THE ROLE OF PHONOLOGICAL AND SEMANTIC INFORMATION ON TIP-OF-THE-TONGUE STATES: EVIDENCE FROM SPANISH-ENGLISH BILINGUALS

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CHAPTER I

INTRODUCTION

A person who is temporarily unable to name a word that he or she knows is described as experiencing a tip-of-the-tongue (TOT) state. When a TOT state occurs, the person can often produce information about the word, such as the number of syllables and the initial phoneme. Prior research has shown that TOT states occur more often for low frequency words than for high frequency words (Brown, 1991) and occur more often for proper names than for non-names (Burke, MacKay, & James, 2000). Furthermore, prior research has shown that some individuals are more likely to experience TOT than others. Burke, MacKay, Worthley, and Wade (1991) showed that older adults experience TOT states more often than young adults. Gollan and Silverberg (2001) have shown that bilinguals experience TOT states more often than monolinguals. The aim of the present research was to understand the processes involved in TOT states. The research contrasted the predictions of the two leading theories of TOT in an experiment involving individuals who are bilingual in Spanish and English.

An early explanation of the cause of TOT states was that a phonologically similar word comes to mind instead of the correct one. The *persistent alternate* diverts enough attention to block retrieval of the target word. This idea was based on anecdotal reports. For example, Brown and McNeill (1966) described an instance in which one of the experimenters was trying to recall the name of the street on which a relative lived, and came up with the words *Congress*, *Corinth*, and *Concord* before looking up the address

and learning that it was *Cornish*. All four words began with *Co*, contained two syllables, and had a stress on the first syllable. Such anecdotal evidence lent an initial level of face validity to this early theory, which has come to be referred to as the Blocking Hypothesis (Durgunoglu & Roediger, 1987; Jones, 1989; Meyer & Bock, 1992).

Jones (1989) presented empirical support for the Blocking Hypothesis in a laboratory experiment in which undergraduate students were presented with 40 definitions of low-frequency words and asked to name the word being described. For example, when presented with the definition "to steam food, particularly meat, slowly in a closed container", participants were expected to produce the target word *braise*. If participants did not know the word or were in a TOT state, a list of five alternate words were presented one at a time and read either silently or aloud by the participants. The alternate word was one of three types: (1) related to the target word in sound and meaning (e.g., *abnormality* for *anachronism*), (2) phonologically related only (e.g., *baulk* for *braise*); (3) related to the target word in meaning only (e.g., *incubus* for *banshee*); or (4) unrelated to the target in both sound and meaning (e.g., *fossilize* for *hospice*). The results showed that TOTs increased when the alternate word was related to the target in terms of sound (i.e., phonologically related). Phonologically related alternates produced more TOTs (4.8% of trials) than phonologically unrelated blockers (2.2%). Of the reported TOTs, 27% were for both phonologically and semantically related cues, 30% for phonological cues, 21% for unrelated cues, and 21% for semantic cues. Jones (1989) concluded that a phonologically related word can block retrieval of a target word. However, the proportion of correct target recalls was not taken into full account. According to Meyer and Bock (1992), the definitions for the phonological, semantic,

both phonologically and semantically related, and the unrelated conditions were 43.5%, 53.7%, 62.6%, and 74.0%.

Meyer and Bock (1992) suggested that Jones's (1989) results were due to his particular choice of materials. Meyer and Bock (1992) found similar results as Jones (1989) when using the same definitions as stimuli, but not when using different definitions. In the first experiment, Meyer and Bock (1992) presented participants with definitions, immediately followed by a prime word. The participants viewed the prime word without pronouncing it aloud. The alternate word was either phonologically related, semantically related, or unrelated to the target word. Planned comparisons indicated that phonological prime words resulted in more correct responses and fewer TOTs than semantic prime words; and semantic prime words resulted in more correct responses and more TOTs than unrelated prime words. A second experiment was conducted in order to examine the effects of cuing on correct target retrieval. The same materials as Experiment 1 were used, but the prime was presented after the participant gave an initial response, rather than immediately after the definition. The results were the same as those of the first experiment. These findings contradicted the study by Jones (1989), in which a different set of definitions were used for each cue condition, whereas Meyer and Bock (1992) used every definition in every cue condition. Finally, in a third experiment, Meyer and Bock (1992) assigning the definitions to the same conditions in which they had appeared in the Jones (1989) study. This time, the pattern of results mimicked that of the Jones (1989) study and contradicted the results of Experiments 1 and 2. It was proposed that Jones's results were due to unusually complex words in the phonological condition, which necessitated more difficult definitions. Meyer and Bock (1992)

concluded that phonological cues facilitate retrieval by providing additional information regarding the identity of the target word, whereas semantic cue provide little information beyond what is already provided in the definition. It was also suggested that semantic prime words may have a weaker relationship with the target word than the phonological prime words.

The most recent and promising theory of TOTs was proposed by Burke and colleagues (Burke et al., 1991; Burke, MacKay, & James, 2000; James & Burke, 2000). Burke et al. (1991) proposed the Insufficient Activation Hypothesis (IAH), stating that TOT states occur because of the inadequate activation of memory representations. The theory incorporated McClelland and Rumelhart's (1981) view that memory is represented in a distributed fashion. In the IAH, a speaker's knowledge of a word involves three levels of nodes: (1) the semantic (or meaning) level; (2) the lexical (or word) level; and (3) phonological (or sound) level. Related nodes are connected via pathways. Figure 1 displays an example network for the word *grocer*. When a word is processed, the nodes representing the different aspects of the memory for the word are activated, and this activation can travel along the connecting pathways to and from any and all related nodes. Several sources of activation can converge upon a single recipient node and contribute to its activation level. However, if a certain threshold level of this activation is not met, the activity does not continue to the next node, and information from that node cannot be retrieved. Burke et al. (1991) further claim that the structure of the nodes representing word knowledge is hierarchical, as there must be sufficient activation from the lexical node in order to activate the appropriate phonological nodes, just as there must be sufficient activation from the semantic nodes in order to activate the lexical node.

TOT occurs because there is a failure to obtain full phonological activation due to a lack of sufficient activation from the lexical node**.**

Burke et al. (1991) provided evidence for the IAH in an experiment comparing TOT rates for older and younger adults. They hypothesized that older adults would experience TOT more often than younger adults**.** In the experiment, participants were presented with a computer program similar to a trivia game. Questions were presented on a monitor and participants pressed the K key if they knew the answer, D if they did not know, and T if they were experiencing a TOT. After responding, participants rated the answer they were thinking of on how familiar they thought the word was and how certain they were that they could recall the word. Participants who had responded with K or D were given a four-choice recognition question, although participants who had responded *Know* were first asked to type the correct answer. Participants who responded *TOT* provided as much information about the answer as possible before being presented with the recognition question, which included a "none of the above" option. The correct answer was then revealed to the participants, who proceeded to the next trial. The results indicated that older adults experienced more TOTs but fewer persistent alternates than young adults. The conclusion was that the memory representations for the phonological level of words receive inadequate activation more often for older adults. According to Burke et al. (1991), age may weaken the connections between nodes, reducing the amount of activation that can be transmitted and the rate at which transmission occurs. This reduction in transmission of priming along connections between the lexical and phonological nodes reduces the likelihood of phonological activation.

Additional evidence for the IAH was reported by James and Burke (2000). They investigated the role of phonological information in the TOT task. They compared performance for older and younger adults. In the first experiment, participants viewed a list of 10 words one at a time on a computer and rated each word for pronunciation difficulty on a scale of 1 (*very easy*) to 5 (*very difficult*). After the tenth word, a question was presented. Each list of words was either phonologically related or unrelated to the correct answer. In the related word list, five of the words cumulatively contained all the phonological components of the target word (i.e., *in*di*gent*, ab*stract*, *trun*cate, *tra*di*tion*, and *lo*cate as primes for the target word *abdicate*). The participants tried to recall the name the target word and responded in one of three ways: (1) I know the word, but I am experiencing TOT (i.e., TOT); (2) I don't know the word (i.e., don't know); or (3) I know the word (i.e., know). After a "know" response, participants typed the word and then proceeded to the next pronunciation list. All other responses proceeded immediately to the next pronunciation list. After completing all the trials, participants were given a multiple-choice test for all items that had elicited a TOT to verify that their TOT was for the target word. In Experiment 2, the order of task presentation was reversed. Participants viewed 80 general knowledge questions (such as the definition of *gourmet* as "a connoisseur of food and drink") and then engaged in the pronunciation task only if they were unable to produce the target word as indicated by a response of "don't know" or "TOT". After the pronunciation task, participants were again presented with the definition, tried again to produce the target word, and then proceeded to the next trial. As predicted by the IAH, the results of both experiments showed that when participants

viewed phonologically related words in the secondary task, TOTs were reduced and number of correct responses was increased

Recent research reports by Abrams, White, and Eitel (2003) further explored the role of phonological information on performance in the TOT task. They studied the effects of these phonological components in isolation, hypothesizing that certain aspects of phonology are more likely than others to facilitate TOT. According to the IAH, phonological information contained in the initial part of a word should lead to greater retrieval success than phonological information contained elsewhere because of the left-right nature of phonological activation. One must activate phonological nodes at the beginning of the word before moving on to subsequent nodes and eventually activating the entire word. In Experiment 1, participants viewed definitions on a computer screen and stated whether they knew the target word. If not, one of two lists was presented: a list of either seven unrelated words or a list in which three words shared the first letter with the target word. The results of Experiment 1 indicated that the initial letter did not produce significant facilitation in the resolution of TOTs. It was concluded that facilitation in previous studies might have been due to conscious participant strategies rather than pure phonology effects, and that an increased amount of phonological activation beyond the first syllable is necessary for TOT resolution.

In their second experiment, the same procedure was used as in Experiment 1, but using words containing either the same first syllable as the target (e.g., *contact, conscious*), middle syllable (e.g., *extradite, ultrasonic*), or last syllable (e.g., *husband, sweatband*) as primes in the related condition. The number of filler words was also increased, bringing the total number of words in each list to ten. Experiment 2 indicated

a significant increase in the facilitation of TOT resolution when provided with first-syllable primes, consistent with the IAH and with research that has emphasized the importance of initial phonological information. In addition, participants who indicated that they had employed strategies were no more likely to resolve TOTs following first-syllable prime words than those that did not use a strategy. A third experiment indicated that first-syllable prime facilitated retrieval but first-phoneme primes did not, and that reading primes silently facilitated retrieval but reading primes aloud did not. Abrams et al. (2003) concluded that first-syllable phonological information facilitates TOT resolution in accordance with the IAH, that these effects are not due to conscious strategies on the part of the participants, and that the difference in retrieval facilitation between first-phoneme and first-syllable primes can also be explained within Insufficient Activation. It was suggested that presenting a first-phoneme prime spreads activation to a large neighborhood of words that contain both the same first syllable and first phoneme as the target word. The target word itself does not receive enough of this priming effect to facilitate retrieval. However, using a first-syllable prime spreads activation to all other words containing the same first syllable, of which there are fewer than the number of words containing the same first phoneme, making it more likely that the target word will receive a sufficient amount of the activation to facilitate retrieval.

The role of phonological processes was also explored by Harley and Bown (1998), who investigated how the number of words that sound similar to a target word influences TOT rates. If activation travels along routes of phonological similarity, then the activation of a lexical node should be influenced by the knowledge of highly phonologically similar words. Activation may spread to a similar incorrect word with a

stronger connection instead of the correct word with a weaker connection (blocking), or the presence of many similar words may diffuse activation too much to fully activate the target word (insufficient activation). This is especially true of words that vary from the target word by only one letter, which are known as neighbors. Harley and Bown (1998) suggested that the role of lexical neighborhoods has been underestimated in previous research. A lexical neighborhood is the number of words that can be formed by replacing a single letter in a word with another letter, preserving the original letter order (Coltheart, 1981). Definitions for sixty words were presented one at a time to participants, for which they were to respond with the appropriate word. There were four conditions of target word: (1) high frequency, or words that occur at least 100 times per million words, (2) low frequency, or words that occur less than 9 times per million, (3) high density, or words who have many close neighbors, and (4) low density, or words that have no neighbors. Participants were to indicate if they were experiencing a TOT. There was a significant interaction effect of frequency and number of neighbors on the number of TOTs, with TOTs being more likely for words that are less frequent and have few neighbors. These results were replicated in a second experiment when using only nouns as target items, and controlling for word length. It was suggested that these neighbor effects are due to increased difficulty in accessing the target phonological forms involved and that neighbor words be taken into consideration when conducting speech research.

The purpose of the present research was to investigate further the role of phonological and semantic processing in word naming. Prior research has focused on phonological processes involved in producing TOT states. Although within the IAH theory, semantic processing should also influence TOT states, little or no research has

attempted to investigate the role of semantic processes in the TOT elicitation task. The approach taken in the present research was to investigate both phonological and semantic processing in the TOT elicitation task for bilingual speakers. Bilingual individuals offer a unique perspective in understanding language processes. By virtue of knowing more than one language, bilinguals possess not one but two lexical representations for each semantic concept. Consider the representation of the concept for *grocer* for a Spanish-English bilingual, as shown in Figure 2. For bilinguals, a concept (or semantic level node) can be connected to two lexical nodes, and each lexical node is connected to the corresponding phonological nodes. The term translation equivalent has been used to refer to words from a bilingual's different languages that refer to the same concept. Translation equivalents typically have different phonological form. However, some translation equivalents can be similar both in terms of meaning and phonology. Such translation equivalents have been referred to as cognates, as the English word *accident* and its Spanish translation equivalent *accidente*. There can also be words in one of the bilingual's languages that can be similar in phonology, but different in meaning to the bilingual's other language, such as the words English word *grocer* and the Spanish word *grosero* (which means rough). These pairs have been called false friends or false cognates (See Friel & Kennison, 2001, for discussion of cognates and false cognates).

