chosen host until they die. In linguistics this same idea applies to second language acquisition. A learner exposed to a new word for the first time is likely to make a connection to a similarly structured word, pre-existing lexical material, in their native language (L1). Over time, the need for the L1 connection lessens (as a parasite eventually dies), and a direct connection is formed to the L2 lexicon (Cieślicka, 2015). According to Heredia & Altarriba (2002) “during the comprehension of an idiomatic expression, the beginning bilingual engages in the following stages: a) translate the given idiomatic expression literally into L1, b) access the literal meaning of the idiomatic expression and attempt to make sense of it, and c) access the figurative meaning if there is one.” At more advanced stages of learning, the learner comes to behave more like a

native monolingual, and thus the reliance on the L1 diminishes. This research supports the claim that the *Parasitic Hypothesis* can explain the processing of bilingual processing of idioms.

Parasitic processing is beneficial, especially when it comes to idioms that have a direct equivalent (i.e., transparent) between the two languages at hand. In this case, an L2 idiom can be mapped onto the L1 equivalent. When there is no L1 equivalent, a literal analysis may be carried out to arrive at the figurative meaning of the expression (Cieślicka, 2015).

Theoretical Frameworks for Bilinguals

Idiom Diffusion Model of Second Languages

The *Idiom Diffusion Model of Second Languages*, proposed by Liontas (2002), states that there are two stages in idiom comprehension, 1) the prediction stage, and 2) the reconstructive stage. In the prediction stage, hypotheses are constructed about the idiom's figurative interpretation, and "in the absence of context [the learner] uses the lexical items comprising the idiom in a variety of situations and contexts" (Liontas, 2002). Those hypotheses are then confirmed (if the context proves to be in agreement with the earlier made hypotheses) or replaced (if the context constraints do not support the earlier made hypotheses) in the second stage upon closer analysis of the context. This suggests that idiom interpretation in large part depends on context (Liontas, 2002). Processing lexical-level idioms (i.e., those that have equivalents between languages) are easiest for second language learners, whereas post-lexical idioms, which lack equivalents, are harder to interpret (Cieślicka, 2015).

Model of Dual Idiom Representation

As the name suggests, there is a dual nature to this model. This duality concerns the decomposability characteristic of idioms. While the model assumes that non-decomposable idioms have their own separate entry in the mental lexicon (also referred to as idiom entries), decomposable idioms can be represented by constituent entries derived from the individual constituents (Abel, 2003). Results from a study done by Abel (2003) show that there are differences in decomposability judgements in native speakers and non-native speakers of a particular language (in this particular study it was English). While native speakers were more likely to label an idiom as non-decomposable, it was discovered that non-native English speakers labeled more idioms as decomposable. This information reflects the need for non-native speakers to rely on literal meanings to derive the intended meaning of the expression, thus reiterating that the figurative meaning is less salient for second language learners (Cieślicka, 2015).

Literal Salience Model

This model brings the idea of salience to the forefront once again. As an L2 learner, when encountering an idiom, it is more likely that the learner will be familiar with the literal meanings of the individual constituents of the expression. This is due to the fact that the literal meanings of the words that comprise idioms are better established in their lexicons than the idiom itself, and are more frequently used (Cieślicka, 2006). Therefore, this model suggests that the literal meanings of the constituent words are salient over the figurative meaning (i.e., activated automatically and directly from the lexicon regardless of contextual information that reflects figurative nature) (Cieślicka, 2006).

What are the methods used to study the processing of idioms?

A useful psycholinguistic method utilized in studying the processing of idioms is called the Cross Modal Priming Task, which also happens to be the method used in my specific research study. This method was originally used by the psycholinguist David Swinney in 1979, and includes the presentation of a prime (a spoken stimulus, or visual in the case of my research), and a visual target. The subject then performs a lexical decision on the target (Tabossi, 1996). As a side note, priming is a technique that measures the facilitation between stimuli (i.e. the word NURSE strongly primes DOCTOR, due to the semantic similarity). The stimuli are on-line, offering researchers a way to measure the processing in real time, as it is happening. Reaction time and number of errors are often measured in this task as dependent variables. Swinney, Onifer, Prather, and Hirshkowitz (1979) demonstrated in their study that priming does in fact occur across sensory modalities, and as the researchers state “it [semantic priming] holds the promise of being one of the few such tasks that can measure moment-to-moment semantic processing while providing only minimal interference with normal ongoing comprehension processes” (Swinney, et al., 1979). Specifically, Titone & Connine (1994) used this method with idiomatic expressions acting as the stimuli, to study the processing of these expressions. Idioms were presented to the subjects, and then the subjects made a lexical decision on the visual target presented, responding to whether the target was a word or non-word in the English language (Titone & Connine, 1994). The method provides insight into the time points at which the figurative interpretations of idioms are activated.

Eye Tracking is another method that can be used to study idiom processing, although not as common as the Cross Modal Priming Task. A design used by Cieślicka & Heredia (2017) measured *first pass reading time* (sum of all fixations made prior to exiting the area of interest),

gaze duration (sum of the duration of all the fixations made within the particular area of interest), *total reading time* (sum of all fixation durations) and *fixation count* (number of all the fixations made). The Eye-Link 1000 tracker was used to measure the eye movements as the subjects were presented with idioms on the screen and asked to answer comprehension questions about the material (Cieślicka & Heredia, 2017). Eye-tracking can also prove to be effective in understanding idiomatic processing.

Prior to the more modern methods, recall studies were employed. Bobrow & Bell (1973) presented subjects with ambiguous sentences on pages and asked to turn the page to indicate which meaning of the sentence they processed initially. This method was used to determine whether the idiomatic or literal interpretation of the idiom was accessed first. Gibbs (1980) employed a recall study that required subjects to return after 24 hours of being presented with the stimuli. The subjects were asked to listen carefully to the pre-recorded sentences that contained either a literal context, figurative context, or no context, and then the next day were asked questions about what they remembered from the prior day (Gibbs, 1980).

Summary

The wide array of proposed models of idiom processing contribute to the complexity of understanding how best it is that idioms are learned, especially when considering non-native speakers. By specifically narrowing in on the congruency of idioms in this study, it will shed light on how an individual's L1 plays a role in idiom processing. We will see patterns in the data that allude to the L1 giving a "boost" to the processing, but we also observe patterns of interference, depending on the type of idiom presented. By using the cross modal priming

experimental design, and manipulating the ISI, we will observe whether congruent idioms modulate the time it takes to access the figurative and literal meanings of idiomatic expressions. Our hypothesis is that congruent idioms between two languages—the same words used to convey the same meaning—will facilitate the bilingual processing of idioms and thus activate the figurative and literal meanings of the expressions at certain time points. This is opposed to the incongruent idioms, which will not experience the same facilitation effect, and may pose a greater challenge to second language learners. The data to test the hypothesis was collected at the *Universidad de Granada*, located in Granada, Spain during the Summer of 2018. I tested 26 Spanish-English late bilinguals (Spanish native speakers, non-immersed in their L2) who all completed a variety of tasks that measured proficiency (level B2 or higher).

Chapter 2

Methods

Participants

Data from 26 Spanish-English late bilinguals was collected between May 2018- July 2018 at a language laboratory at the *Universidad de Granada* located in Granada, Spain. Late bilinguals acquire their L2 after the age of 8. Participants were required to be native Spanish speakers, 18 years of age or older. Additionally, eligible participants were required to have a B2 level or higher proficiency rating in English. This is based on the Common European Framework of Reference for Languages (CEFR) scale, which is a standard guideline used in Europe to measure the levels of proficiency of foreign language learners. While level A denotes a basic learner, level B denotes an upper-intermediate status, while the highest level C denotes a proficient user. B2 learners “can understand the main ideas of complex text on both concrete and abstract topics, can interact with a degree of fluency and spontaneity that makes regular interaction with native speakers quite possible without strain, can produce clear, detailed text, and explain a viewpoint on a topical issue...” (Tracktest.eu). Once eligible participants were recruited, they were scheduled for an appointment at a lab on the UGR campus. Sessions lasted approximately 1.5 hours, and consisted of the main experimental task (lexical decision), a picture naming task, verbal fluency (in Spanish and English), and the Flanker task to assess proficiency in Spanish and English. A language history questionnaire was also administered to collect information about language use and proficiency by self-report.

Lexical Decision Task

In the main experimental task, participants were instructed to decide whether or not the word that appeared on the screen was a real word in the English language by pressing either the green or red button on the keyboard. The participants were presented with a total of 240 trials: 120 'yes' answers (green button), and 120 'no' answers (red button). The 'no' trials were the filler materials. A fixation cross ('+') was on the screen for either 300ms or 600ms (depending on the ISI manipulation), and after, the word (or non-word) would appear. Accuracy and reaction time were recorded.

