Universidad de las Américas Puebla
Escuela de Ciencias Sociales, Artes y Humanidades
Departamento de Lenguas

Concreteness and Translation Ambiguity Effects: Exploring the Lexical Organization in the Bilingual Mental Lexicon

Tesis profesional presentada por
Caroline Anne Payant

Para obtener el grado en
Maestría en Lingüística Aplicada

Jurado Calificador

Presidente: Dr. Patrick Henry Smith Ashmore
Secretario y Director: Dr. Christopher John Hall Sim
Vocal: Dr. Roberto Herrera Herrera

Cholula, Puebla, México a 15 de mayo de 2006.

Table of Reference

The processes governing first language vocabulary acquisition involve learning phonological/orthographic forms, syntactic frames, and associating these with new conceptual features. In second language vocabulary training, it appears that the learning burden is lightened since conceptual information has normally already been acquired. Nonetheless, this process is an intricate part of second language acquisition development. Learners often find that a single form can map onto multiple concepts and that some lexical forms lack equivalents in the first language.

Recently, Tokowicz & Kroll (in press) show that the number of available translations for concrete and abstract words also determines the organization in the bilingual mental lexicon. The research reported here investigated, the existence of a correlation between concreteness and translation ambiguity.

A translation recognition task from Spanish to English was conducted with incipient bilinguals. It was expected that the number of translation equivalents would not affect the performance for concrete words but that abstract words with a single translation would be recognized faster than abstract words with multiple translations. Furthermore, concrete words with a single translation would be recognized as fast as abstract words with a single translation but that concrete words with multiple translations would be recognized faster than abstract words with multiple translations.

Reaction times were obtained using DMDX, a reaction time software. A significant interaction was observed between concrete words with a single translation equivalent and abstract words with multiple translation equivalents. The results are discussed and linked back to the predictions of the Distributed Feature Model (de Groot, 1992a).

Chapter I

Psycholinguistics is the study of the cognitive processes involved in the acquisition, perception and productive use of language. Early work in psycholinguistics primarily focused on investigating the connections between syntactic, lexical and conceptual information governing monolingual language processes. As Kroll and de Groot discuss (1997), there are many natural bilingual speakers in the world and there is a growing number of adult bilinguals, primarily due to travel and migration, the use of internet and computer technology. In order to lighten the second language learning burden, there is an increasing interest in the field of psycholinguistics documenting the mental processes and organization of multiple languages. The relationship between multiple languages in the mind is complex and cannot be explained by simply understanding first language processes and expanding monolingual models to bilingual mental representations.

Jackendoff (1983) first introduced the idea of linguistic meaning as conceptual representations in the mind that may only be expressed through language, gestures, and/or drawings. Jackendoff (1992) also argued that concepts are linked in the long-term memory to elements of linguistic expression: phonological and syntactic structures.

When learning vocabulary in a second language, lexical forms (orthographic, phonological, and syntactic) are already mapped to a conceptual representation in the L1. For example, the conceptual representation for *bus* is already linked to the phonological form /bʌs/ and its syntactic structure. An English speaker learning Spanish must map the conceptual information to a new Spanish lexical form, i.e. *camión.* This mapping process is an intricate part of second language acquisition development. Bilinguals often observe that concepts do not perfectly match the conceptual information in another language, find that a single form can map onto multiple concepts or notice that some lexical forms have no equivalents in the other language.

Different hierarchical models have been proposed describing the types of bilinguals and the types of bilingual organization in the mind (see Weinreich, 1953/1974; Kroll and Stewart, 1994; de Groot, 1992a; Hall, 1992). Common to these models of lexical representation is the distinction between two levels of representation in the mind: the lexical level and the conceptual level. Earlier work in psycholinguistics sought to determine whether bilinguals possessed two independent lexical stores, one for each language, or whether languages were integrated into a single lexical store. The dependent view is widely accepted in the field of psycholinguistics such that languages are stored in a common lexical store.