There have been very few investigations of TOTs in bilingual individuals to date (Askari, 1999; Gollan & Silverberg, 2000). Gollan and Silverberg (2000) provided compelling evidence that that bilinguals experience TOT more often than monolinguals. They compared TOT rates in English monolinguals to those in Hebrew-English bilinguals. Participants were presented with definitions of low frequency words and

asked to say aloud the appropriate word for that definition. Monolinguals were tested in English only. Bilinguals were tested in both English and Hebrew, producing the target word in whatever language came to mind first and then saying the word in the other language. If the participant could not come up with the target word, they were instructed to try to give information about the word such as the initial letter or syllabic stress. Bilingual participants had higher rates of TOT, knew fewer words, and had more response variability than monolinguals. Bilinguals' ability to recover from TOT spontaneously and to provide partial phonological information during TOT was comparable to monolinguals'. Furthermore, if a target word was counted as correct if recalled in either language, bilinguals and monolinguals did not differ in their performance. This suggested that while bilinguals may be more prone to experience a TOT to begin with, once a TOT state occurs, both groups behave similarly.

Gollan and Silverberg (2000) offered two possible explanations for the causes of increased TOT in bilinguals. Foremost, there may be a reduced frequency of exposure to words in each language for bilinguals as compared to monolinguals. Thus, thresholds required to activate fully low frequency target words would differ for bilingual and monolingual participants. Secondly, as bilinguals know more words than monolinguals, there may be increased competition for activation among lexical representations. The activation from the conceptual level would be spread over many more nodes for bilinguals than for monolinguals. Both explanations can be viewed as consistent with Burke et al.'s (1991) IAH.

Another study of TOTs in bilinguals is one reported by Askari (1999). She investigated TOTs in a laboratory study with Farsi-English bilinguals. She presented 16

participants with definitions of low frequency words. A definition was given in either English or Farsi, and was followed by a prime word in either English or Farsi that was either phonologically related, semantically related, or unrelated to the target word, which the participants read silently to themselves. After the presentation of the definition and prime word, participants were instructed to guess the target word. If they knew the word, they wrote the word under a column titled "know" on an answer sheet. If they were experiencing a TOT, participants placed a check mark under the "TOT" column and wrote down as much information as they could about the word. If participants did not know the word, they checked the "don't know" column and proceeded to the next trial. Askari's (1999) results produced no significant effect of prime type on TOT, but the trend observed in the data supported both Insufficient Activation and Blocking. When the definition was in English, phonologically related prime words resulted in the greatest proportion of TOTs, followed by semantic prime words and unrelated prime words. This pattern is consistent with the Block Hypothesis. However, when the definition was in Farsi, phonologically related prime word conditions resulted in the fewest TOTS, followed by unrelated prime words, and the most TOTs were observed in semantically related prime word conditions. This pattern was consistent with the IAH.

In the present paper, two experiments are reported whose results clearly demonstrate that semantic processing can influence bilinguals' performance in the TOT elicitation task. In Experiment 1, bilingual participants were presented with definitions and asked to produce the English word being defined. Responses other than the target word were followed by a secondary task in which a Spanish word was presented which conveyed either similar phonology as that of the English target, similar meaning, both, or

no relevant information. It was predicted that adding information about both meaning and phonology would result in greater correct retrieval than providing information about phonology alone. A second experiment was conducted to determine whether the difference observed in Experiment 1 was due to participants' having knowledge of the semantic relatedness of prime and target words. In Experiment 2, monolingual English speakers underwent the same study procedure with the same stimuli as the bilingual participants. It was predicted that monolingual participants would not show the same level of semantic effect as the bilingual participants because of their lack of familiarity with the meaning of the Spanish words in the secondary task.

CHAPTER II

EXPERIMENT ONE

The purpose of the present research was to examine the role of phonological and semantic information in the TOT task for bilingual participants. Specifically, the influence of such information on correct word retrieval and on the occurrence of TOTs was considered. Participants were tested using a common TOT induction task and adjusting the phonological and semantic relatedness of a Spanish prime word. It was hypothesized that both semantic and phonological information can influence performance in the TOT task. Prime words were selected to vary in their phonological and semantic relatedness to the target items by using cognates (words related in both sound and meaning), false cognates (sound only), non-cognate translation equivalents (meaning only), and unrelated words. Participants were expected to show the largest difference in retrieval rates for unrelated versus related prime conditions for the item group containing cognate primes. The item group containing false cognate primes was expected to show the second largest difference in retrieval rates for unrelated versus related prime conditions. The item group containing non-cognate translation equivalent primes was expected to show the least difference in retrieval rates for unrelated versus related prime conditions.

Method

Participants. Participants were 32 Spanish-English bilinguals (21 women, 11 men) with a mean age of 32.74 years (*SD* = 15.92, range = 18-76). Participants resided in

Oklahoma or Texas, and received $10 as compensation. All participants rated themselves as native, near native, or advanced speakers of both English and Spanish on a language history questionnaire developed and used previously by Judith Kroll[1] (See Kroll and Stewart, 1994; Tokowicz, Michael, & Kroll, submitted). A copy of the language history questionnaire has been included in Appendix B.

Materials. One hundred eighty-six English target words were selected for the task. Definitions for the target words were taken from Webster's New Dictionary of the English Language and the American Heritage Dictionary. For each definition there was a Spanish prime word that was either unrelated to the target word, or was related in both sound and meaning (cognates), sound only (false cognates) or meaning only (translation equivalents). English target words in each of the three item conditions were closely matched in printed frequency (Francis & Kucera, 1982), length in syllables, and number of neighbors (as defined by Coltheart, 1981).

In terms of printed frequency, English target words with a corresponding Spanish cognate had a mean printed frequency of 3.97 (*SD* = 3.44). English target words with a corresponding Spanish false cognate had a mean printed frequency of 3.81 (*SD* = 3.68). English target words with a corresponding Spanish non-cognate translation equivalent had a mean printed frequency of 3.32 (*SD* = 3.63). The mean length in number of syllables for these three item groups was 2.28 (*SD* = 0.84), 2.03 (*SD* = 0.97), and 2.02 (*SD* = .73), respectively. The mean number of neighbors for these three item groups was 0.74 (*SD* = 1.49), 1.77 (*SD* = 2.26), and 1.52 (*SD* = 2.64), respectively. For each definition, the related and unrelated prime was also closely matched on length in number

of syllables and in printed frequency (as assessed by Sebastiá, Martí, Carreiras, & Cuetos, 2000).

In terms of printed frequency, the mean frequency in the related and unrelated conditions for the items involving Spanish cognates was 7.63 (*SD* = 6.58) and 8.10 (*SD* = 12.58). The mean frequency in the related and unrelated conditions for the items involving Spanish false cognates was 8.48 (*SD* = 12.84) and 9.82 (*SD* = 16.41). The mean frequency in the related and unrelated conditions for the items involving Spanish non-cognate translation equivalents was 3.63 (*SD* = 6.20) and 2.87 (*SD* = 7.58). The mean length in number of syllables for the related and the unrelated prime conditions for the items involving Spanish cognates was 3.00 (*SD* = 0.87) and 2.85 (*SD* = 0.68), respectively. The mean length in number of syllables for the related and the unrelated prime conditions for the items involving Spanish false cognates was 2.82 (*SD* = 0.88) and 2.87 (*SD* = 0.69), respectively. The mean length in number of syllables for the related and the unrelated prime conditions for the items involving Spanish non-cognate translation equivalents was 2.81 (*SD* = 0.72) and 2.81 (*SD* = 0.72), respectively. A complete list of materials has been included in Appendix A.

In order to confirm that the definitions used for cognate, non cognate, and translation equivalents did not differ in how well they described target words, a rating study was conducted with an additional group of 32 participants. All participants were native speakers of English. Participants received a questionnaire containing a random ordering of the 186 definitions followed by the target word and a seven point rating scale (1 = *not very good*, 7 = *very good*). Participants were instructed to consider how well the definition described the target word and to circle the number that best reflects their

opinion. No significant differences in quality of the definition were found between conditions, (M = 5.44, SD = .73), F (1, 5) = .434, p > .05.

Procedure. Participants were individually tested in a single session lasting 120 minutes. Participants were told that a TOT is "an experience in which a person attempts to recall a particular word that he or she is sure that he or she knows, but cannot recall at the moment, and yet feels that recall is just about to happen." For each trial, the experimenter held up a large index card on which the definition was printed in large type. The participants read the definition and gave one of three responses: (1) know, i.e., the participant responded with a word that the experimenter wrote down; (2) don't know; and (3) experiencing TOT. If they did not know the word or were experiencing a TOT, the participant carried out a secondary pronunciation task. The experimenter flipped over the index card, revealing the Spanish prime word (either a related or unrelated word). The participant read the word and rated it for pronunciation difficulty on a scale of 1 (easy) to 5 (difficult), which was recorded by the experimenter. After rating the word, the English definition was presented again. Participants again indicated one of three responses: (1) know; (2) don't know; and (3) still experiencing TOT. Participants then proceeded to the next trial. Two counterbalancing lists were used to ensure that each definition was paired with a related prime and an unrelated prime equally often across participants. Each participant was randomly assigned to one of the two counterbalancing lists.

Experimental Design

For each trial, participants could have made a maximum of two responses – one before the prime and one after. For trials on which the participant initially named the target word, the trial terminated when the correct response was given. Participants'

responses before and after the prime were classified into five categories: 1) participants indicated that they did not know the target word; 2) participants produced the correct target word; 3) participants indicated that they knew the target word, but their response was incorrect; 4) participants indicated that they were experiencing TOT and later it was determined that they had experienced TOT for the target word; and 5) participants indicated that they were experiencing TOT and later it was determined that they had experienced TOT for a word other than the target. The mean percentage of initial responses and responses following the prime tasks was calculated for each response type by condition for each participant (see Table 3), and a 2 x 3 ANOVA was used to model the results. Tests of specific predictions were furthermore conducted using the multivariate approach to repeated measures designs, and the family-wise alpha for these tests was .006 (.05 divided by 9) to adjust for the multiple analyses conducted. It was predicted that before the presentation of the prime, no significant differences would be found between correct responses in the cognate, false cognate, translation equivalent and unrelated conditions because participants had not yet viewed anything except a definition. After the presentation of the prime, it was predicted that cognates would have the greatest facilitative effect on correct word retrieval, followed by false cognates, translation equivalents, and unrelated primes, respectively. No predictions were made regarding incorrect responses, which are responses of *Know* or *TOT* for words other than the target word.

CHAPTER III

RESULTS AND CONCLUSIONS OF EXPERIMENT ONE

Initial Responses.

As predicted, the 2 x 3 interaction for *Know* responses was not significant before participants viewed any primes, F (2, 30) = 1.53, $p > .05$. Specific analyses indicated participants gave a correct *Know* response an average of 14.92 percent of the time, and there were no significant differences in correct *Know* responses before the prime according to condition, F (1, 31) < 1, $p = .85$ (see Figure 3).

The 2 x 3 interaction for *Don't Know* responses was not significant before participants viewed any primes, F (2, 30) = 0.53, $p > .05$. Specific analyses indicated participants gave a *Don't Know* response an average of 40.98 percent of the time. Prior to viewing the prime, there were fewer *Don't Know* responses following cognate condition items (M = 39.34, SD = 20.56) and false cognate condition items (M = 45.20, SD = 19.48), $p = .003$, $\eta^2 = .27$, (see Figure 9). There were no other significant differences in most *Don't Know* responses before the prime according to condition, F (1, 31) < 1, $p = .54$.

The 2 x 3 interaction for *TOT* responses was not significant before participants viewed any primes, F (2, 30) = 2.05, $p > .05$. Specific analyses indicated participants gave a *TOT* response an average of 3.36 percent of the time. Prior to viewing the prime, there were more TOT responses following unrelated items in the cognate condition (M = 4.69, SD = 4.22) than unrelated items in the false cognate condition (M = 1.52, SD =

3.25), t (31) = 4.21, $p < .001$ (see Figure 8). There were no other significant differences prior to viewing the prime, F (1, 31) < 1, $p = .62$.

The 2 x 3 interaction for incorrect *Know* responses was not significant before participants viewed any primes, F (2, 30) = 2.26, $p > .05$. Specific analyses indicated participants gave an incorrect *Know* response an average of 37.53 percent of the time, and there were no significant differences in incorrect *Know* responses before the prime according to condition, F (1, 31) < 1, $p = .88$.

The 2 x 3 interaction for incorrect *TOT* responses was not significant before participants viewed any primes, F (2, 30) = .17, $p > .05$. Specific analyses indicated participants gave an incorrect *TOT* response an average of 3.21 percent of the time, and there were no significant differences in incorrect *TOT* responses before the prime according to condition, F (1, 31) = 1.38, $p = .25$.