Picture Naming Task

In this task, participants named 132 simple black and white pictures into a microphone. They were directed to name the pictures as quickly and accurately as possible in the specified language. They were also instructed to avoid hesitating, or making other noises before naming the picture (saying "um," coughing, tapping the table). The task started with a brief practice round of 8 trial pictures, followed by 66 pictures to be named in Spanish, and another 66 pictures to be named in English (with the opportunity to take a brief break before switching between languages). Each trial was initiated by pressing the space bar. A fixation screen would appear ('+') for 500ms, followed by the picture. The picture would remain until a voice triggered its disappearance from the screen or 3000ms passed before voice detection. The responses were coded and considered accurate if the response matched the intended target picture, or was an alternative variation of the word (i.e. dialectal difference).

Verbal Fluency Task

This task was completed in both Spanish and English to measure proficiency in the two languages. Participants were instructed to name as many exemplars as possible in a specific semantic category for a duration of 30 seconds. Each participant was presented with four categories in Spanish, and four categories in English (eight different categories in total). Two lists, A and B, alternated from participant to participant. List A consisted of the following categories in the Spanish block: colors, body parts, fruits and furniture. And in the English block: musical instruments, clothing, animals, vegetables. List B consisted of the same categories stated above, but they were the opposite for English and Spanish. Each participant began the task with a practice session of the category ‘tools’ or ‘herramientas.’ The participants were told to avoid repeating exemplars. The name of the category appeared on the screen for 3000ms, which prompted the participant to start naming exemplars, and then a stop sign appeared on the screen after the 30 seconds passed. The participant was directed to press the space bar to proceed to the next category. If the participant named a correct exemplar within the specified category they were given one point when coding the responses. Repetitions, and incorrect responses were coded as no points.

Flanker Task

This task is a measure of the effect of conflicting information within a stimulus set. It is a method used to study how subjects cognitively process targets when presented with distracting information. The conflicting stimuli are referred to as “the flankers.” Participants are asked to indicate the direction the red arrow is pointing on the screen by using a button box. The leftmost

button was pressed for a red arrow pointing to the left, and the rightmost button was pressed for a red arrow pointing to the right. There are three different types of stimuli presented in this task, as described, and shown below in the figure.

- 1) Congruent: stimuli call for the same response as the target (red arrow)
- 2) Incongruent: stimuli call for the opposite response as the target
- 3) Neutral: stimuli do not evoke the same response nor a response conflict

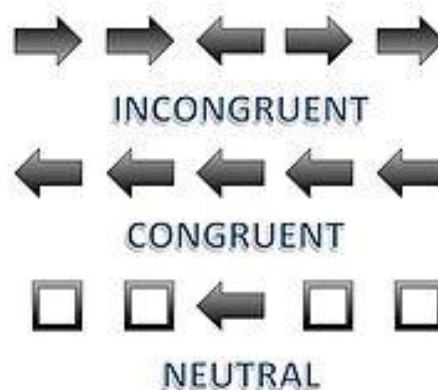


Figure 1: Stimuli

Language History Questionnaire

The questionnaire was used as a method of self-reporting language background and experience. The LHQ was administered on the computer as a word document. It asked participants to record all the languages they speak, at what age they acquired these languages, how often they use each one, and in what settings they use them. Questions also asked about proficiency levels (i.e. rating skill level on a 1-10 scale). All participants were native Spanish speakers who acquired the language during early childhood, while acquiring English later in life (i.e. late bilinguals: after the age of 8 years old).

Materials

The experimental materials consisted of a total of 120 idioms. The idioms were then divided into congruent idioms (60) and incongruent idioms (60). The distinction between congruent and incongruent idioms lies in the fact that congruency not only equates the same meaning across languages but uses the same words to do so. Conversely, incongruent idioms convey the same meaning across languages but the words used differ across the languages.

Table 1: Examples of Congruent and Incongruent Idioms

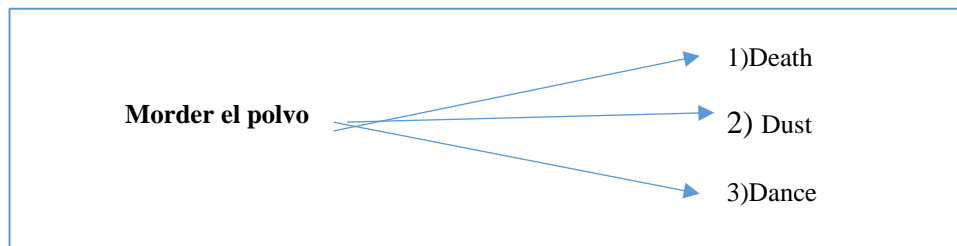
	English	Spanish
Congruent	To tighten one's <i>belt</i>	Apretarse el <i>cinturón</i>
Incongruent	To pull one's <i>leg</i>	Tomar el <i>pelo</i>

Along with the experimental materials, there were filler materials included as well. The fillers were necessary to distract the participants from the critical items. The fillers consisted of 60 idioms that were different from the ones used in the experimental materials, 40 collocations—which can be defined as the regular use of some words and phrases with others, especially in a way that is difficult to guess—20 of which were congruent and 20 of which were incongruent between English and Spanish, and 20 normal sentences. The normal sentences consisted of sentences that were not identified as idioms nor collocations.

Table 2: Filler Items

Filler	Congruent Collocation	Incongruent Collocation	Normal Sentence	Idioms
English	To save energy	To perform the operation	To call the police	To have a big heart
Spanish	Ahorrar energía	Realizar la operacaci3n	Llamar a la policia	Tener un gran coraz3n

A cross-modal priming task was employed with the previously mentioned materials. The idioms served as the prime. Each participant would read the idiom that appeared on the screen in English (their L2). For each idiom, there were three possible targets: (1) a figurative target (the translation of the figurative meaning of the idiom), (2) a literal target (the translation of the last word in the expression), and (3) a control (an unrelated word).

**Figure 2: Display of an idiom with the three possible targets**

The target word presented on the screen was dependent on the file administered to each participant, therefore there were three different files. Each file contained the same materials, and only differed in the target words.

The participants were asked to make a lexical decision on the target word presented. Because the lexical decision task requires an equal number of 'yes' and 'no' responses, the filler items were randomly added to the script, all followed by legal non-words in the English language, prompting a 'no' response from the participants. The participants used the keyboard to

register their responses; there a green sticker on key ‘a’ as the ‘yes’ response, and a red sticker on key ‘l’ as a ‘no’ response.

The materials were further manipulated to investigate the time course of activation for the figurative and literal interpretations of the idioms. This was done by manipulating the interstimulus interval, or ISI. The ISI is defined as the time between the presentation of the prime and when the target appears. In the study, we manipulated the ISI to be set at 300ms for half of the materials, and 600ms for the other half. The design follows the same pattern for the fillers, but the primes consisted of idioms, collocations, and normal sentences.

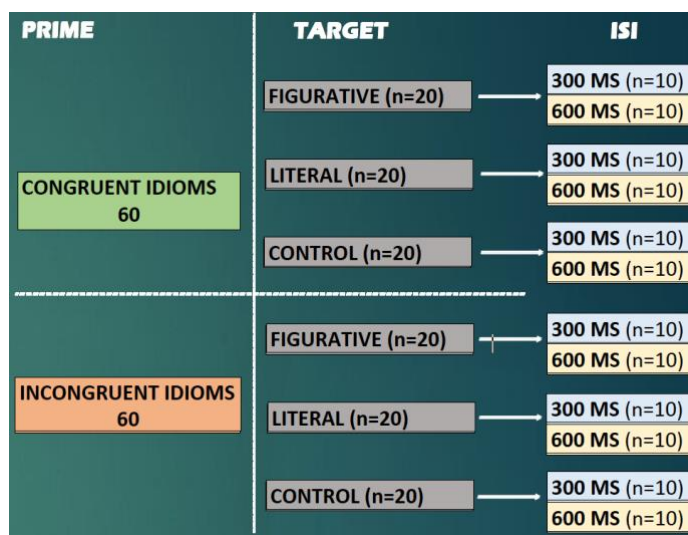


Figure 3: Experimental Design

The other proficiency tasks we administered during the session were completed in the following order: Picture naming, Spanish verbal fluency, English verbal fluency, the Flanker test, and the language history questionnaire.

Procedure

Eligible participants came to the lab and began the session by giving informed consent to the tasks that are involved in the experiment. From there, the participants were brought into a small room with a computer, sound recording devices, a microphone, and a button box. The main lexical decision task was administered first. Once the directions were explained to the participant there was a brief practice round to ensure the participant understood the task. The experimenter left the room following the practice round. There were two breaks built into this portion of the experiment, which gave each participant the option to take a short break before proceeding to the next block of materials. Below is a sample figure of the lexical decision trials.