Concreteness effects have been used as a marker of conceptual mediation. Research with monolinguals has yielded evidence for distinct organizations in the mental lexicon for concrete and abstract words where concrete words lead to more accurate memorization and recall than abstract words (Paivio, 1971; Kieras, 1978; Schwanenflugel and Shoben, 1983). These findings suggest that concrete words have more constant conceptual representations across speakers because the latter are created through perceived input. The conceptual representations for abstract words on the other hand are subject to greater meaning variation because abstract concepts are created based on socially constructed knowledge. Based on these findings, de Groot, 1992a; de Groot, Dannenburg and van Hell, 1994; van Hell and de Groot, 1998a; Schönpflug, 1997; and Tokowicz and Kroll (in press) further investigated concreteness effects with bilingual speakers. The general finding was that concrete words are recognized and translated faster and remembered with greater accuracy than abstract words. To account for the observed concreteness effects, de Groot (1992a) proposed the Distributed Feature Model (DFM), shown in Figure 1. The DFM is a bilingual model that schematically represents the links between the lexical and the conceptual levels of words: the lexical level consisting of information related to word form, grammatical properties and syntactic specifications and the conceptual level consisting of information related to meaning specifications (Kroll and de Groot, 1997; Hall, 2005). Information at the conceptual level is depicted as a collection of nodes, where each node represents one meaning element. The lexical node maps onto the feature nodes at the conceptual level. De Groot and colleagues (de Groot, 1992a; van Hell and de Groot, 1998a) argued that the concreteness effects could be explained through the number of shared overlapping conceptual nodes across the words from the two languages. The research reported here investigated the claims of the DFM.

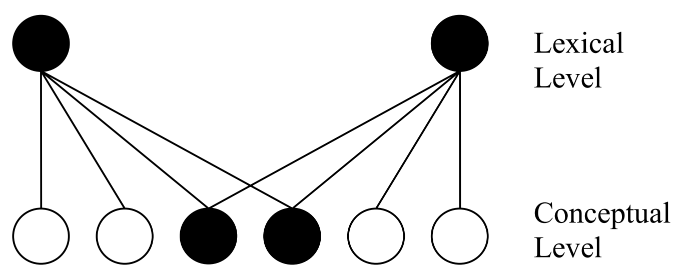


Figure 1. The Distributed Feature Model, adapted from de Groot, 1992a, p.393.

However, Tokowicz and Kroll (in press) argue that the DFM is too simplistic because it does not consider cross-linguistic translation ambiguity effects. The term translation ambiguity refers to the number of translation equivalents available in the other language. Ambiguous words are those that have more than one translation equivalent in the other language. The Spanish word *camión* for example is considered ambiguous because it has two available translations in English: *bus* and *truck*. The word *playa* is considered unambiguous because *beach* is the only existing English translation. Tokowicz and Kroll (2000; in press) manipulated the number of translations for concrete and abstract words and found that the reported ubiquitous concreteness effects disappeared when words had a single translation equivalent in the target language. They also found that the number of translation equivalents only affected the reaction times (RTs) for abstract words where unambiguous abstract words were translated faster than ambiguous abstract words[1].

There is a lack of empirical evidence investigating a possible interaction between concreteness and the number of translations, and it is this concern that has motivated the present research. In this work, concreteness and translation ambiguity with low-intermediate bilinguals was investigated. Balanced bilinguals are the marked case in the world yet a significant amount of psycholinguistic research has focused on advanced and balanced bilingual learners' representation. It is imperative to also work with low-intermediate bilinguals for the development of the existing models of bilingual representation.

Early empirical data in monolingual and bilingual research supports the claim that concrete and abstract words have distinct representations in the mind and that with advanced bilinguals the concreteness effects interact with translation ambiguity. In light of these results, the following research question was proposed: is there evidence suggesting that concreteness effects positively correlate with the number of translation equivalents in the target language with low-intermediate learners of a second language?

---

[1] The terms unambiguous and ambiguous are used interchangeably with the terms single translation equivalent and multiple translation equivalents, respectively. The translations may share semantic similarities (synonyms) or have completely unrelated meanings (homonyms).

1.1. Lexical Representation

1.1.1. Lexical Representation in the Monolingual Mind

The different organization for concrete and abstract words was first researched with monolingual speakers. Through an association memorization task, Paivio (1971) observed that concrete words were remembered better than abstract words. To explain these findings, he postulated the Dual-Code Theory (DCT) which claimed that the memory is comprised of two coding systems: a verbal system and an imaginal system. The verbal system was defined as the common-memory store because both abstract and concrete words could access it. The imaginal system was defined as the special-purpose store, accessed only by words that could evoke an image. The concept for *computer* is argued to be accessed via both the verbal and the imaginal system whereas the concept for *justice,* a socially constructed abstract concept, which does not evoke an image of a tangible object, only via the verbal system. The concreteness effect was shown by concrete words where the latter were accessed via the verbal and the imaginal systems.

To further investigate the claims of the DCT, Kroll and Merves (1986) conducted a lexical decision task. They controlled the order of appearance of words, displaying word types in blocks and alternating between concrete and abstract word blocks. They predicted that starting the task with the presentation of concrete word blocks, participants would develop strategies, enabling them to access both the lexical and the imaginal representation for retrieval. When continuing with abstract word blocks, a modification of the retrieval strategy would be required, thereby affecting RTs because the imaginal system would no longer be available. However, if an abstract word block was presented first, followed by a concrete word block, participants would rely on the previously developed strategy (verbal link only), leading to similar RTs across word type. Kroll and Merves (1986) found that concrete words were recognized faster when they were preceded by abstract nouns. When abstract word blocks preceded concrete word blocks, the RTs were not significantly different. An interaction between word type and order of presentation was not supported under the DCT.