Responses Following the Prime Task.

As predicted, the 2 x 3 interaction for correct *Know* responses following the prime task was statistically significant, F (2, 30) = 48.44, $p < .001$. Participants gave a correct *Know* response an average of 19.24 percent of the time. As can be seen in Figure 4, the highest percentage of *Know* responses was given after cognate primes, followed by false cognates, translation equivalents, and unrelated primes in descending order. Specific tests indicated participants gave more correct *Know* responses following cognate primes (M = 54.56, SD = 24.61) than false cognate primes (M = 36.76, SD = 25.28), t (31) = 6.65, $p < .001$, $\eta^2 = .59$, more correct responses following false cognate primes than translation equivalent primes (M = 9.28, SD = 7.93), t (31) = 7.29, $p < .001$, $\eta^2 = .63$, and more correct responses following cognate primes than translation equivalent primes, t

(31) = 11.53, $p < .001$, $\eta^2 = .81$. Participants gave more *Know* responses following related cognates than unrelated cognate condition items ($M = 6.33$, $SD = 12.58$), t (31) = 9.02, $p < .001$, more *Know* responses following related false cognates than unrelated false cognate condition items ($M = 4.30$, $SD = 9.65$), t (31) = 6.49, $p < .001$, and more *Know* responses following translation equivalents than unrelated translation equivalent items ($M = 4.23$, $SD = 4.97$), t (31) = 3.95, $p < .001$. There were no significant differences between unrelated condition items, ($M = 4.95$, $SD = 9.07$), F (1, 31) < 1, $p = .36$.

As predicted, the 2 x 3 interaction for *Don't Know* responses following the prime task was statistically significant, F (2, 30) = 29.34, $p < .001$. Participants gave a *Don't Know* response an average of 58.11 percent of the time. As can be seen in Figure 10, the highest percentage of *Don't Know* responses was given after unrelated primes, followed by translation equivalents, false cognates, and cognate primes in descending order. Specific tests indicated participants gave more *Don't Know* responses following an unrelated prime ($M = 72.35$, $SD = 16.06$) than a translation equivalent prime ($M = 61.02$, $SD = 18.14$), t (31) = 4.64, $p < .001$, $\eta^2 = .41$, more *Don't Know* responses following a translation equivalent prime than a false cognate prime ($M = 47.27$, $SD = 25.78$), t (31) = 5.74, $p < .001$, $\eta^2 = .52$, and more *Don't Know* responses following a false cognate prime than a cognate prime ($M = 29.87$, $SD = 18.22$), t (31) = 6.39, $p < .001$, $\eta^2 = .57$. Participants gave fewer *Don't Know* responses following related cognates than unrelated cognate condition items ($M = 67.04$, $SD = 17.85$), t (31) = 10.45, $p < .001$, more *Don't Know* responses following related false cognates than unrelated false cognate condition items ($M = 71.13$, $SD = 16.85$), t (31) = 6.21, $p < .001$. There were no significant

differences between unrelated condition items, (M = 70.17, SD = 16.92), F (1, 31) = 5.62, $p > .005$.

The 2 x 3 interaction for correct *TOT* responses following the prime task was not statistically significant, F (2, 30) = 3.13, $p > .05$. There was a significant item effect, F (2, 30) = 15.12, $p < .001$, $\eta^2 = .17$. There were more correct *TOT* responses following items in the translation equivalent (M = 5.55, SD = 6.18) condition than both the cognate (M = 2.16, SD = 2.77), t (31) = 2.96, $p = .006$, $\eta^2 = .22$, and false cognate conditions, (M = 1.43, SD = 2.68), t (31) = 3.72., $p = .001$, $\eta^2 = .31$. There were no significant differences in the percentage of *TOT* responses following cognate primes and false cognate primes, t (31) = 1.04, $p = .31$, $\eta^2 = .03$. There were no significant differences in the percentage of *TOT* responses following translation equivalent and unrelated translation equivalents (M = 4.97, SD = 6.01) primes, t (31) = .63, $p = .53$, $\eta^2 = .01$, false cognates and unrelated false cognates (M = 1.92, SD = 3.17), t (31) = .68, $p = .50$, or cognates and unrelated cognates (M = 4.74, SD = 4.59), t (31) = 2.48, $p = .02$ (see Figure 8).

The 2 x 3 interaction for incorrect *Know* responses following the prime task was statistically significant, F (2, 30) = 9.28, $p = .001$. There were more incorrect *Know* responses following translation equivalent primes than cognate primes (M = 11.26, SD = 8.17), t (31) = 3.77, $p = .001$, $\eta^2 = .31$, and more incorrect *Know* responses following translation equivalent primes than false cognate primes (M = 12.79, SD = 8.36), t (31) = 4.64, $p < .001$, $\eta^2 = .41$. There were no differences between responses following cognate primes and false cognate primes, t (31) = .83, $p = .41$, $\eta^2 = .02$. There were more incorrect *Know* responses following translation equivalent primes (M = 21.26, SD =

12.62) than unrelated translation equivalent primes (M = 15.05, SD = 10.59), t (31) = 3.25, p = .003, η^2 = .25, more responses following false cognate primes than unrelated false cognate primes (M = 20.58, SD = 13.87), t (31) = 3.21, p = .003, and more responses following cognate primes than unrelated cognate primes (M = 20.02, SD = 13.64), t (31) = 3.07, p = .004. There were no significant differences between unrelated cognates and unrelated false cognates, t (31) = .34, p = .74, unrelated false cognates and unrelated translation equivalents, t (31) = 3.21, p = .03, or between unrelated cognates and unrelated translation equivalents, t (31) = 3.25, p = .03.

The 2 x 3 interaction for incorrect *TOT* responses following the prime task was not statistically significant, F (2, 30) = .49, p > .05. There was a significant item effect, F (2, 30) = 6.33, p < .005, η^2 = 29. There were fewer incorrect *TOT* responses following cognate primes (M = .72, SD = 2.12) than translation equivalents (M = 2.89, SD = 4.38), t (31) = 3.44, p = .002, η^2 = .28. There were no other significant differences in incorrect *TOT* responses, F (1, 31) = 4.61, p > .005.

Conclusion

As expected, both semantic and phonological information provided a facilitative effect in word retrieval. Spanish primes that were both phonologically and semantically related to the target word (cognates) resulted in a greater proportion of correct *Know* responses than primes that were phonologically related only (false cognates), and words that were related to the target word in meaning only (translation equivalents) resulted in a greater proportion of correct *Know* responses than primes that were unrelated. A complimentary pattern was found for *Don't Know* responses; Spanish primes that were unrelated to the target word resulted in the most *Don't Know* responses, followed in

descending order by translation equivalents, false cognates, and cognates. Although the number of TOT responses was too small to establish a strong pattern, an interesting trend was that there was an increase in TOT responses after the presentation of a translation equivalent and a decrease in TOT responses after the presentation of a cognate, with no change after the presentation of a false cognate. Implications of TOT responses will be discussed further in the general discussion.

A follow-up experiment with English-speaking monolinguals was desirable to confirm the effects of semantic information on retrieval. It was hypothesized that the semantic priming effects found for the bilingual participants should not found for the monolingual participants, who did not know the meaning of the primes.

CHAPTER IV

EXPERIMENT TWO

The purpose of Experiment 2 was to clarify whether the results of Experiment 1 were due to participants' having knowledge of the semantic relatedness of prime and target words. Given the same task, monolingual participants should not show the same level of semantic priming effect as bilingual participants because of their lack of familiarity with the meaning of the Spanish words in the secondary task. To a monolingual English speaker, Spanish cognates and false cognates appeared to be related to the target only in sound, whereas translation equivalents and unrelated Spanish words both appeared to be unrelated to the target word.

Method

Participants. Participants were 32 native English-speaking monolingual individuals 18 years of age or older residing in the Stillwater, Oklahoma area. Participants that were enrolled in Psychology courses at Oklahoma State University received course credit in exchange for participation. Other participants received ten dollars as compensation.

Materials. Materials were the same as in Experiment 1.

Procedure. The procedure for the monolingual individuals was the same as that of the bilingual individuals in Experiment 1.

CHAPTER V

RESULTS AND CONCLUSIONS OF EXPERIMENT TWO

The same analyses were conducted in Experiment 2 as in Experiment 1. It was predicted that before the presentation of the prime, no significant differences would be found between correct responses in the cognate, false cognate, translation equivalent and unrelated conditions because participants had not yet viewed anything except a definition. It was predicted that after the presentation of the prime, cognates and false cognates would have a similar facilitative effect on correct word retrieval, and that translation equivalents and unrelated primes would fail to have a facilitative effect on correct word retrieval. No predictions were made regarding incorrect responses, which are responses of *Know* or *TOT* for words other than the target word.

Initial Responses

As predicted, the 2 x 3 interaction for *Know* responses was not significant before participants viewed any primes, F (2, 30) = 1.48, $p > .05$. Specific analyses indicated participants gave a correct *Know* response an average of 19.89 percent of the time, and there were no significant differences in correct *Know* responses before the prime between cognate and false cognate conditions, $p = .85$, $\eta^2 = .001$, false cognate and translation equivalent conditions, $p = .05$, $\eta^2 = .12$, or cognate versus translation equivalent, $p = .06$, $\eta^2 = .11$. However, there were more correct *Know* responses in the translation equivalent condition (M = 19.93, SD = 10.41) than the unrelated translation equivalent condition (M = 26.08, SD = 10.03), t (31) = 3.77, $p = .001$, $\eta^2 = .31$, and more Know responses in the

unrelated translation equivalent condition than the unrelated false cognate condition, (*M* = 19.31, *SD* = 9.500), *t* (31) = 5.13, *p* < .001 (see Figure 5).

As predicted, the 2 x 3 interaction for *Don't Know* responses was not significant before participants viewed any primes, *F* (2, 30) = 0.35, *p* > .05. Specific analyses indicated participants gave a *Don't Know* response an average of 36.79 percent of the time, and there were no significant differences in *Don't Know* responses before the prime between cognate and false cognate conditions, *p* = .81, η^2 = .002, or between translation equivalent and unrelated translation equivalent conditions, *p* = .34, η^2 = .03. There were fewer *Don't Know* responses in the translation equivalent condition (*M* = 34.42, *SD* = 13.13) than the false cognate condition (*M* = 40.31, *SD* = 12.97), *t* (31) = 4.06, *p* < .001, η^2 = .35 (see Figure 11). There were no other significant differences in *Don't Know* responses.

As predicted, the 2 x 3 interaction for correct *TOT* responses was not significant before participants viewed any primes, *F* (2, 30) = 0.66, *p* > .05. Specific analyses indicated participants gave a *TOT* response an average of 2.51 percent of the time, and there were no significant differences in *TOT* responses before the prime according to condition, *F* (1, 31) > 1, *p* = .39 (see Figure 7).

As predicted, the 2 x 3 interaction for incorrect *Know* responses was not significant before participants viewed the prime, *F* (2, 30) = 3.53, *p* = .04. Participants gave an incorrect *Know* response an average of 38.33 percent of the time. There were no significant differences in incorrect *Know* responses before the prime according to condition, *F* (1, 31) > 1, *p* = .70.

As predicted, the 2 x 3 interaction for incorrect *TOT* responses was not significant before participants viewed any primes, F (2, 30) = 0.62, $p > .05$. Specific analyses indicated participants gave an incorrect *TOT* response an average of 2.07 percent of the time, and there were no significant differences in incorrect *TOT* responses before the prime according to condition, F (1, 31) < 1, $p = .95$.

Responses Following the Prime Task.

As predicted, the 2 x 3 interaction for correct *Know* responses following the prime task was statistically significant, F (2, 30) = 52.06, $p < .001$. Participants gave a correct *Know* response an average of 22.62 percent of the time. As can be seen in Figure 6, the highest percentage of *Know* responses was given after cognate and false cognate primes, followed by translation equivalents and their matched unrelated primes. There were no differences between translation equivalents and matched unrelated primes. Specific tests indicated that participants gave more correct *Know* responses following cognate primes (M = 51.09, SD = 19.71) than translation equivalent primes (M = 11.27, SD = 8.33), t (31) = 8.89, $p < .001$, $\eta^2 = .72$. Participants also gave more correct *Know* responses following false cognate primes (M = 44.81, SD = 17.85) than translation equivalent primes, t (31) = 8.75, $p < .001$, $\eta^2 = .71$. Unlike bilingual participants, there were no significant differences between responses following cognate primes and false cognate primes, t (31) = 2.49, $p > .02$, $\eta^2 = .17$, and there were no significant differences between responses following translation equivalent primes and unrelated translation equivalent primes, (M = 12.92, SD = 11.42), t (31) = .91, $p = .37$, $\eta^2 = .03$. There were more correct *Know* responses following cognate primes than unrelated cognate primes (M = 9.28, SD = 7.07),

t (31) = 10.31, *p* < .001, and more correct *Know* responses following false cognate primes than unrelated false cognate primes (*M* = 6.32, *SD* = 5.99), *t* (31) = 11.92, *p* < .001.