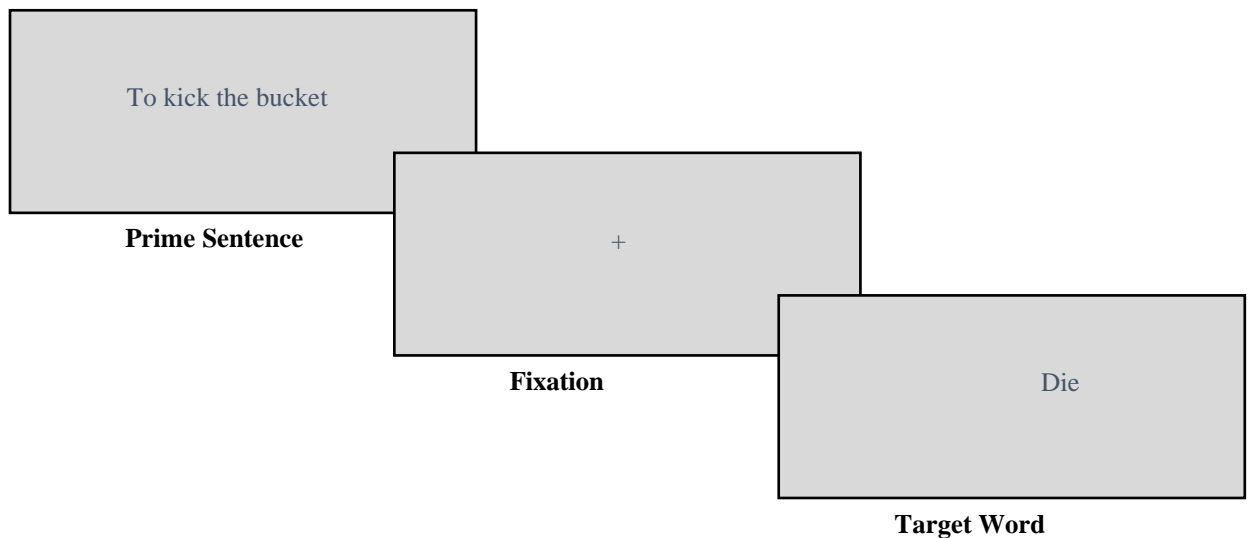


Figure 4: Trial Procedure-Lexical Decision

The prime sentence appeared on the screen followed by a fixation that lasted either 300ms or 600ms depending on the manipulation of the ISI. Then the participant was asked to decide whether the target word was a real word or not by using the specified keyboard buttons. After all 240 trials were completed, the participant moved onto the picture naming task, then the verbal fluency task, and finally the Flanker task. After all these tasks were completed the

participants filled out the language history questionnaire. They were paid the equivalent of \$10.000 US American dollars per hour of their time, in Euros.

Chapter 3

Results

These results focus on the RTs obtained in the LDT (lexical decision task) in response to the target words. The RTs were analyzed using a 2 x 2 x 3 mixed design ANOVA with Congruency (Congruent vs. Incongruent idioms), ISI (Short at 300 ms vs. Long at 600 ms) and Target Type (Figurative vs. Literal vs. Control targets) as factors.

A main effect of ISI was observed, $F(1, 25) = 4.61$, $MS = 301157$, $p < .05$, $\eta p^2 = .155$. The main effect of Congruency (C) was not significant ($F < 1$). The “Target Type” (TT) effect did not reach significance, $F(2, 50) = 1.06$, $MS = 109503$, $p = .35$, $\eta p^2 = .04$. The two-way interaction between C x ISI was not significant, $F < 1$. The two-way interaction between C x TT was not significant $F(2, 50) = 2.29$, $MS = 208151$, $p = .11$, $\eta p^2 = .08$. Conversely, the two-way interaction between ISI x TT was significant, $F(2, 50) = 3.54$, $MS = 361966$, $p < .05$, $\eta p^2 = .124$. The three-way interaction between C x ISI x TT was significant, $F(2, 50) = 4.78$, $MS = 364721$, $p < .05$, $\eta p^2 = .160$.

Planned comparisons were performed within congruent and incongruent idioms to compare the RTs in response to the different target types both at 300 ms (short) and 600 ms (long) ISI.

The processing of congruent idioms

There were no statistical differences between the responses provided to the different target types after the presentation of a congruent idiomatic prime at short ISI (all $F_s < 1$). Means (with standard deviations in parenthesis) for Target Type were: 1187.45 ms (585.11) for control

targets, 1154.83 ms (510.29) for figurative targets and 1180.15 ms (633.12) for literal targets. Interestingly, RTs in response to the different Types of Target within congruent idioms after a long ISI did reach significance; the planned comparison between figurative vs. control targets was $F(1, 25) = 4.65$, $MS = 321365.2$, $p < .05$, $\eta^2 = .15$ while the comparison between literal vs. control targets was $F(1, 25) = 7.92$, $MS = 321880$, $p < .01$, $\eta^2 = .24$. When a congruent idiom was employed as a prime, responses both to the literally and figuratively related targets after a long ISI were faster compared to control targets. Means (with standard deviations in parenthesis) for Target Type were: 1188.02 ms (473.98) for control targets, 1030.80 ms (370.23) for figurative targets and 1030.67 ms (373.62) for literal targets.

The processing of incongruent idioms

There were no statistical differences between the responses provided to the different target types after the presentation of an incongruent idiomatic prime at short ISI (all $F_s < 1$). Means (with standard deviations in parenthesis) for Target Type were: 1145.99 ms (435.84) for control targets, 1082.10 ms (412.77) for figurative targets and 1186.22 ms (388.28) for literal targets. Importantly, RTs in response to the different Types of Target within incongruent idioms after a long ISI did reach significance. When an incongruent idiom was employed as a prime, responses to the literally related targets after a long ISI were faster compared to control targets. The planned comparison between literal vs. control targets was as follows: $F(1, 25) = 4.82$, $MS = 174398.7$, $p < .05$, $\eta^2 = .16$. Conversely, responses to the figuratively related targets were slower compared to control targets. The planned comparison between figurative vs. control targets was: $F(1, 25) = 4.69$, $MS = 622146.3$, $p < .05$, $\eta^2 = .15$. Means (with standard deviations in

parenthesis) for Target Type were: 1070.50 ms (400.79) for control targets, 1289.26 ms (647.67) for figurative targets and 954.67 ms (280.07) for literal targets.

Chapter 4

Discussion

The main focus of this study was to understand how and when bilinguals access the figurative and literal meanings of idioms in their second language. This study specifically examined whether level of congruency of idioms between languages modulates the time that bilinguals need to access the figurative and literal meanings of the idioms in their second language. Congruent idioms not only convey the same meaning across two languages, but they use the same words to do so. In the study, the manipulation of the ISI (interval between the prime and the target) is a pivotal characteristic that lends insight into the processing of idioms by bilinguals. The two intervals, 300ms and 600ms, provide different data that allow us to draw conclusions about when and how the figurative and literal meanings of idioms are accessed when presented in a subject's second language (L2).

Based on the parasitic view of language (Kroll, J.F., & Stewart, E., 1994) which proposes that non-natives rely heavily on their already established L1 lexical and conceptual networks during the processing of L2 idioms, congruent idioms should be easier to process and should result in faster reaction times to arrive at the intended meaning of the expression than incongruent ones. Incongruent idioms maintain the same meaning of the expression across the two languages, but use different words across the languages to do so. This may present difficulty for a non-native speaker when considering the parasitic view of language because the expression uses different words to express the same meaning. Hence, it would be expected that the reaction times are slower in these trials, as some interference may present.

The processing of congruent idioms

For congruent idioms the data showed that at 300ms there were no significant differences between the responses. This implies that an ISI of 300ms is too early on in processing to see what is being activated. The figure below shows the data of congruent idioms at 300ms on a boxplot graph with *Type of Target* plotted on the x-axis, and *Reaction Time* plotted on the y-axis. Reaction time is not yet significant at 300ms, hence, activation of neither the figurative nor literal meanings has not occurred.

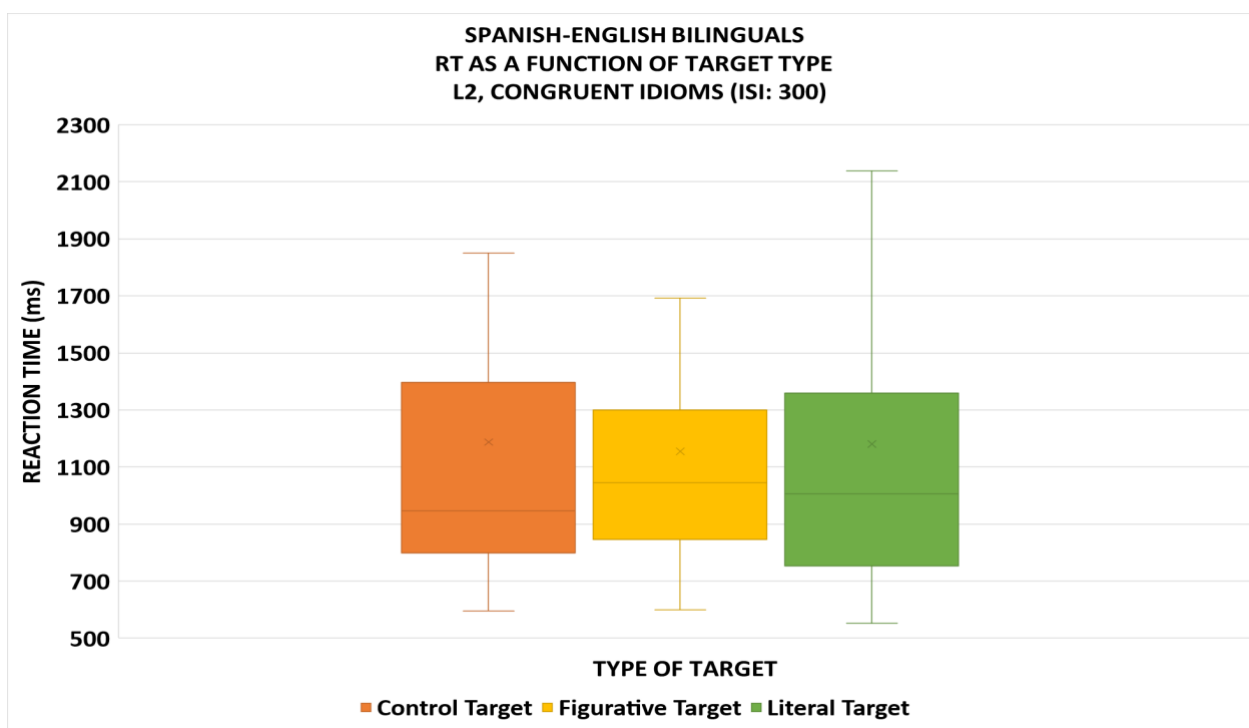


Figure 5: Reaction times of targets with congruent idioms at an ISI of 300ms

However, the data showed something different at an ISI of 600ms. At 600ms, both the figurative and literal targets showed significant differences when compared to the control target. The figurative and literal meanings were accessed faster as shown by the faster reaction times

recorded for the targets. The figure below shows the data with the same axes as described above, only with a different ISI (600ms).

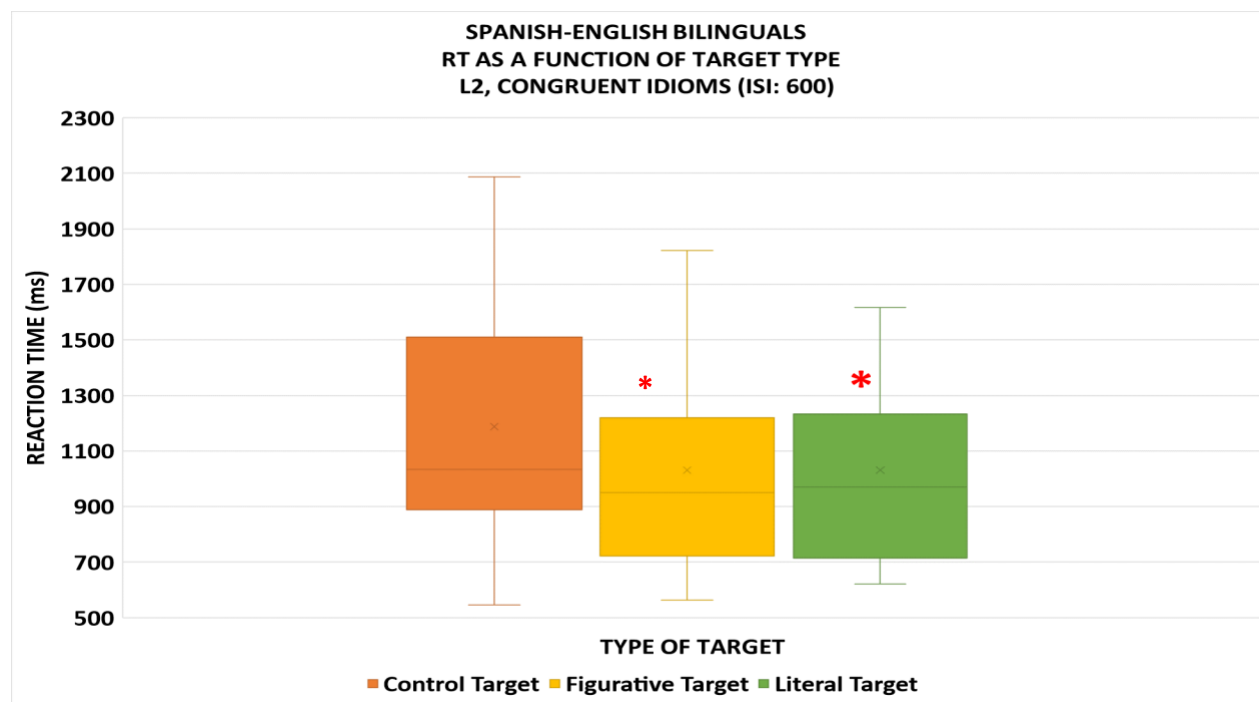


Figure 6: Reaction times of targets with congruent idioms at an ISI of 600ms

In other words, when participants were presented with a congruent idiom as the prime, and a 600ms ISI, both the figurative and literal targets were activated faster relative to the control. The data showed that congruency acts as a “boost” in second language processing of idioms. The “boost” stems from the idea that participants may rely on their L1 to help them arrive at the intended meaning of the idiom. This is justified by the fact that congruent idioms not only carry the same meaning across languages, but also use the same words to do so. Therefore, the literal and figurative meanings are activated, implying that literal interpretation is carried out in arriving to the figurative, or intended meaning of the idiomatic expression. The more similar an L2 idiom is to its native language equivalent, the easier it is for non-native speakers to process

because of the “boost” provided by their already established L1 lexical and conceptual networks.

The “boost” congruent idioms present with is beneficial in idiomatic language processing.

The processing of incongruent idioms

The data for incongruent idioms at an ISI of 300ms are similar to what the data showed with congruent idioms at an ISI of 300ms in that there are no significant differences in the responses. This may be attributed to the fact that 300ms is too early of an interval to show activation of the literal or figurative meaning of an idiomatic expression. The graph below shows the same axes plotted as the previous graphs for incongruent idioms at an ISI of 300ms.

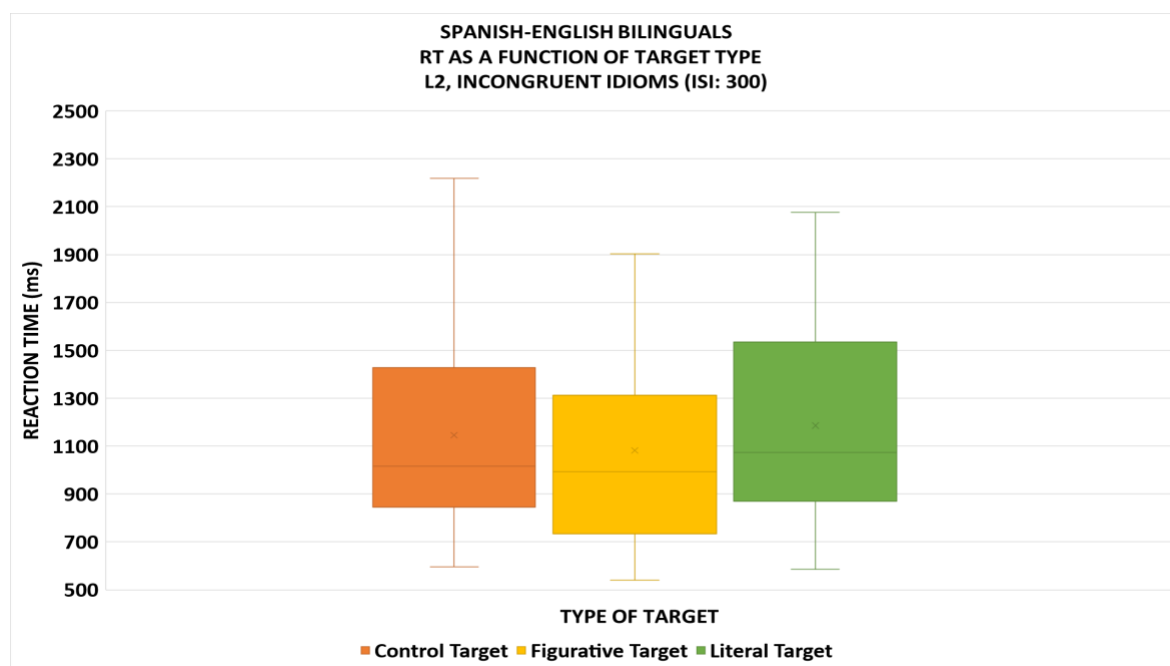


Figure 7: Reaction times of targets with incongruent idioms at an ISI of 300ms

The data for incongruent idioms at an ISI of 600ms show a different trend. The “boost” observed with the congruent idioms is no longer a factor because incongruent idioms do not use the same words across two languages to convey the meaning of the idiomatic expression. This can present issues because a participant who relies on the already established L1 lexical and conceptual networks will not arrive at the intended figurative meaning of the idiomatic expression. This is reflected in the data for the reaction times of the figurative targets. The data showed significantly slower reaction times for the figurative targets. In fact, the data showed a pattern of interference with slower reaction times and a higher percentage of errors. The data for literal targets showed literal activation at the ISI of 600ms with significantly faster reaction times as compared to the control targets. In other words, we only see activation of the literal interpretation of incongruent idioms at 600ms. The graph below visually presents the data at 600ms ISI.