As predicted, the 2 x 3 interaction for *Don't Know* responses following the prime task was statistically significant, *F* (2, 30) = 33.41, *p* < .001. Participants gave a *Don't Know* response an average of 58.78 percent of the time. As can be seen in Figure12, the highest proportion of *Don't Know* responses were given following unrelated primes, followed by translation equivalents and phonologically related primes. Responses following cognates (*M* = 38.21, *SD* = 19.12) and false cognates (*M* = 42.89, *SD* = 18.45) were not significantly different from one another, *t* (31) = 1.56, *p* = .13, η^2 = .06. There were significantly more *Don't Know* responses following translation equivalents (*M* = 62.54, *SD* = 12.69) than cognates, *t* (31) = 7.25, *p* < .001, η^2 = .29 and false cognates, *t* (31) = 6.62, *p* < .001. There were no differences in *Don't Know* responses following translation equivalents and unrelated translation equivalents (*M* = 65.36, *SD* = 16.18), *t* (31) = 1.22, *p* = .23). There were more *Don't Know* responses following unrelated cognates (*M* = 72.05, *SD* = 11.24) than related cognates, *t* (31) = 8.96, *p* < .001, and more *Don't Know* responses following unrelated false cognates (*M* = 71.65, *SD* = 14.26) than related false cognates, *t* (31) = 9.46, *p* < .001.

The 2 x 3 interaction for correct *TOT* responses following the prime task was not significant, *F* (2, 30) = .79, *p* > .05. Specific analyses indicated participants gave a *TOT* response an average of 1.83 percent of the time, and there were no significant differences in *TOT* responses before the prime according to condition: cognate versus false cognate, *p* = .79, η^2 = .002, false cognate versus translation equivalent, *p* > .0125, η^2 = .14,

cognate versus translation equivalent, $p = .14$, $\eta^2 = .07$, and translation equivalent versus unrelated translation equivalent, $p = .83$, $\eta^2 = .002$ (see Figure 8).

There was a significant 2 x 3 interaction for incorrect *Know* responses following the prime task, F (2, 30) = 8.39, $p = .001$. Specific analyses indicated participants gave an incorrect *Know* response an average of 15.16 percent of the time. Participants gave more incorrect Know responses Participants gave more incorrect *Know* responses following cognate primes ($M = 8.67$, $SD = 7.96$) than unrelated cognates ($M = 14.36$, $SD = 7.78$), t (31) = 3.94, $p < .001$, $\eta^2 = .33$, and more incorrect *Know* responses following false cognate primes ($M = 9.99$, $SD = 7.53$) than unrelated false cognates ($M = 18.08$, $SD = 10.93$), t (31) = 4.55, $p < .001$, $\eta^2 = .40$. There were no significant differences in the proportion of responses following translation equivalent primes ($M = 21.93$, $SD = 12.13$) and unrelated translation equivalents ($M = 17.93$, $SD = 11.46$), $p = .07$, $\eta^2 = .10$, and no significant differences in the proportion of responses following cognate primes and false cognate primes, t (31) = .75, $p = .46$. There were no significant differences in the proportion of incorrect *Know* responses among unrelated primes, F (1, 31) = 3.44, $p = .07$.

The 2 x 3 interaction for incorrect *TOT* responses following the prime task was not significant, F (2, 30) = 1.23, $p > .05$. Specific analyses indicated participants gave an incorrect *TOT* response an average of 1.61 percent of the time, and there were no significant differences in incorrect *TOT* responses before the prime according to condition: cognate versus false cognate, $p = .79$, $\eta^2 = .002$, false cognate versus translation equivalent, $p > .05$, $\eta^2 = .12$, cognate versus translation equivalent, $p = .07$, $\eta^2 = .10$, and translation equivalent versus unrelated translation equivalent, $p = .63$, $\eta^2 = .08$.

There were no significant differences in the proportion of incorrect *TOT* responses among unrelated primes, F (1, 31) < 1 , p = 98.

Conclusion

Results from Experiment 2 supported the conclusions from Experiment 1. Monolingual participants provided similarly high proportions of correct *Know* responses after viewing cognate primes and false cognate primes, and they provided similarly low proportions of correct *Know* responses following translation equivalent primes and unrelated primes. In addition, monolingual individuals provided the highest proportion of *Don't Know* responses following translation equivalent primes and unrelated primes, and provided equally low proportions of *Don't Know* responses following cognate and false cognate primes. Based on these results, it can be concluded that the differences in bilinguals' responses in cognate and false cognate conditions observed in Experiment 1 were due, at least in part, to their knowledge of the meaning of prime and target words.

CHAPTER VI

DISCUSSION

The data support a facilitative role of semantic information in word retrieval above and beyond phonological information in the classic tip-of-the-tongue elicitation task. Bilingual individuals were able to retrieve a word correctly most often following primes that were both phonologically and semantically similar to the target word, followed next by primes that were phonologically similar only, then primes that were semantically similar only, and least often following primes that were unrelated to the target word. As expected, the same semantic facilitation effect was not found in monolingual individuals, for whom the Spanish primes held no meaning. Monolingual individuals were able to retrieve a word correctly most often following primes that were phonologically related to the target word, regardless of semantic similarity. Monolingual individuals also had the lowest retrieval rates for primes that were unrelated to the target word or were related only in meaning.

For bilingual individuals there was an increase in the number of TOT responses after the presentation of a translation equivalent prime and a decrease in TOT responses after the presentation of a cognate prime, with no change after the presentation of a false cognate prime. No such differences were found in monolingual individuals. A possible explanation may be that bilingual individuals experience a block when provided with a strong lexical alternative of differing phonology that diverts activation away from necessary phonological nodes. By contrast, when presented with a strong lexical

alternative with a similar phonology, no such diversion takes place, and full phonological activation is more likely to occur. Lastly, when presented with a false cognate, there may be both a semantic and phonological pull in differing directions, leading to a canceling-out effect. Monolingual individuals experienced no such differences in priming effects on TOT, which augments the idea that semantic activation may play a role in the TOT task.

Theoretical Implications

The influence of semantic information on word retrieval may help to explain why there is an increase in retrieval failure or TOT in specific circumstances, such as those involving bilingual individuals, older individuals, and proper nouns. Bilingual individuals have a double lexicon, diffusing activation between the semantic and lexical levels of representation as both words are recipients of a finite amount of semantic activation. In cases of retrieval failure in bilinguals, a TOT may be generated because of competition between two semantically-similar words with differing phonology. Older adults, through life experience, may have generated a richer semantic network and a broader vocabulary than younger adults. Rather than becoming weakened over time, semantic network connections to lexical nodes in older adults may become more numerous and complex as experiences forge new associations, creating a diffusion of activation not unlike bilingual individuals. Finally, the semantic representation of a proper noun may be underdeveloped through lack of encounters. For example, the name of an acquaintance may be mainly associated with the environment in which the person is usually encountered (such as the workplace). When encountered elsewhere (such as the grocery store), an important semantic cue is missing and may prevent sufficient

activation from spreading to the lexical node, leading to recognition that one knows the person without recalling his or her name. The role of semantic activation in word retrieval provides a common thread among circumstances frequently associated with TOT states.

Limitations

Ideally, participants should be unaware of the relationship between the prime and the target word. However, in the present study, it became apparent to the participants that some of the Spanish primes looked or sounded similar to the word being defined. Although participants were instructed not to make guesses about the target word, they may have developed strategies based upon saying a word that sounded similar to the prime. It would be preferable to conduct a study in which semantic and phonological priming are achieved in a more subtle way so as to prevent these strategies from being implemented.

Another limitation of the study was the low incidence of TOT experiences compared to past studies, which makes interpretation of those results difficult. In order to generate a sufficient quantity of target words in each condition that were also matched on all the levels mentioned in Experiment 1, it became necessary to use a number of very infrequent words as targets. It is possible that the words were too unfamiliar, leading to a stronger dichotomy between *Don't Know* and *Know* responses instead of *TOT* responses. Incidences of *TOT* responses were also not equivalent before the presentation of the prime in bilingual individuals, which again makes interpretation difficult for that group. Therefore, if knowledge of the effect of semantic activation on the incidence of TOT is desired, future studies may address this limitation.

Future Directions

Future studies will center on replicating a semantic priming effect on retrieval. In monolingual individuals, one way this may be achieved is through the use of related or unrelated contexts, followed by the traditional definition stimulus or an image of the target word. For example, if the target word is a type of animal, a context may be presented in which animals either are salient or are not salient. Within each of those conditions would be a secondary condition, in which words would be presented that either do or do not provide subtle phonological resemblances to portions of the target word. Such a method would decrease the probability that the participant will consciously use the phonology of the prime words as a basis for guessing the target words. If semantic priming facilitates retrieval, there should be an improvement in the reaction time of correct retrieval over no priming at all or phonological priming alone.

In conclusion, a semantic priming effect on retrieval in the TOT task would necessitate modifications to the Insufficient Activation Hypothesis. Specifically, the IAH would need to include activation between the semantic and lexical levels of representation in its explanation of retrieval failure, not just phonological level activation. If such modifications were made, it may generate subsequent hypotheses that account for apparent discrepancies in TOT research, such as experiences of blocking, and bring researchers closer to a working theory of what causes retrieval failure in healthy individuals. More importantly, new ideas may be generated regarding what can be done to help improve recall in everyday circumstances.

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APPENDICES

Appendix A

The following lists contains the stimuli that will be used in the experiment. There are three groups of items: (1) items with a Spanish cognates in the related prime condition; (2) items with a Spanish false cognates in the related prime condition; and (3) items with a translation equivalent in the related prime condition. These items have been presented in this order. Each set of items is composed of 66 definitions and two Spanish prime words. For each item listed below, the definition for the English target word is provided, followed by three words: (1) the English target word; (2) the Spanish prime word in the related condition; and (3) the Spanish prime word in the unrelated condition.

Items with a Spanish Cognate in the Related Prime Condition

1. An indirect reference. (allusion, allusion, frazada)
2. No longer in fashion or in use. (antiquated, anticuado, hacendoso)
3. The act of mounting upward. (ascent, ascenso , madera)
4. Any of several thick-skinned long-bodied carnivorous reptiles of tropical and subtropical waters. (crocodile, cocodrilo, mariposa)
5. A dark substance found in natural beds or obtained as a residue in petroleum refining and used especially in paving streets. (asphalt, asfalto, naranja)
6. A quality of being shrewdly discerning. (astute, astuto, prolijo)
7. A carbonic acid in which one hydrogen atom has been replaced (bicarbonate, bicarbonate, enladrillado)

8. A round bulging cask with flat ends of equal diameter. (barrel, barril, corvo)

9. To make or become white or pale. (blanch, blanquear, tapizar)

10. The isolation of a place, usually by troops or ships. (blockade, bloqueo, duranzo)

11. A cylinder or spindle for holding or dispensing thread. (bobbin, bobina, escala)

12. A candy with creamy center and a soft covering (as of chocolate). (bonbon, bombon, duplex)

13. Blustering, swaggering conduct. (bravado, bravata, remilgo)

14. An interruption or opening made by or as if by breaking through. (breach, brecha, ceceo)

15. A regulation decreed by a church council. (canon, canon, mastín)

16. A traveling enterprise offering amusements. (carnival, carnaval, gallina)

17. An unfilled space within a mass. (cavity, cavidad, varilla)

18. A widely know and often referred to person. (celebrity, celebridad, burócrata)

19. A person making showy pretenses to knowledge or ability (charlatan, charlatan, inmigrante)

20. To tighten a girth for a pack or saddle. (cinch, cinchar, fincar)

21. Provoking laughter or amusement. (comical, comico, torero)

22. To drive or urge with force. (compel, compelar, entallar)

23. The change from vapor to liquid. (condensation, condensación, gallardete)

24. To solidify or to cause to solidify, as by freezing. (congeal, congelar, pringar)

25. To plan secretly an unlawful act. (conspire, conspirer, profesar)

26. An entire range or series of something. (gamut, gama, sojo)

27. A concave brass plate that produces a brilliant clashing sound. (cymbal, címbalo, navaja)

28. An entry in an account showing money paid out or owed. (debit, debito, jarcia)

29. To postpone or put off something. (defer, diferir, propalar)

30. Disposition to resist or contend. (defiance, desafío, absorción)

31. Having distinct limits. (definite, definido, reñidor)

32. To condescend to give or grant. (deign, dignarse, lancear)

33. To open up or expand something. (dilate, dilatar, batallar)

34. To look on someone or something with scorn. (disdain, desdén, arrojo)

35. A feeling of aversion or repugnance. (disgust, disgusto, mission)

36. A hill or ridge of sand piled up by the wind. (dune, duna, arca)

37. To make clear by explanation. (elucidate, elucidar, modular)

38. To hold high regard for someone or something. (esteem, estima, atento)

39. A usually brief journey or outing. (excursion, excursión, commission)

40. A person driven from his or her native place. (exile, exilio, librero)

41. A person who obtains by force or improper pressure. (extortionist, extorsionista, compositor)

42. A group or combination acting together within and against a larger body. (faction, facción, zagal)

43. The collection and study of postage and imprinted stamps. (philately, filatelia, pulpa)

44. A breaking of something, especially a bone. (fracture, fractura, lapso)

45. One who practices deception. (fraud, fraude, remero)

46. A large body of slowly moving ice, formed from compacted snow. (glacier, glaciar, comodín)

47. Mineral consisting of a form of carbon; it is soft, black, and lustrous and has a greasy feeling; used in pencils, crucibles, lubricants, paints, and polishes. (graphite, grafito, lustre)