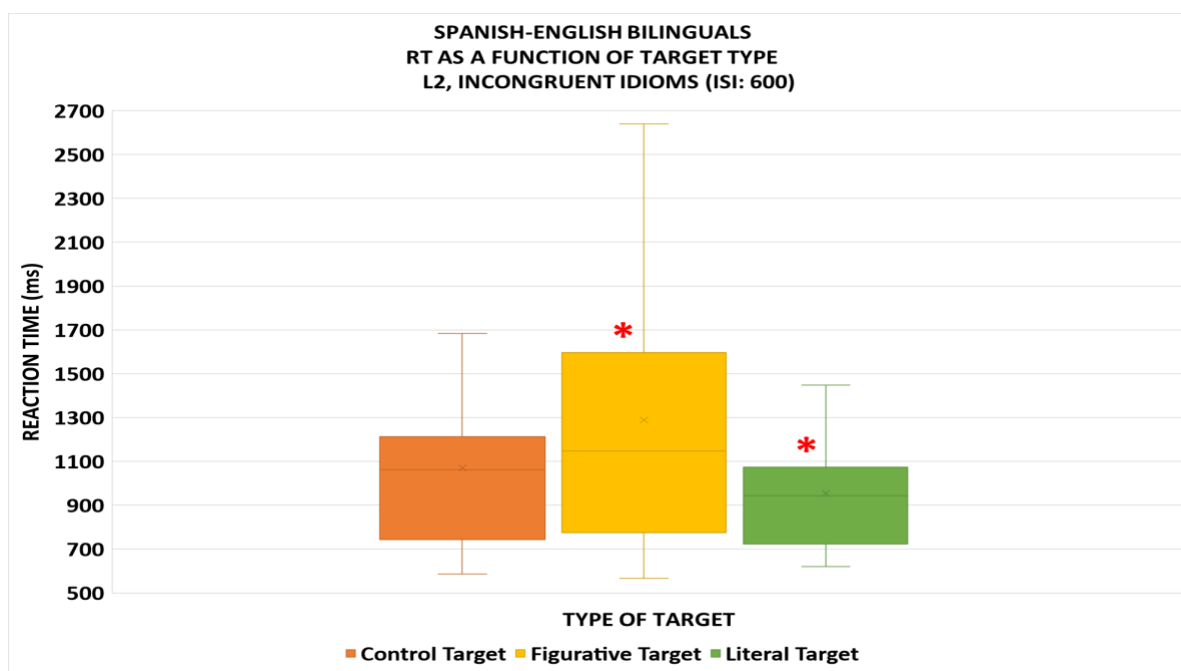


Figure 8: Reaction times of targets with incongruent idioms at an ISI of 600ms

Overall, the data confirm two important points.

- 1) The L1 is activated while processing an idiom in the L2. This could be due to the fact that the speakers in this study had upper-intermediate proficiency in English. The fact that the L1 is being activated in these trials suggests that the L2 language skills of the speakers were not high enough for them to be able to rely solely on their L2.
- 2) Congruency between the L1 and L2 *facilitates* bilingual idiomatic processing.

The findings of this study lend support for previous models of idiom processing that propose literal activation can be used to help a speaker arrive at the figurative meaning of an idiomatic expression (i.e., The Literal First Model, Parallel Processing, Literal Salience, etc., all described in the literature review). Congruency has proven to be an important factor in bilingual idiomatic processing as it facilitates the processing and activation of the intended meaning of the expression. This study indicates that congruent and incongruent idioms are processed differently and thus require different teaching methods for non-native speakers. An emphasis on the vocabulary and intended meanings of the words in incongruent idioms can help ease the obstacle that these expressions present to non-native speakers.

Future Directions

Future comparisons between the group of bilinguals in this study and a similar group of bilinguals immersed in an English-speaking country will help us gain insight into how different bilingual environments affect idiomatic processing. This particular study was conducted in an environment in which the participants were not immersed in English (the L2). In the future,

examining idiomatic processing in which the participants are immersed in English would be helpful in seeing how immersion impacts this type of processing. Immersion could be a factor that facilitates bilingual idiomatic processing.

In addition, by using Event Related Potential (ERP) or eye tracking methods in future experiments, this behavioral data can be connected and compared to the underlying cognitive processes that are occurring when non-native speakers encounter idioms in their L2. ERP “helps capture neural activity related both to sensory and cognitive processes” (Sur & Sinha, 2009). In this case, it would measure the neural activity of participants presented with congruent and incongruent idioms. In ERP studies of this nature, the N400 component is prominently researched because it “is indicative of the ease or difficulty of semantic retrieval from memory and contextual integration, which makes it an ideal tool for investigating the processes involved in understanding inherently ambiguous figurative expressions” (Cieślicka, 2018).

A study conducted by Paulmann et. al (2015) used the N400 to explore how and when figurative and literal meanings are accessed in the course of native and nonnative processing of phrases that can be interpreted both in a figurative and literal way (Cieślicka, 2018). For example, the phrase *run over* is an example of a phrase that can be interpreted figuratively (*kill by driving*) or literally (*walk over something*), and therefore, was presented in a sentence with a disambiguating word that either biased the figurative or literal interpretation (Cieślicka, 2018). The results of the study showed higher peaks for the sentences that biased the literal meaning, suggesting that participants retrieved the figurative meaning of the phrase with more ease, and thus, shows support for the *Direct Access Model* (Gibbs, 1980, 1985), a figurative first approach. This same type of methodology can be applied to the study at hand to lend insight into whether idioms produce similar results with the N400 component as the phrasal verbs mentioned in the

Paulmann et. al (2015) study. It is possible that there will be different N400 peaks when comparing congruent and incongruent idioms, and whether participants are immersed or not in the language the idioms are presented in. This data could have important implications in understanding the bilingual processing of idiomatic expressions, and the cognitive processes that underlie.

In addition, as discussed in the introduction, *The Configuration Hypothesis* (Cacciari & Tabossi, 1988) is a model for idiomatic processing that suggests that “idiomatic meaning retrieval occurs after a sufficient portion of the phrase has been processed at a critical point referred to as the *idiomatic key*” (Cieślicka, 2018). The *key* marks the shift in the expression from literal processing to the activation of figurative processing. This is due to the fact that the meanings of the individual words in the expression are initially activated, as if they are a unit, until the *key* is encountered. ERP studies are beneficial in investigating “moment-by-moment perceptual and cognitive processes that underlie language comprehension” (Cieślicka, 2018). Therefore, it would be helpful to examine the time course of idiomatic comprehension when considering the *key* (i.e., it is predicted that idioms are processed faster when the *key* occurs earlier in the string). It would also be helpful to evaluate the N400 peak, especially when specifically considering the *idiomatic key*, and the role it plays in idiom processing.

Appendix A

Language History Questionnaire

Marian, Blumenfeld, & Kaushanskaya (2007).
Northwestern Bilingualism & Psycholinguistics Research Laboratory
Traducción por Rojas & Iglesias (2008)
Temple University Bilingual Language Laboratory

Cuestionario de Experiencia y Competencia Lingüística

+	Apellido(s)	Nombre(s)	Fecha	
	Edad	Fecha de Nacimiento	Masculino <input type="checkbox"/>	Feminino <input type="checkbox"/>

(1) Por favor indique todos los idiomas que conozca **en orden de dominio**:

1	2	3	4	5
---	---	---	---	---

(2) Por favor indique todos los idiomas que conozca **en orden de adquisición** (su idioma materno primero):

1	2	3	4	5
---	---	---	---	---

(3) Por favor indique que porcentaje del tiempo UD *actualmente* y *en promedio* está expuesto a cada idioma.

(Los porcentajes deben de sumar a 100%):

Indique idioma:					
Indique porcentaje:					

(4) ¿Al escoger leer un texto disponible en todos sus idiomas, en que porcentaje de los casos escogería leerlo en cada idioma? Asuma que el texto original fue escrito en un idioma que UD no conoce.

(Los porcentajes deben de sumar a 100%):

Indique idioma:					
Indique porcentaje:					

(5) ¿Al escoger que idioma usar para hablar con una persona igualmente fluida a UD en todos sus idiomas, que porcentaje del tiempo escogería UD hablar en cada idioma? Por favor indique el porcentaje del tiempo total.

(Los porcentajes deben de sumar a 100%):

Indique idioma:					
Indique porcentaje:					

(6) Por favor indique las culturas con las cuales UD se identifica. En una escala del cero al diez, por favor valore hasta qué punto UD se identifica con cada cultura. (Ejemplos de culturas posibles incluyen Estado Unidense, China, Judío-Ortodoxo, etc.):

Indique cultura:					
	(pulsar aquí para esc)	(pulsar aquí para esc)	(pulsar aquí para esc)	(pulsar aquí para esc)	(pulsar aquí para esc)

(7) ¿Cuántos años de educación tiene UD? _____

Por favor indique su nivel más alto de educación (o la aproximación Estado Unidense equivalente a un título obtenido en otro país):

- | | | |
|--|--|--|
| <input type="checkbox"/> Menos que escuela secundaria | <input type="checkbox"/> Algo de Universidad | <input type="checkbox"/> Maestría |
| <input type="checkbox"/> Escuela secundaria/preparatoria | <input type="checkbox"/> Universidad | <input type="checkbox"/> Ph.D./M.D./J.D. |
| <input type="checkbox"/> Entrenamiento Profesional | <input type="checkbox"/> Algo de Escuela Post-Graduado | <input type="checkbox"/> Otro: _____ |

(8) Fecha de inmigración a los Estados Unidos, si aplicable _____

Si UD ha inmigrado a otro país, por favor indique el nombre del país y la fecha de inmigración aquí abajo.

(9) ¿UD ha tenido un problema de visión , impedimento de audición , incapacidad de lenguaje , o incapacidad de aprendizaje ? (Indique todo lo aplicable). Si es el caso, por favor explique (incluyendo cualquier corrección/es necesaria/s):

Idioma:

Este es mi idioma **(por favor seleccione del menú extraído)** .

Todas las preguntas que siguen se refieren a su conocimiento de .

(1) Edad cuándo UD...:

<i>empezó a adquirir</i> :	<i>llegó a ser fluido</i> en :	<i>empezó a leer</i> en :	<i>llegó a leer fluidamente</i> en :
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

(2) Por favor indique el número de años y meses que UD pasó en cada ambiente lingüístico:

	Años	Meses
Un país donde es hablado	<input type="text"/>	<input type="text"/>
Una familia donde es hablado	<input type="text"/>	<input type="text"/>
Una escuela y/o ambiente de trabajo donde es hablado	<input type="text"/>	<input type="text"/>

(3) En una escala del cero al diez, por favor seleccione su *nivel de competencia* al hablar, comprender, y leer de los menús extraídos:

Hablar	<input type="text"/> (pulsar aquí para escala)	Comprender lenguaje hablado	<input type="text"/> (pulsar aquí para escala)	Leer	<input type="text"/> (pulsar aquí para escala)
--------	--	-----------------------------	--	------	--

(4) En una escala del cero al diez, por favor seleccione cuanto los siguientes factores contribuyeron a su aprendizaje de :

Conviviendo con amistades	<input type="text"/> (pulsar aquí para escala)	Cintas de lenguaje/auto instrucción	<input type="text"/> (pulsar aquí para escala)
Conviviendo con familia	<input type="text"/> (pulsar aquí para escala)	Viendo televisión	<input type="text"/> (pulsar aquí para escala)
Leyendo	<input type="text"/> (pulsar aquí para escala)	Escuchando la radio	<input type="text"/> (pulsar aquí para escala)

(5) Por favor valore hasta qué punto UD actualmente está expuesto a en los contextos siguientes:

Conviviendo con amistades	<input type="text"/> (pulsar aquí para escala)	Escuchando la radio/música	<input type="text"/> (pulsar aquí para escala)
Conviviendo con familia	<input type="text"/> (pulsar aquí para escala)	Viendo televisión	<input type="text"/> (pulsar aquí para escala)
Leyendo	<input type="text"/> (pulsar aquí para escala)	Cintas de lenguaje/auto instrucción	<input type="text"/> (pulsar aquí para escala)

(6) ¿Según a su percepción, cuánto acento extranjero tiene UD en ?

(pulsar aquí para escala)

(7) Por favor valore que tan frecuentemente los demás lo identifican a UD como un hablante no nativo basado en su acento en :

(pulsar aquí para escala)

Idioma:

Este es mi idioma (por favor seleccione del menú extraído) .

Todas las preguntas que siguen se refieren a su conocimiento de .

(1) Edad cuándo UD...:

<i>empezó a adquirir</i> :	<i>llegó a ser fluido</i> en :	<i>empezó a leer</i> en :	<i>llegó a leer fluidamente</i> en :
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

(2) Por favor indique el número de años y meses que UD pasó en cada ambiente lingüístico:

	Años	Meses
Un país donde es hablado	<input type="text"/>	<input type="text"/>
Una familia donde es hablado	<input type="text"/>	<input type="text"/>
Una escuela y/o ambiente de trabajo donde es hablado	<input type="text"/>	<input type="text"/>

(3) En una escala del cero al diez, por favor seleccione su *nivel de competencia* al hablar, comprender, y leer de los menús extraídos:

Hablar	(pulsar aquí para esca	Comprender lenguaje hablado	(pulsar aquí para escala	Leer	(pulsar aquí para esca
--------	------------------------	-----------------------------	--------------------------	------	------------------------

(4) En una escala del cero al diez, por favor seleccione cuanto los siguientes factores contribuyeron a su aprendizaje de :

Conviviendo con amistades	(pulsar aquí para escala)	Cintas de lenguaje/auto instrucción	(pulsar aquí para escala)
Conviviendo con familia	(pulsar aquí para escala)	Viendo televisión	(pulsar aquí para escala)
Leyendo	(pulsar aquí para escala)	Escuchando la radio	(pulsar aquí para escala)

(5) Por favor valore hasta qué punto UD actualmente está expuesto a en los contextos siguientes:

Conviviendo con amistades	(pulsar aquí para escala)	Escuchando la radio/música	(pulsar aquí para escala)
Conviviendo con familia	(pulsar aquí para escala)	Viendo televisión	(pulsar aquí para escala)
Leyendo	(pulsar aquí para escala)	Cintas de lenguaje/auto instrucción	(pulsar aquí para escala)

(6) ¿Según a su percepción, cuánto acento extranjero tiene UD en ?

(pulsar aquí para escala)

(7) Por favor valore que tan frecuentemente los demás lo identifican a UD como un hablante no nativo basado en su acento en :

(pulsar aquí para escala)

Appendix B

Experimental and Filler Materials

ORDER	SENTENCE	CONGRUENCY	FIGURATIVE TARGET	LITERAL TARGET	CONTROL TARGET
1	To walk on eggshells	C	CAUTIOUS	CRUSHED	COLORFUL
2	To tighten the belt	C	SAVE	LOOSEN	BELONG
3	To be on solid ground	C	STABILIZE	WALK	ISOLATE
4	To be on the same boat	C	RESEMBLE	FLOAT	SCAN
5	To be off one's game	C	UNDERPERFORM	TRAIN	ACQUIRE
6	To wear the pants in the house	C	LEAD	DRESS	PRINT
7	To lay one finger on someone	C	HIT	PUT	CALCULATE
8	To give it on a platter	C	FACILITATE	SERVE	BELIEVE
9	To recharge one's battery	C	REST	CONNECT	AFFORD
10	To have the feet on the ground	C	REALISTIC	SANDY	NATIONAL
11	To have one foot in the grave	C	SUFFER	STEP	ADDRESS
12	To throw something in someone's face	C	REPROACH	THROW	BUILD
13	To throw in the towel	C	SURRENDER	TOSS	CAPTURE
14	To tear one's hair out	C	STRESS	WAX	BRING
15	To make someone's blood boil	C	IRRITATE	HEAT	INTRODUCE
16	To have something on hand	C	CONSPIRE	HOLD	FLY
17	To see the stars	C	HURT	LOOK	ANNOUNCE
18	To have one's hands tied	C	PREVENT	FASTEN	DREAM
19	To dirty one's hands	C	GUILTY	CLEAN	MILITARY
20	To fall into the trap	C	CHEAT	CATCH	DISCUSS
21	To see the light	C	INSPIRED	ILLUMINATED	WOODEN
22	To play with fire	C	JEOPARDIZE	BURN	CHECK
23	To break the ice	C	START	REFRIGERATE	DISOBEY
24	To waste your breath	C	ARGUE	INHALE	EXPLORE
25	To see the tip of the iceberg	C	COMPLEX	FROZEN	LATE
26	To play your cards right	C	STRATEGIZE	BET	FORBID
27	To make somebody sick	C	DISTURB	INFECT	APPROACH
28	To hang by a thread	C	FALL	UNSTITCH	CONGRATULATE
29	To lose the thread	C	CONFUSE	FIND	HAPPEN
30	To have balls	C	DARE	PLAY	COMPLAIN
31	To count sheep	C	AWAKEN	ENUMERATE	APPROVE
32	To cross the line	C	OVERREACT	JUMP	KISS