48. A metallic disk that produces a resounding tone when struck. (gong, gong, enano)

49. A covered and enclosed area for housing and repairing aircraft. (hangar, hangar, legion)

50. Produced, growing, or living naturally in a particular region. (indigenous, indígena, borrascoso)

51. Existing in, belonging to, or determined by factors present in an individual from birth. (innate, innato, costoso)

52. To bury or deposit in the earth. (inter, enterrar, cuerear)

53. One who forces in without being wanted or asked. (intruder, intruso, sobrino)

54.Discolored by bruising. (livid, lívido, fragante)

55. To expand and contract rhythmically. (pulsate, pulsar, nevar)

56. To hold back or delay the process of. (retard, retardar, obviar)

57. Exhibiting a loss of mental ability associated with old age. (senile, senil, pulcro)

58.Very large in extent; roomy. (spacious, expacioso, cotizable)

59. The death of soft tissues in a local area of the body due to loss of blood supply. (gangrene, gangrena, ostra)

60. To put or plunge under the surface of water. (submerge, sumergirse, encumbrar)

61. A slight or pale coloration. (tint, tinte, bacín)

62. The quality or state of being alertly watchful. (vigilance, vigilancia, flaqueza)

Items involving Spanish False Cognates in the Related Prime Condition

1. A small burrowing insect-eating mammal related to the shrews and hedgehogs. (mole, mole, basa)

2. To plunge something into a liquid for the purposes of pickling. (souse, sauce, prestar)

3.To speak or utter in a curt loud tone. (bark, abarcar, notar)

4. A hanging mass formed by the freezing of dripping water. (icicle, acicalar, dramaturgo)

5. An edge at the top of a steep place. (brink, brincar, aerosol)

6. The act of getting rid of by or as if by solemn command. (exorcism, exorcismo, ahogo)

7. Covered in loose particles of hard broken rock. (sandy, sandía, enteco)

8. A pear-shaped edible fruit of warm regions. (fig, figón, bosque)

9. Excessively particular in taste or standards. (finicky, finiquito, consabido)

10. A dealer in staple foodstuffs. (grocer, grosero, agente)

11. To harass with petty irritations. (pester, apestar, desdecir)

12. A missile shot from a bow and having a slender shaft, pointed head, and feathers at the butt. (arrow, aro, bata)

13. To separate by or as if by cutting. (sever, aseverar, poblar)

14. To bring into harmony. (tune, atun, mirar)

15. Lacking a natural or usual covering (as of hair). (bald, balde, pillo)

16. A heavy concentration of fire (as of artillery). (barrage, baraja, desdicha)

17. To expose oneself to comfortable heat. (bask, basca, porfiar)

18. Strikingly unconventional. (bizarre, bizarre, cercano)

19. A counter for refreshments. (buffet, bufete, chancero)

20. A course fabric, usually of jute or hemp, used especially for bags. (burlap, burla, sésamo)

21.A caustic powdery white solid that consists of calcium and oxygen and is used in making cement and in fertilizer. (lime, lime, coz)

22. The elongated orange root of a common garden plant that is eaten as a vegetable. (carrot, careta, garfio)

23. An overhanging cover, shelter, or shade. (canopy, canapé, pilcha)

24. A box or chest for a corpse to be buried in. (casket, casco, gacha)

25. A thick yellowish oil extracted from the poisonous seeds of an herb and used as a lubricant and purgative. (castor, castor, majada)

26. A perforated utensil for draining food. (colander, colindar, chalupa)

27. A toothed instrument for arranging the hair or for separating and cleaning textile fibers. (comb, comba, maleta)

28. A prayer for harm to come upon one. (curse, concurso, dehesa)

29. A short sharp sound characteristic of a small bird or cricket. (chirp, chiripa, encía)

30. To work or involve oneself without serious effort. (dabble, dable, estallar)

31. To be lavish or excessive in one's attention, affection, or fondness. (dote, dote, jalar)

32. To run nimbly and playfully. (scamper, escampar, jurar)

33. To rush. (scurry, escurrir, premiar)

34. A shovel with a blade for digging. (spade, espada, retorno)

35. A boat used to carry people or things across a body of water. (ferry, féreo, peluca)

36. A manner of moving on foot. (gait, gaita, nitro)

37. To express grief, pain, or discontent. (gripe, gripe, digerir)

38. A medicinal substance applied to the skin. (salve, salvo, prócer)

39. Dash or flamboyance in style and action. (panache, penacho, valía)

40. A sudden surprise attack or invasion. (raid, raído, ápice)

41. Effectively brief. (terse, terso, harto)

42. To feel a longing or craving. (yearn, yerno, postrar)

43. The hue or appearance of the skin, especially of the face. (complexion, complexión, puntilla)

44. The condition of being out of favor. (disgrace, desgracia, rebunzo)

45. A strong dislike, distaste, or antagonism. (disgust, disgusto, apunte)

46. Suffering extreme poverty. (destitute, destituido, montañoso

47. Overly difficult to please. (fastidious, fastidioso, sintético)

48. Something representing only a symbolic effort. (token, toque, porte)

49. A joyful celebration. (jubilation, jubilación, monotanía)

50. A prickling or thrilling sensation. (tingle, tinglado, polvera)

51. A difficult state of affairs. (jam, jamón, garabato)

52. An act or result of reproducing or representing by artistic or verbal means. (rendition, rendición, gimoteo)

53. Something's relation to the matter at hand. (relevance, revelencia, impedimiento)

54. A bag filled with gas or heated air so as to rise and float in the atmosphere. (balloon, balón, horma)

55. Experiencing self-conscious distress. (embarrassed, embarazada, temático)

56. To beat, bruise or tear something or someone. (maul, maula, anden)

57. Materials (as pen, paper, or ink) for writing. (stationery, estacionario, destilería)

58. A venomous snake of Asia and Africa capable of expanding the skin of the neck to form a flattened hood. (cobra, cobre, pulga)

59. Of, pertaining to, or suitable to informal speech or writing. (colloquial, colloquial, haraposo)

60. A made-up story for the purposes of deception. (fabrication, fabricación, golondrina)

61. Something (as money) that may be offered in payment. (tender, tender, mirlo)

62. The highest of the four voice parts in vocal music. (treble, trébol, palco)

Items with a Spanish Translation Equivalent in the Related Prime Condition

1. An incidence in which a person is taken away by force. (abduction, rapto, ogro)

2. A state of being the subject of a prayer for harm. (accursed, maldito, omiso)

3. To contract (as in one's mouth) into folds and wrinkles. (pucker, fruncir, hundir)

4. The nut of an oak tree. (acorn, bellota, espuma)

5. To cause to know personally. (acquaint, enterer, chispear)

6. The quality of mental keenness and discernment. (acumen, caletre, carrizo)

7. A sensation (as of flavor) continuing after the stimulus causing it has ended. (aftertaste, dejo, reata)

8. A list of things to be done. (agenda, temario, tiranía)

9. An excuse offered by an accused person of not having been at the scene of an offence. (alibi, coartado, rapiña)

10. To come down from the air to rest. (alight, apearse, recocido)

11. A narrow passageway, especially between buildings. (alley, callejon, rebuzno)

12. The process of setting a value upon something. (appraisal, tasa, pulla)

13. A false report maliciously uttered and tending to injure the reputation of a person. (slander, calumniar, enjaezar)

14. A pointed instrument designed specifically for making small holes. (awl, lezna, sebo)

15. A roof-like (as of canvas) extended over or in front of a place as a shelter. (awning, toldo, caló)

16. A shaft on which a wheel revolves. (axle, eje, hato)

17. A large African monkey with an elongated, doglike muzzle. (baboon, mandril, seibó)

18. A sudden violent reverse movement or reaction. (backlash, contragolpe, rejonear)

19. To cook (as an egg or fish) in simmering liquid. (poach, escalfar, sisear)

20. Any of various small marine crustaceans related to the lobsters. (shrimp, camaron, arrayán)

21. A covering for the head and neck and sometimes the face. (hood, capirote, tremetina)

22. To make or cause to make a series of clattering and knocking sounds. (rattle, traquetear, compenueces)

23. To bring down or defeat something (as a government). (overthrow, derrocar, refundir)

24. A male relative. (kinsman, deudo, resina)

25. To unite (as two lengths of film) by connecting the ends together. (splice, empalmar, enlosar)

26. A condition of lacking sensation or emotion, usually as a result of cold or trauma. (numb, entumido, suplicante)

27. Being in a condition in which blood is deficient in quantity, in red blood cells, or in hemoglobin and which is marked by pallor, weakness, and irregular heart action. (anemic, exangue, vistoso)

28. Undue pride in oneself and one's appearance. (vanity, fachenda, simetría)

29. One who is a guarantor for another person. (bondsman, fiador, pulpero)

30. A prying, meddlesome person. (snoop, fisgon, síncopa)

31. A sweetened cooked mixture of milk and eggs. (custard, flan, troj)

32. To feel about or search for blindly and uncertainly. (grope, tentar, sancochar)

33. The return in kind of goods or services. (recompense, galardon, romería)

34. A slender weasel-like mammal with fine gray or brown fur. (marten, garduna, remero)

35. A place like a hideout or a center of secret activity. (den, guarida, tramoya)

36. A claspe (as on a belt) for two loose ends. (buckle, hebilla, sacacorchos)

37. A trailing woody evergreen vine with small black berries that is related to ginseng. (ivy, hiedra, ubre)

38. A fine black powder consisting chiefly of carbon that is formed when something burns and that colors smoke. (soot, hollin, quicio)

39. Any of a major group of organisms (as molds, mildews, and mushrooms) that lack chlorophyll and are usually classified as plants. (fungus, hongo, testuz)

40. A state of being gloomily silent or morose. (sullen, hosco, sagaz)

41. A cutting tool consisting of a curved metal blade with a short handle. (sickle, hoz, rabón)

42. Any of a breed of tall slender dogs noted for speed and keen sight. (greyhound, lebrel, timón)

43. Any of numerous bright-colored tropical birds that have a stout hooked bill. (parrot, loro, anca)

44. The inner soft part of a seed, fruit stone, or nut. (kernel, simiente, rebaba)

45. A bag (as of canvas) strapped on the back and used especially for carrying supplies. (knapsack, mochila, tranvía)

46. To destroy to the ground. (raze, asolar, riego)

47. Bearing resemblance in texture or appearance (as in physical strength) to tendons. (sinewy, membrudo, prensil)

48. Any of several marine food fishes related to cod. (hake, merluza, grulla)

49. Rapid, indistinct, and meaningless speech. (gabble, monserga, salmuera)

50. Characterized by small brownish spots on the skin. (freckled, pecoso, versado)

51. A descriptive trait involving giving or spending as little as possible. (stingy, nimio, voraz)

52. A young cow, especially one that has not had a calf. (heifer, novella, sarampión)

53. A thread, strip, or sheet of metal , paper, or plastic used to produce a glittering appearance. (tinsel, oropel, aprisco)

54. A wormlike often hairy insect larva especially of a butterfly or moth. (caterpillar, oruga, terraplén)

55. Any of numerous pigeons, especially a small wild pigeon. (dove, paloma, tocón)

56. A condition of being like a spongy wetland. (swampy, pantanoso, tiñoso)

57. A small piece of cloth used for various personal purposes, as of wiping the face. (handkerchief, panuelo, serrucho)

58. Characterized by a reddish coating formed on iron when it is exposed to especially moist air. (rusty, mohoso, taimado)

59. Given to discussing or commenting. (talkative, parlero, vasallo)

60. A skin especially of a fur-bearing animal. (pelt, zalea, giba)

61. To beat, drive, or shape with repeated blows. (hammer, martillar, fermentar)

62. A cut of beef including most of the neck and the parts around the shoulder blade and the first three ribs. (chuck, portabroca, hospedaje)

Appendix C

IRB Approval Form

Oklahoma State University
Institutional Review Board

Protocol Expires: 3/14/2005

Date: Monday, March 15, 2004 IRB Application No AS0467

Proposal Title: Tip-of-the-Tongue Experiences in Spanish-English Bilinguals

Principal Investigator(s):

Elaine Fernandez
215 N. Murray
Stillwater, OK 74078

Shelia M. Kennison
215 N. Murray
Stillwater, OK 74078

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

Dear PI :

Your IRB application referenced above has been approved for one calendar year. Please make note of the expiration date indicated above. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact me in 415 Whitehurst (phone: 405-744-5700, colson@okstate.edu).

Sincerely,

Carol Olson

Carol Olson, Chair
Institutional Review Board

Appendix B

Sex: M / F Age (in years) _____ Native country _____

Years spent in the U.S. _____ Years spent in U.S. schools_____

1. Do you have any known visual or hearing problems (corrected or uncorrected)?

2. What is your first language? (i.e., language first spoken).

3. Do you speak and/or have you studied a language other than your first language (circle one)?

YES NO If so, which one(s)?

4. Please circle YES, NO or N/A in response to the following statements:

a. I have studied at least one foreign language in high school and/or at the university level.