33	To stay afloat	C	RESIST	SOAK	JUSTIFY
34	To put a spoke in one's wheel	C	COMPLICATE	BUMP	LISTEN
35	To have something under one's nose	C	SEE	BREATH	CLIMB
36	To be two-faced	C	FEIGN	DUPLICATE	CORRODE
37	To bury the hatchet	C	AGREE	HIDE	BRUSH
38	To have someone in one's pocket	C	DOMINATE	KEEP	PASTE
39	To take one's hat off	C	RESPECT	UNDRESS	ORGANIZE
40	To give a green light	C	ALLOW	LIGHTEN	DRINK
41	To win the lottery	C	SUCCESSFUL	RICH	ELECTRONIC
42	To reopen a wound	C	REVISIT	BLEED	OWN
43	To line one's pockets	C	PROFIT	SEW	POUR
44	To be born yesterday	C	NAÏVE	YOUNG	ANXIOUS
45	To break one's back	C	WORK	WOUND	READ
46	Not to open one's mouth	C	MUTE	IMMOBILIZE	RECOLLECT
47	To follow one's footsteps	C	IMITATE	TRACK	SAIL
48	To be an open book	C	HONEST	CLOSED	RECENT
49	To be a shark	C	NEGOTIATE	SWIM	REFLECT
50	To be a chicken	C	FRIGHTEN	CLUCK	QUIT
51	To show one's teeth	C	INTIMIDATE	SMILE	REMAIN
52	To pack one's bags	C	DISAPPEAR	WRAP	REQUEST
53	To bite the dust	C	DECEASE	SWALLOW	PRETEND
54	To bite one's tongue	C	SILENCE	CHEW	TEACH
55	To stretch your legs	C	DEPART	WORKOUT	SACRIFICE
56	To lose one's seat	C	DEPRIVE	SIT	TRANSLATE
57	To take one's first steps	C	BEGIN	CRAWL	STORE
58	To break someone's heart	C	BELOVED	SICK	ASLEEP
59	To cross somebody's path	C	MEET	TRAVERSE	UNDERSTAND
60	To cover one's back	C	PROTECT	WARM	SHAPE
61	To land on one's feet	I	SURVIVE	FALL	ADOPT
62	To pave the way	I	PLAN	ASPHALT	FILL
63	To hit the ground	I	RUIN	COLLIDE	STIR
64	To hit the nail on the head	I	SUCCEED	SCREW	ABSORB
65	To be left on the scene	I	DISMISSED	THEATRICAL	ELEGANT
66	To turn the tables	I	REVERT	ROTATE	ASSAULT
67	To dodge a bullet	I	MISS	SURVIVE	SELL
68	To hang one's hat	I	SETTLE	UNCLOTHE	SHIVER
69	To put all the eggs in one basket	I	RISK	DEPOSIT	MEDITATE
70	To throw everything out the window	I	ABANDON	DISPOSE	BUY
71	To give a boost	I	HELP	LIFT	SEND

72	To be built on sand	I	CRUMBLED	SMOOTH	HUMAN
73	To have a full plate	I	OVERWHELM	FEED	NARRATE
74	To smell fishy	I	SUSPECT	STINK	REWIND
75	To run the show	I	CONTROL	PERFORM	DRAW
76	To miss the boat	I	FAIL	TRAVEL	SING
77	To touch a nerve	I	BOTHER	SUTURE	ACHIEVE
78	To go with the flow	I	ACCEPT	MOVE	LIE
79	To have one's head screwed on	I	RESPONSIBLE	PLACED	ECONOMIC
80	To hit the books	I	STUDY	PUNCH	CELEBRATE
81	To pump the brakes	I	LIMIT	DECELARATE	BLESS
82	To hit the ceiling	I	ENRAGE	BREAK	GAIN
83	To let the cat out of the bag	I	DISCLOSE	RELEASE	ADMIRE
84	To get under someone's skin	I	ANNOY	CONTAMINATE	DETERMINE
85	To pull one's leg	I	JOKE	STRETCH	BANISH
86	To bring the bacon	I	EARN	COOK	CHALLENGE
87	To push up the daisies	I	DIE	IRRIGATE	GUESS
88	To hit below the belt	I	HARM	BEAT	EXPRESS
89	To hang up the jersey	I	LEAVE	GRIP	GLITTER
90	To hang up the sword	I	RETIRE	PIN	IDENTIFY
91	To let one's hair down	I	DISINHIBIT	STYLE	IMPEDE
92	To put down roots	I	ESTABLISH	PLANT	INSULT
93	To take a wrong turn	I	ERR	RIDE	IMPOSE
94	To swallow the bait	I	DECEIVE	INGEST	MELT
95	To be someone's pet	I	OBEY	BARK	FORGET
96	To lose one's rag	I	ENFURIATE	CLEANSE	NOTIFY
97	To blow one's fuse	I	UPSET	BROKEN	COPY
98	To lose one's marbles	I	CRAZE	MISPLACE	DIVE
99	To be a piece of cake	I	SIMPLIFY	EAT	MANAGE
100	To run on all cylinders	I	EASY	MOTORIZED	PREGNANT
101	To pull the strings	I	PLOT	HANDLE	POLISH
102	To reinvent the wheel	I	STUPID	ROUND	AVAILABLE
103	To take a weight off one's shoulders	I	RELIEVE	UNLOAD	PRESERVE
104	To take up the hatchet	I	FIGHT	GRAB	RAIN
105	To chew the cud	I	SPECULATE	NOURISH	RACE
106	To open the door for someone	I	ASSIST	CLOSE	QUALIFY
107	To spill the beans	I	REVEAL	DROP	FRY
108	To lose one's shirt	I	IMPOVERISH	DISORDER	RECOGNIZE
109	To pull the plug	I	STOP	DISCONNECT	PRAY
110	To scratch one's head	I	WONDER	ITCH	DOWNLOAD
111	To take the cake	I	WIN	BAKE	TERMINATE

112	To go to town	I	ENJOY	DRIVE	ERASE
113	To turn the corner	I	IMPROVE	PASS	SCREAM
114	To kick the bucket	I	PERISH	STRIKE	RUSH
115	To cover someone's tracks	I	CORRUPT	CAMOUFLAGE	TASTE
116	To hit the sack	I	SLEEP	IMPACT	SEPARATE
117	To buy the farm	I	SUCCUMB	PURCHASE	SHAKE
118	To carry a torch	I	CHERISH	BRIGHTEN	VOMIT
119	To clear the air	I	CALM	REFRESH	TRANSFER
120	To grease the wheels	I	AID	LUBRICATE	SEARCH

Filler materials:

ORDER	SENTENCE	SENTENCE TYPE	TARGET	TARGET TYPE
1	To throw somebody to the wolves	Idiom	GRUSH	Non-word
2	To look after number one	Idiom	SURVORN	Non-word
3	To be the apple of one's eyes	Idiom	SECENT	Non-word
4	To gain ground	Idiom	MEBURE	Non-word
5	To call the shots	Idiom	DALL	Non-word
6	To hit the bull's eye	Idiom	ASPHOFF	Non-word
7	To add fuel to the fire	Idiom	PERWOGS	Non-word
8	To catch a snooze	Idiom	CRUNK	Non-word
9	To give a hand	Idiom	TRARESTANT	Non-word
10	To start off with the right foot	Idiom	PUDOT	Non-word
11	To catch one's eye	Idiom	DECUSIP	Non-word
12	To have a cold feet	Idiom	LAULED	Non-word
13	To beat around the bush	Idiom	SCROW	Non-word
14	To put the foot in the mouth	Idiom	CLUSH	Non-word
15	To cook someone's goose	Idiom	MEFTEN	Non-word
16	To twiddle one's thumbs	Idiom	DAVOT	Non-word
17	To dig up the dirt	Idiom	FLEAT	Non-word
18	To be an old fox	Idiom	SQUEW	Non-word
19	To have a big heart	Idiom	PERFAID	Non-word
20	To get the fingers burnt	Idiom	TRAMESTANT	Non-word
21	To take the bull by the horns	Idiom	DORGE	Non-word
22	To swallow your pride	Idiom	EXERDACS	Non-word
23	To kill two birds with one stone	Idiom	CROAT	Non-word
24	To tie the loose ends	Idiom	DECUSIP	Non-word
25	To tie the knot	Idiom	PERWOID	Non-word
26	To be in good hands	Idiom	FEAD	Non-word
27	To be the black sheep	Idiom	SHOSENT	Non-word

28	To climb on the high horse	Idiom	CLOGRE	Non-word
29	To be in deep water	Idiom	TRIDEL	Non-word
30	To eat one's words	Idiom	PROMENT	Non-word
31	To kill time	Idiom	SURARE	Non-word
32	To meet the maker	Idiom	CONDEFT	Non-word
33	To go out of hand	Idiom	SELPS	Non-word
34	To know by heart	Idiom	DUT	Non-word
35	To pull yourself together	Idiom	STRILE	Non-word
36	To be under the weather	Idiom	RUFTEN	Non-word
37	To compare apples to oranges	Idiom	DESHRUY	Non-word
38	To cry over spilt milk	Idiom	SERBS	Non-word
39	To get a taste of one's own medicine	Idiom	DIX	Non-word
40	To give the cold shoulder	Idiom	CLOW	Non-word
41	To be a chip off the old block	Idiom	WASK	Non-word
42	To be on cloud nine	Idiom	HORK	Non-word
43	To put something on ice	Idiom	ILLAMICESS	Non-word
44	To take something with a grain of salt	Idiom	BUFT	Non-word
45	To have the ball in one's court	Idiom	DETHORM	Non-word
46	To burn bridges	Idiom	RETLETER	Non-word
47	To cut the mustard	Idiom	INBYLE	Non-word
48	To beat a dead horse	Idiom	IPPIPATE	Non-word
49	To sit on the fence	Idiom	AFFAF	Non-word
50	To pop the question	Idiom	LEAT	Non-word
51	To twist someone's arm	Idiom	AWBIX	Non-word
52	To be up in the air	Idiom	LIN	Non-word
53	To stab someone in the back	Idiom	STIMPS	Non-word
54	To lose one's touch	Idiom	FAND	Non-word
55	To face the music	Idiom	SCAY	Non-word
56	To be on the ball	Idiom	FREEFS	Non-word
57	To ring a bell	Idiom	HESTEN	Non-word
58	To blow off one's steam	Idiom	CATES	Non-word
59	To find one's feet	Idiom	FOOK	Non-word
60	To keep the chin up	Idiom	WHAY	Non-word
61	To walk for two hours	Normal	FISS	Non-word
62	To clean the floor	Normal	STREMED	Non-word
63	To write a document	Normal	HOUT	Non-word
64	To work hard	Normal	TOLE	Non-word
65	To play the guitar	Normal	WAWL	Non-word
66	To have a dog	Normal	RUBLIRATE	Non-word

67	To eat in the porch	Normal	BAWN	Non-word
68	To leave the house	Normal	JULT	Non-word
69	To drink coffee	Normal	BREACE	Non-word
70	To put down the weapon	Normal	MISPLERT	Non-word
71	To put the milk in the fridge	Normal	ONSCCESS	Non-word
72	To share a meal	Normal	BERIEWS	Non-word
73	To give back the books	Normal	DRIRE	Non-word
74	To take the dog for a walk	Normal	PREED	Non-word
75	To stop working	Normal	HARGLE	Non-word
76	To take a flight	Normal	VERDITATE	Non-word
77	To wear a new coat	Normal	PINTOUT	Non-word
78	To charge the phone	Normal	NEETISH	Non-word
79	To call the police	Normal	BETEEVE	Non-word
80	To play in the garden	Normal	LITHS	Non-word
81	To send a message	Congruent Collocation	NEATISH	Non-word
82	To sense a presence	Congruent Collocation	UNVOUD	Non-word
83	To wait a minute	Congruent Collocation	WOUSE	Non-word
84	To love animals	Congruent Collocation	DOUND	Non-word
85	To feel the tension	Congruent Collocation	IMPOBIRUMS	Non-word
86	To watch TV	Congruent Collocation	FLACK	Non-word
87	To win the elections	Congruent Collocation	SEAD	Non-word
88	To read a story	Congruent Collocation	QUIM	Non-word
89	To burn calories	Congruent Collocation	GROSE	Non-word
90	To achieve a goal	Congruent Collocation	CLOLE	Non-word
91	To find an excuse	Congruent Collocation	BLOP	Non-word
92	To share a secret	Congruent Collocation	FATGET	Non-word
93	To avoid conflict	Congruent Collocation	GRORM	Non-word
94	To suffer the effects	Congruent Collocation	BLOP	Non-word
95	To hear a voice	Congruent Collocation	DRALLAW	Non-word
96	To sign the petition	Congruent Collocation	INJANT	Non-word
97	To need protection	Congruent Collocation	DRACK	Non-word
98	To see a doctor	Congruent Collocation	CEAK	Non-word
99	To do the homework	Congruent Collocation	DRIRE	Non-word
100	To say goodbye	Congruent Collocation	PLIVE	Non-word
101	To perform the operation	Incongruent Collocation	WERNOUT	Non-word
102	To pour coffee	Incongruent Collocation	ROTOCK	Non-word
103	To miss the point	Incongruent Collocation	CRARM	Non-word
104	To beg someone's pardon	Incongruent Collocation	IMBROKE	Non-word
105	To dial a number	Incongruent Collocation	CLAVEDTH	Non-word
106	To ask permission	Incongruent Collocation	HOAT	Non-word

107	To fail a test	Incongruent Collocation	REAT	Non-word
108	To handle stress	Incongruent Collocation	SID	Non-word
109	To cut the costs	Incongruent Collocation	PURTRESE	Non-word
110	To reach a conclusion	Incongruent Collocation	SPITCHEN	Non-word
111	To meet the standards	Incongruent Collocation	CHAVELTS	Non-word
112	To undergo a treatment	Incongruent Collocation	REGLOSH	Non-word
113	To save energy	Incongruent Collocation	BRATCHEN	Non-word
114	To shake hands	Incongruent Collocation	FUBLIRATE	Non-word
115	To schedule an appointment	Incongruent Collocation	SPILTHEN	Non-word
116	To submit a proposal	Incongruent Collocation	IMBECT	Non-word
117	To slam the door	Incongruent Collocation	CAMOUSPICS	Non-word
118	To calculate the incomes	Incongruent Collocation	CHAVETTE	Non-word
119	To flush the toilet	Incongruent Collocation	PUNG	Non-word
120	To change one's mind	Incongruent Collocation	SUT	Non-word

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ACADEMIC VITA

MAGGIE ROSE PELELLA

Education

THE PENNSYLVANIA STATE UNIVERSITY

The Schreyer Honors College

B.S in General Science.

Honors B.S in Spanish.

Dean's List 2016-2020

University Park, PA

May 2020

BINGHAMTON HIGH SCHOOL

Salutatorian in a class of 387, Advanced Regents Diploma

Honors: BOCES New Visions Health Academy, National Honor Society President, WBNG Academic All Star, Captain of the Cross Country team

Binghamton, NY

June 2016

Leadership and Activities

THE BILINGUALISM, MIND, AND BRAIN LAB

Research Assistant

University Park, PA

Jan 2017 – May 2020

Assist graduate students with their research. Arrange behavioral tasks. Perform and facilitate ERP brain measuring tasks. Code research data using Excel programming, Praat and Audacity software; Analyze data. Develop computer programming skills, and knowledge of data processing programs.

NSF PIRE Fellow, Summer 2018: Conducted research and collected data abroad at the University of Granada, in Granada, Spain as part of the National Science Foundation PIRE grant.

NSF PIRE fellow, Summer 2019: Conducted research and collected data abroad in Bogotá, Colombia. The research focuses on language processing involving the aspiration of word final /s/ which is done in many dialects of Spanish.

Penn State Net Impact Undergraduate Chapter

Service Corp Director/General Member

University Park, PA

Sep 2016 – May 2020

The club aims to inspire the next generation of leaders in the world of sustainability and promotes sustainable ideas that stretch beyond campus. Responsibilities as Service Corp Director include planning local service activities, running the food recovery program, and other collaborations.

Sigma Delta Pi

Inducted Member-Alpha Beta Iota

University Park, PA

December 2019

Member of the National Collegiate Hispanic Honor Society. Inducted in the first established chapter of this honor society at Penn State University.

Experience

WEGMANS FOOD MARKETS

Ready to Cook Chef/Customer Service Representative

Johnson City, NY

Dec 2014 – Jan 2019

Ready to cook (RTC) chef and customer service representative. Prepare specialty meat and seafood meals, assist customers with their purchases, and organize special orders.

PENN STATE RESIDENTIAL DINING

Food Service Employee/Coffee Barista

University Park, PA

Aug 2018-May 2020

Skills

Technical: Proficient in Microsoft Office

Language: Comprehensive in Spanish, with the ultimate goal of reaching fluency