YES NO N/A

b. As a result of formally studying a foreign language, my proficiency in that language(s) is above a novice level. YES NO N/A

c. I use my other language(s) frequently as a means of communication with friends, family, acquaintances, etc. YES NO N/A

d. I have spent more than 3 weeks in a country where English was not spoken.

YES NO N/A

e. During my stay in a non-English speaking country, I used the dominant language spoken in that country as my primary means of communication. YES NO N/A

5. I would rate my proficiency in my second language as the following (check one):

_____ **Not proficient** (I cannot communicate at all with a native speaker of the language)

_____ **Somewhat proficient** (I can communicate with a native speaker of the language to a very limited degree (i.e., using broken words or phrases), but cannot carry on a conversation with a native speaker.)

_____ **Intermediate proficiency** (I can communicate with a native speaker of the language, although I find it difficult to do so; I can carry on a conversation with a native speaker of the language if (s)he speaks very slowly.)

_____ **Advanced proficiency** (I can carry on a conversation with a native speaker of the language, although it is highly evident that I am not a native speaker of the language).

_____ **Near-native proficiency** (I can carry on a conversation with a native speaker of the language with very little difficulty. Sometimes I am mistaken as a native speaker of the language)

_____ **Native proficiency** (I am considered by other speakers of the language as a native speaker).

6. Is there anything else about your language background you would like to comment on? Please feel free to comment on about things that were not covered in this questionnaire.

TABLE I

SAMPLE STIMULI FROM THE EXPERIMENT BY TYPE OF ITEM

Type of Item	Definition	Target	Related Prime	Unrelated Prime
Translation Equivalent calva	A large African monkey with an elongated, doglike muzzle.	baboon	mandril	
False Cognate puntilla	The natural color, texture and appearance of the skin.	complexion	complexion	

Cognate	A large mass of slowly moving ice, formed from compacted snow.	glacier	glaciar
comodin			

TABLE II

MEAN PERCENTAGE OF INITIAL RESPONSES BY RESPONSE CATEGORY

BY CONDITION FROM EXPERIMENT 1

Initial Responses

		Type of Response				
Item Type	Relatedness	Correct Know	Incorrect Know	Don't Know	Correct TOT	Incorrect TOT
Mean						
Cognate	Related	14.61	38.23	39.34	4.87	2.94
20.00						
	Unrelated	17.00	37.50	38.05	4.69	2.76
20.00						
False Cognate	Related	13.00	36.71	45.20	2.12	2.96
20.00						

	Unrelated	14.44	39.07	41.45	1.52	3.53
20.00						
Translation	Related	15.84	34.77	42.76	2.97	3.67
20.00						
Equivalent	Unrelated	14.65	38.90	39.10	3.96	3.39
20.00						
	Mean	14.92	37.53	40.98	3.36	3.21
20.00						

TABLE III

MEAN PERCENTAGE OF SECONDARY RESPONSES BY RESPONSE CATEGORY

BY CONDITION FROM EXPERIMENT 1

Responses Following Prime Tasks

		Type of Response				
Item Type	Relatedness	Correct Know	Incorrect Know	Don't Know	Correct TOT	Incorrect TOT
Mean						
Cognate	Related	54.56	11.26	29.87	2.16	0.72
19.71						
	Unrelated	6.33	20.02	67.04	4.74	1.88
20.00						
False Cognate	Related	36.76	12.79	47.27	1.43	1.75
20.00						

	Unrelated	4.30	20.58	71.13	1.92	2.07
20.00						
Translation	Related	9.28	21.26	61.02	5.55	2.89
20.00						
Equivalent	Unrelated	4.23	15.05	72.35	4.97	3.41
20.00						
	Mean	19.24	16.83	58.11	3.46	2.12
19.95						

TABLE IV

MEAN PERCENTAGE OF INITIAL RESPONSES BY RESPONSE CATEGORY

BY CONDITION FROM EXPERIMENT 2

Initial Responses

		Type of Response				
Item Type	Relatedness	Correct Know	Incorrect Know	Don't Know	Correct TOT	Incorrect TOT
	Mean					
Cognate	Related	17.13	38.12	39.81	2.61	2.33
	20.00	Unrelated	20.04	38.05	37.13	2.76
	2.02		20.00			
False Cognate	Related	16.86	38.03	40.31	3.04	1.75
	20.00					

	Unrelated	19.31	40.24	36.43	1.76	2.26
20.00						
Translation	Related	19.93	40.90	34.42	2.68	2.08
20.00						
Equivalent	Unrelated	26.08	34.67	32.65	2.20	1.95
19.51						
	Mean	19.89	38.34	36.79	2.51	2.07
19.92						

TABLE V

MEAN PERCENTAGE OF SECONDARY RESPONSES BY RESPONSE CATEGORY

BY CONDITION FROM EXPERIMENT 2

Responses Following Prime Tasks

		Type of Response				
Item Type	Relatedness	Correct Know	Incorrect Know	Don't Know	Correct TOT	Incorrect TOT
Mean						
Cognate	Related	51.09	8.67	38.21	1.13	0.90
20.00						
	Unrelated	9.28	14.36	72.05	2.52	1.78
20.00						
False Cognate	Related	44.81	9.99	42.89	1.31	1.00
20.00						
	Unrelated	6.32	18.08	71.65	1.90	2.06
20.00						

Translation	Related	11.27	21.93	62.54	2.14	2.11
20.00						
Equivalent	Unrelated	12.92	17.93	65.36	2.00	1.79
20.00						
	Mean	22.62	15.16	58.78	1.83	1.61
			20.00			

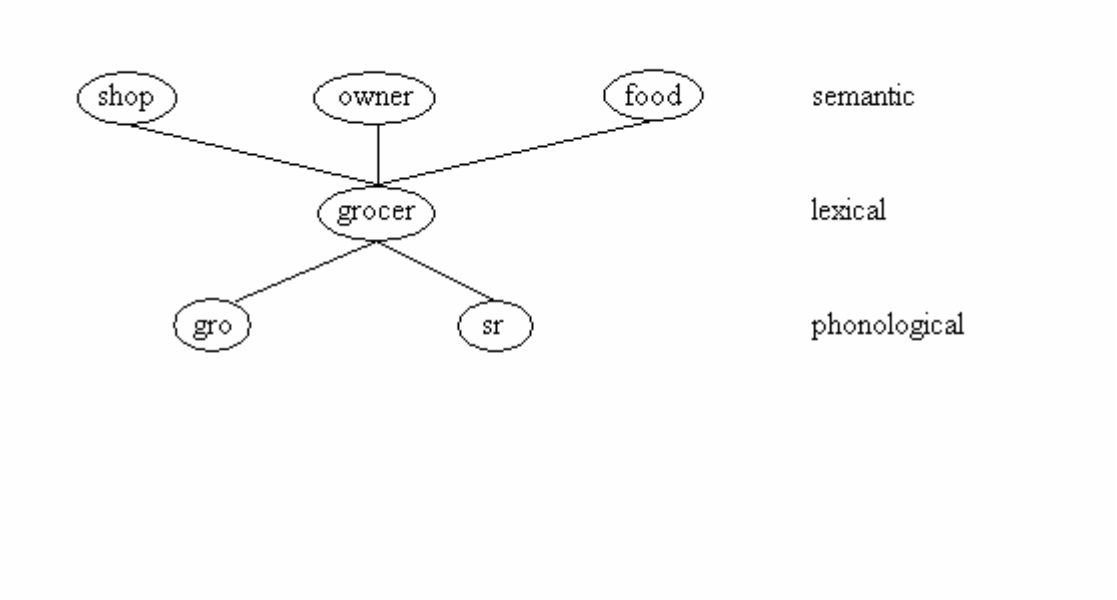


Figure 1. Example of node structure at the semantic, lexical, and phonological levels.

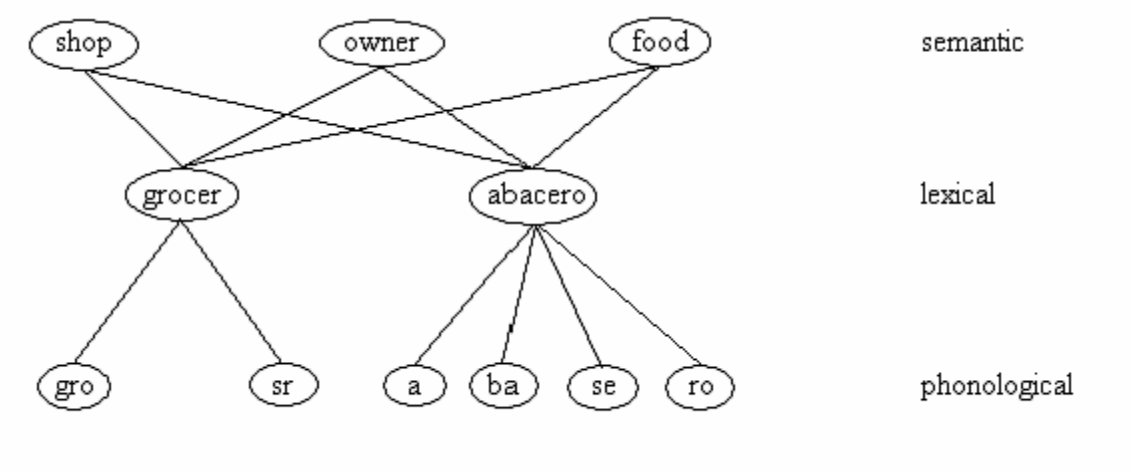
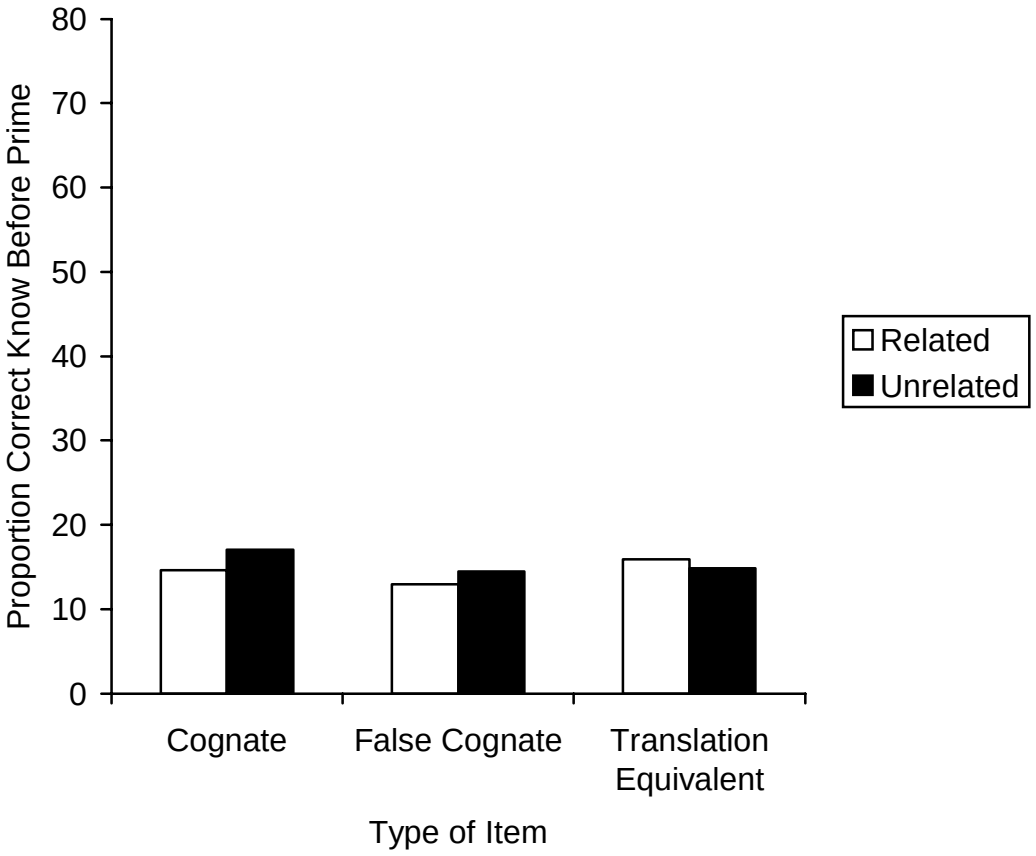


Figure 2. Example of dual lexicon node structure in bilingual individuals.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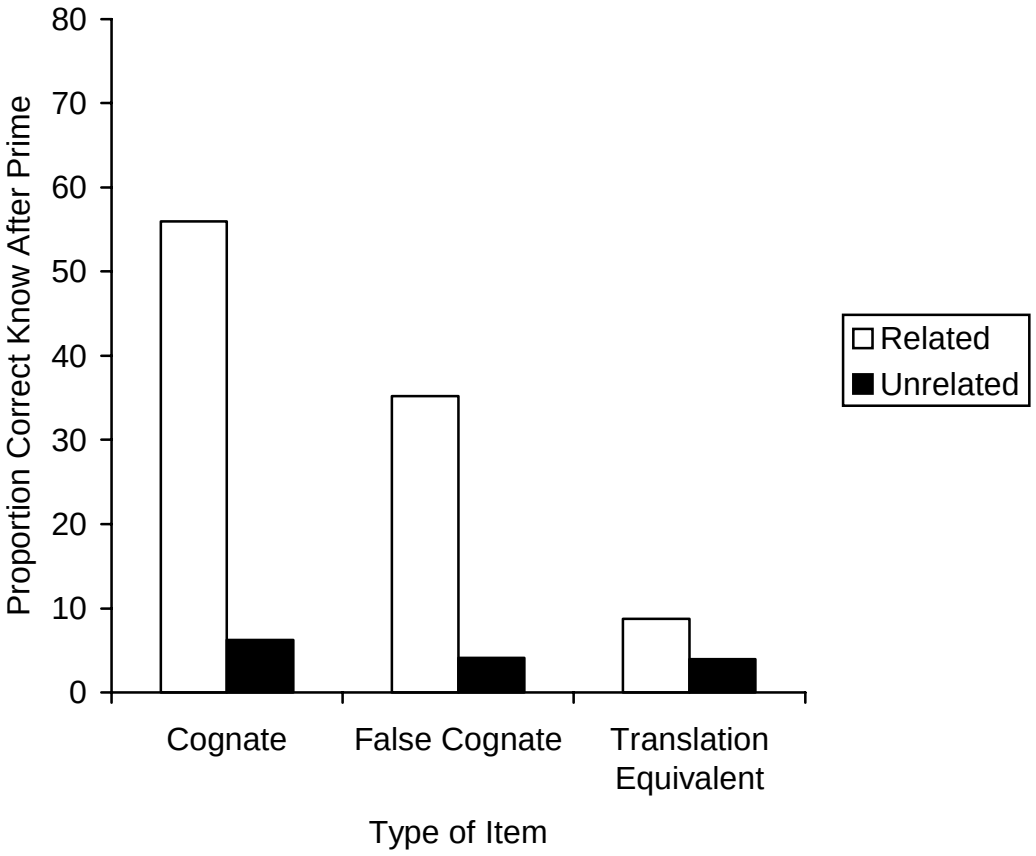
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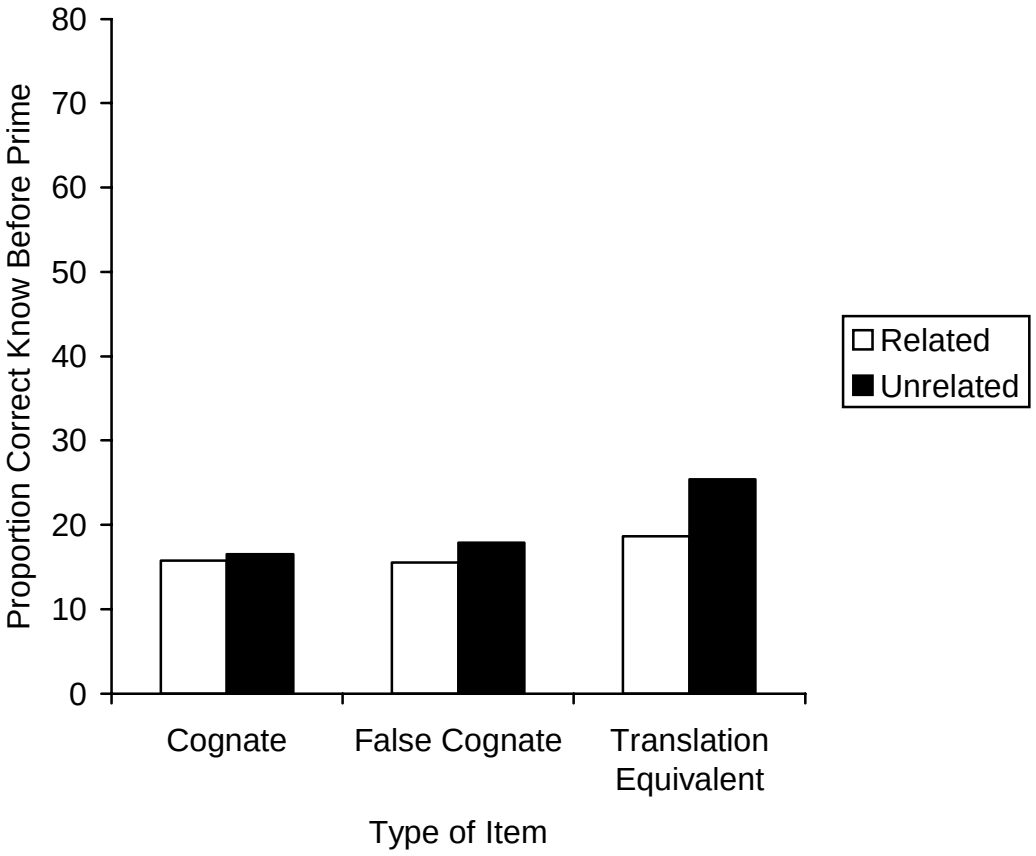
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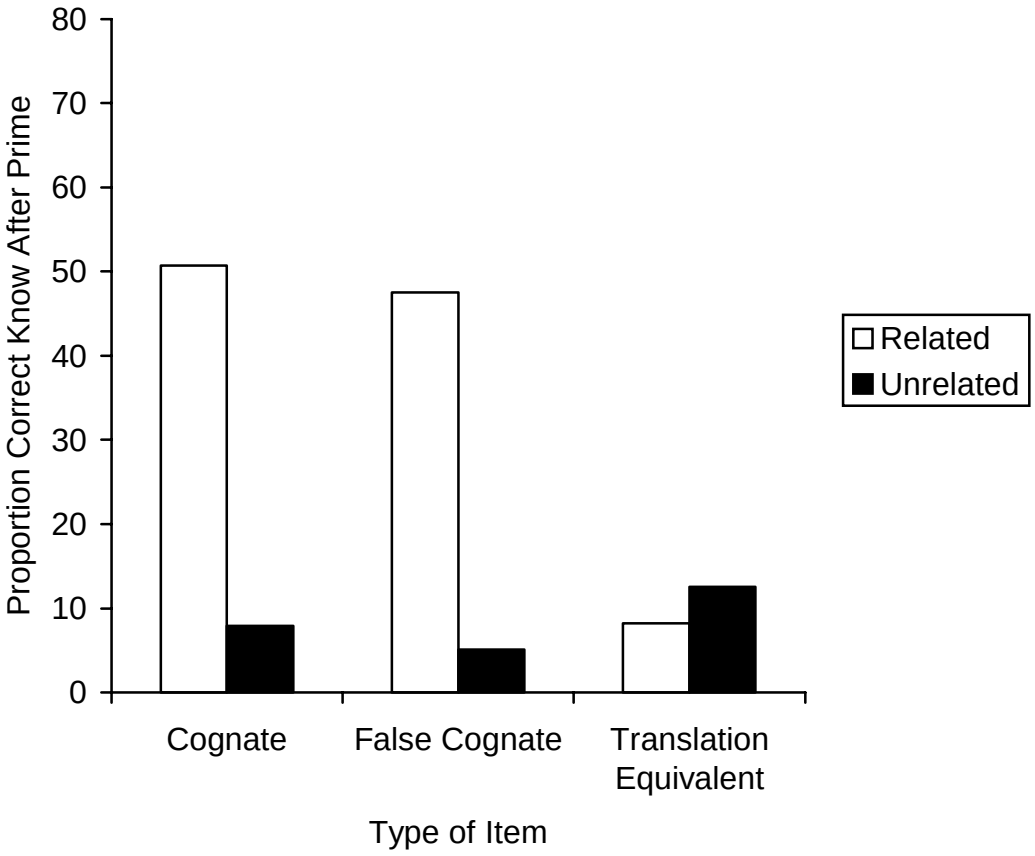
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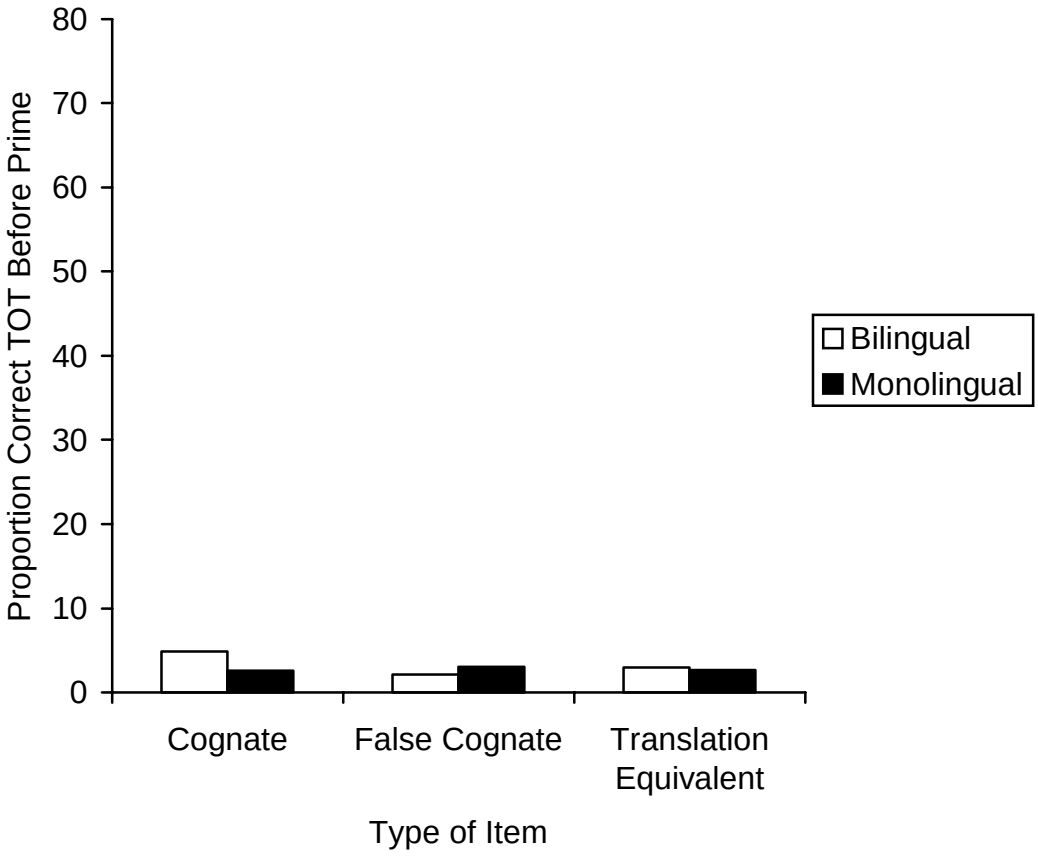
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Proportion Correct TOT Before Prime
Bilingual
Monolingual
Cognate
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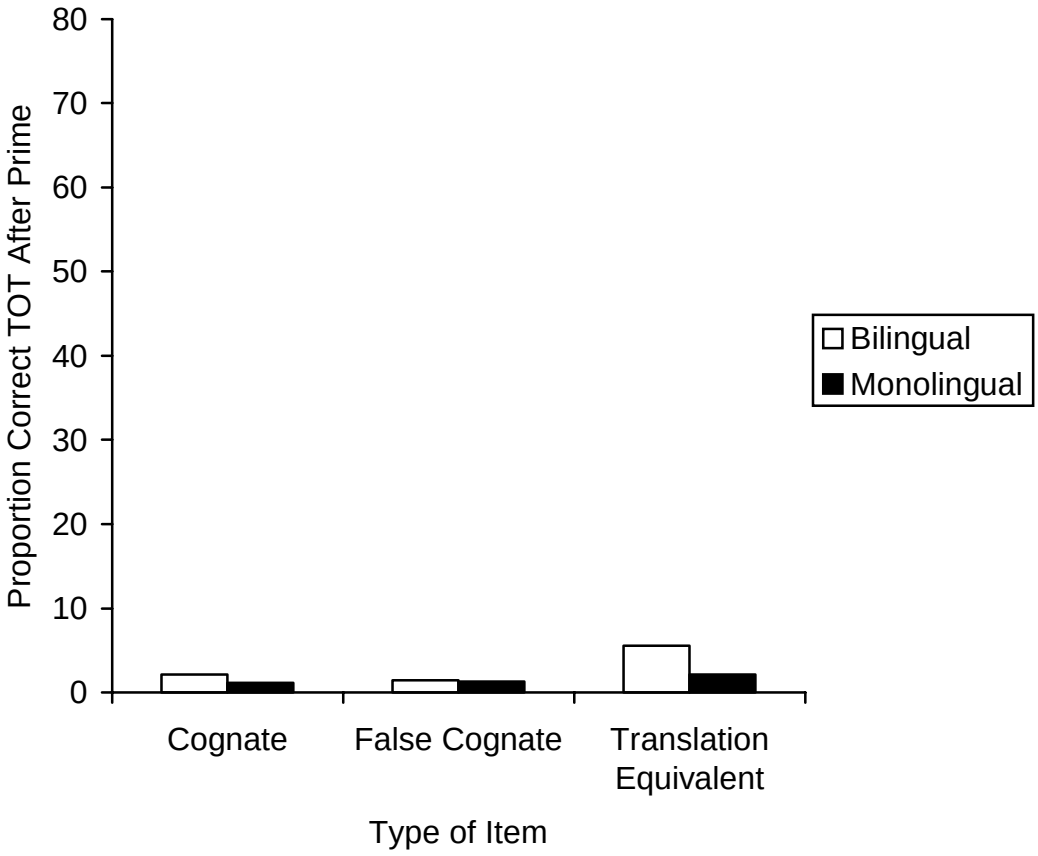
Translation Equivalent
Type of Item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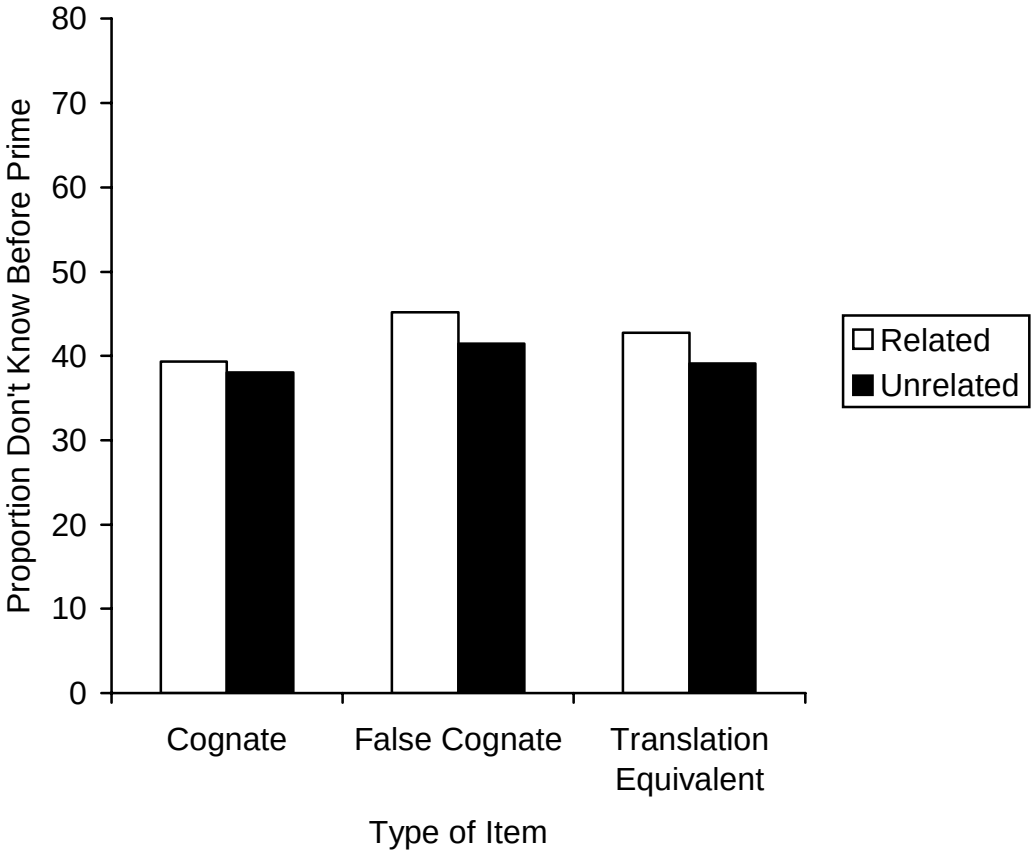
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Cognate
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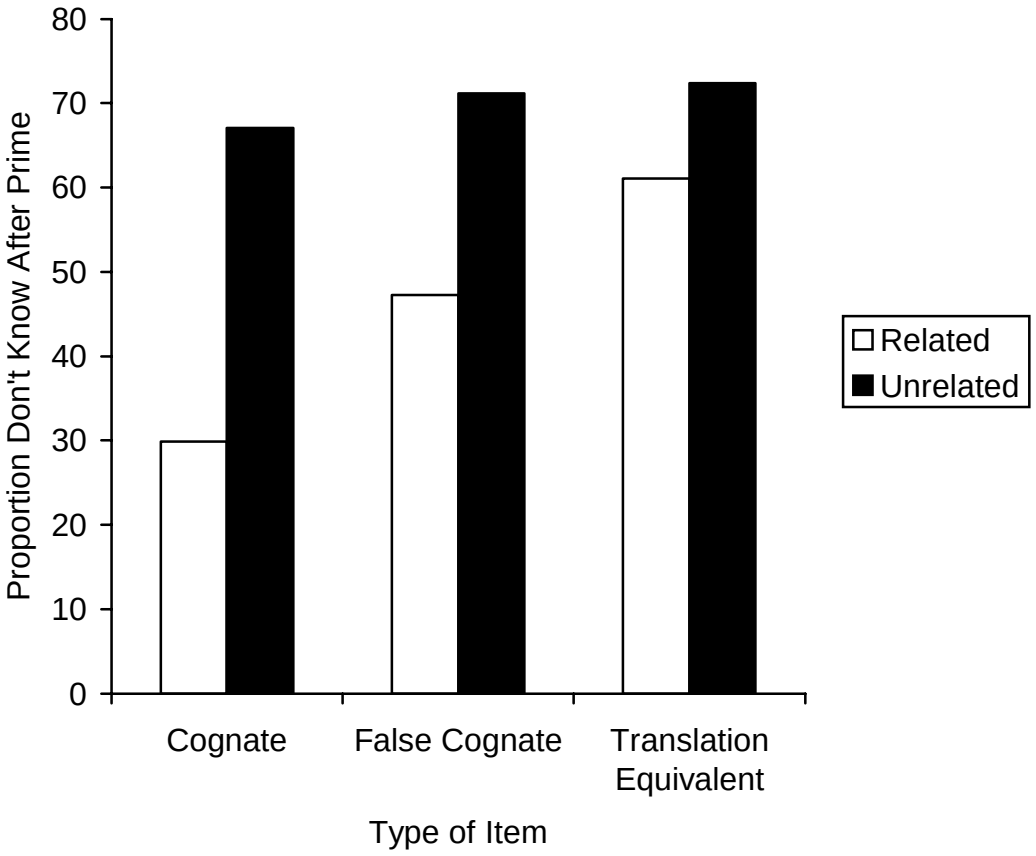
Translation Equivalent
Type of Item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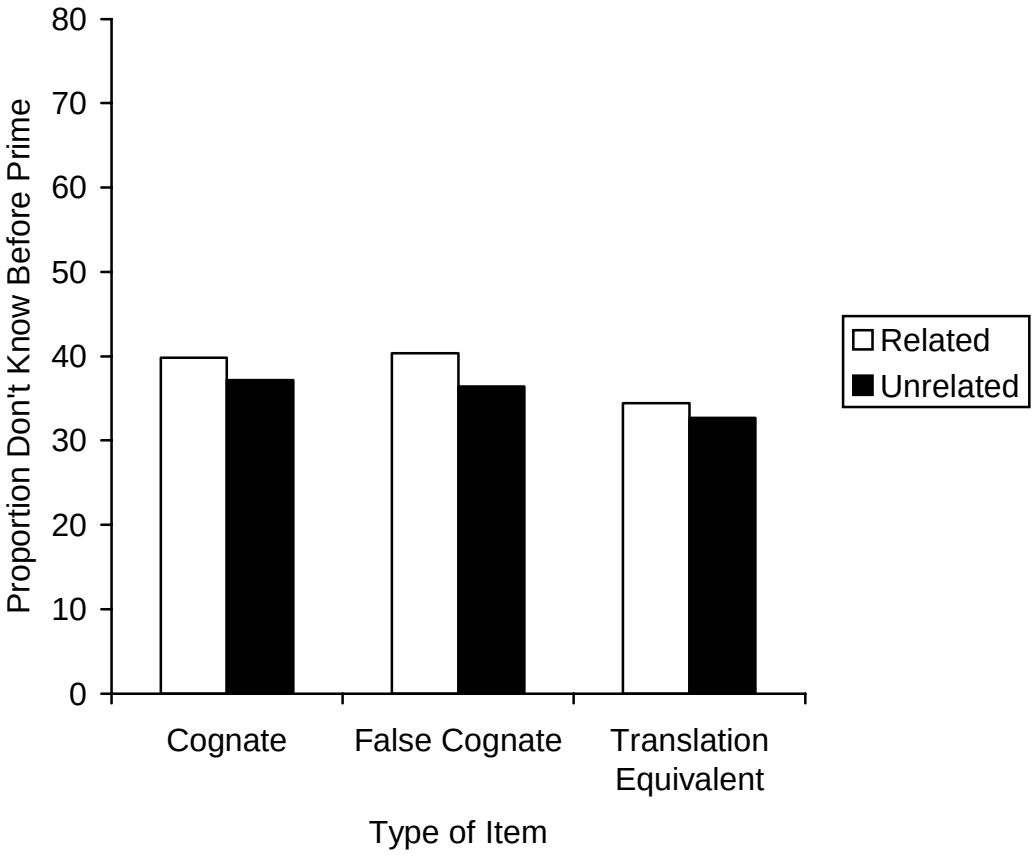
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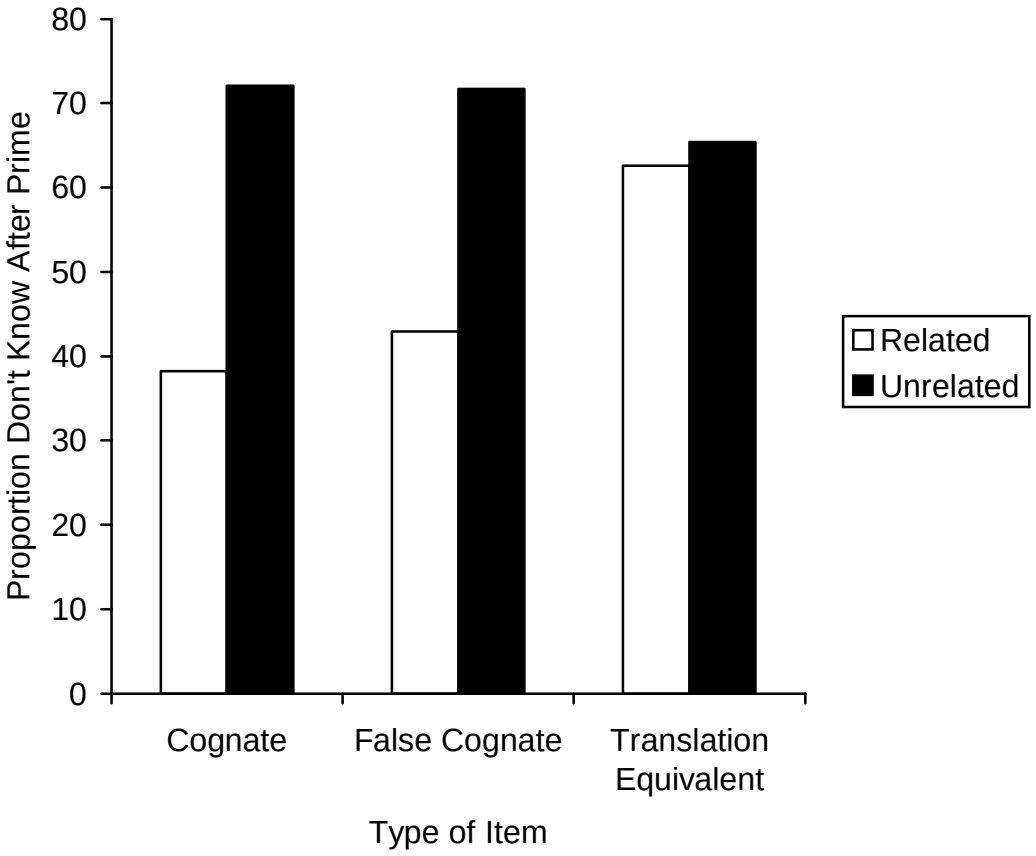
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VITA

Elaine C. Fernandez

Candidate for the Degree of

Master of Science

Thesis: THE ROLE OF PHONOLOGICAL AND SEMANTIC INFORMATION IN THE TIP-OF-THE-TONGUE TASK: EVIDENCE FROM SPANISH-ENGLISH BILINGUALS

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Institutional Review Board, Student Alternate Member (2005-2006)
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Name: Elaine C. Fernandez Date of Degree: December, 2006

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: THE ROLE OF PHONOLOGICAL AND SEMANTIC INFORMATION IN THE TIP-OF-THE-TONGUE TASK

Pages in Study: 73 Candidate for the Degree of Master of Science

Major Field: Psychology

Scope and Method of Study: Tip-of-the-tongue (TOT) states occur when a person knows a word, but is unable to produce it. Prior research has shown that TOT rates are influenced by phonological (sound) processing. The present research tested the hypothesis that both phonological (sound) and semantic (meaning) processing influence the likelihood that a TOT state will occur. In the present experiment, Spanish-English bilinguals named English words when cued with written definitions. When the correct word was not produced, a secondary task was performed in which a Spanish word was rated on its ease of pronunciation. Half of the time, the Spanish word was similar to the English word; the words were similar 1) both in sound and meaning; 2) in sound only; or 3) in meaning only.

Findings and Conclusions: The results confirmed the hypothesis, showing that more correct responses occurred when the Spanish word was similar to the English target word in both sound and meaning than when the Spanish word was similar in sound only or meaning only. A second experiment with monolingual English-speaking participants confirmed that bilinguals' performance in Experiment 1 was affected by their having knowledge of the meaning of both prime and target words.

ADVISER'S APPROVAL: Shelia M. Kennison, PhD