To explain their findings, Kroll and Merves (1986) turned to the Context Availability Model (CAM, Kieras, 1978; Schwanenflugel and Shoben, 1983; Schwanenflugel, Harnishfeger, and Stowe, 1988). The CAM is a model for reading comprehension processes in which comprehension is hypothesized to be facilitated by additional contextual information. This information may either come from clues embedded in the text or from the participants' world knowledge, which is argued to be more salient for concrete words. Schwanenflugel and Shoben (1983) had their participants perform a reading comprehension task and obtained equal RTs for both concrete and abstract words, regardless of the order of presentation, when context availability ratings were equal across word-type[2]. Unlike the CAM, the DCT made no predictions of an interaction between order of presentation, context effects and concreteness. Kroll and Merves (1986) provided a possible explanation for their findings, stating that concrete words have two possible representations: core meanings created from the participants' world knowledge and contextually dependent meanings. Abstract words only benefited from contextually dependent meanings. Although their findings were not explained congruently under the CAM, because the CAM presented words in a context-rich environment, the empirical findings suggested that contextual cues aided comprehension and memorization. This suggested that concreteness effects are explained either through the available imaginal systems and/or the contextual information.

---

[2] The context availability ratings instructions are those devised by Schwanenflugel and Shoben (1983). Participants were asked to decide how easy or how difficult it was to come up with a particular context. The concreteness rating instructions are those devised by Paivio, Yuille, & Madigan (1968). Participants were asked to decide how easy or how difficult it was to come up with a visual representation.

1.2. Lexical Representation in the Bilingual Mind

1.2.1. Types of Bilinguals

A clearer understanding of the organization of words in the monolingual mental lexicon is important but cannot explain the organization of lexical items in the bilingual mental lexicon. Weinreich (1953/1974) carried out pioneering work investigating bilingualism and proposed three types of bilinguals; the compound, coordinate and subordinate bilingual, shown in Figure 2. He argued that the coordinate bilingual retrieved information from two separate lexical stores which were linked to two independent conceptual stores. The compound bilingual retrieved information from two lexical stores which were linked to a single shared conceptual store. The subordinate bilingual accessed the conceptual store via the L1 lexical store. The predictions were that the learner dominated a language and was in the process of learning another language, therefore relying heavily on native language knowledge. Weinreich (1953/1974) further put forth the Developmental Hypothesis, which predicted a transition into either the compound or coordinate organization with increasing proficiency.

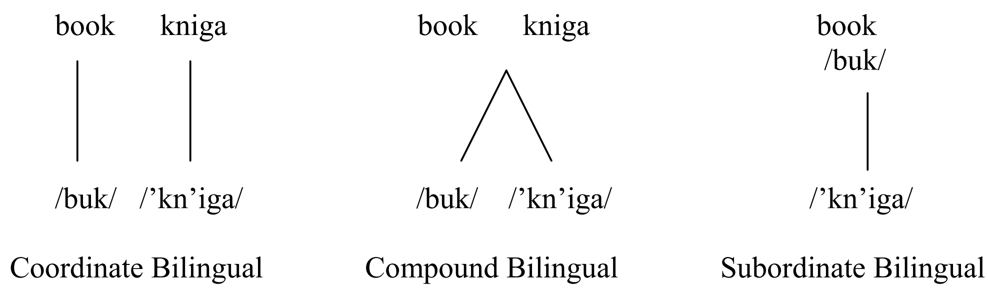


Figure 2. Schematic representation of the three types of bilinguals, adapted from Weinreich, 1953/1974, p.9-10.

1.2.2. Types of Organizations in the Bilingual Minds

While the existence of a conceptual level and a lexical representation was accepted, the mapping between the lexical and the conceptual store needed further empirical support. Potter, So, Eckardt and Feldman (1984) tested the Lexical Association and the Concept Mediation hypotheses derived from Weinreich's (1953/1974) subordinate and compound organizations respectively, as shown in Figure 3. The predictions under the Lexical Association Hypothesis postulated that access to lexical items to and from the L2 is mediated via the L1 and that newly learned words in the L2 are directly associated with words in the L1. Under the Concept Mediation Hypothesis, association to the L2 is accessed through the shared conceptual store and a direct link across the two languages at the lexical level is non-existent.

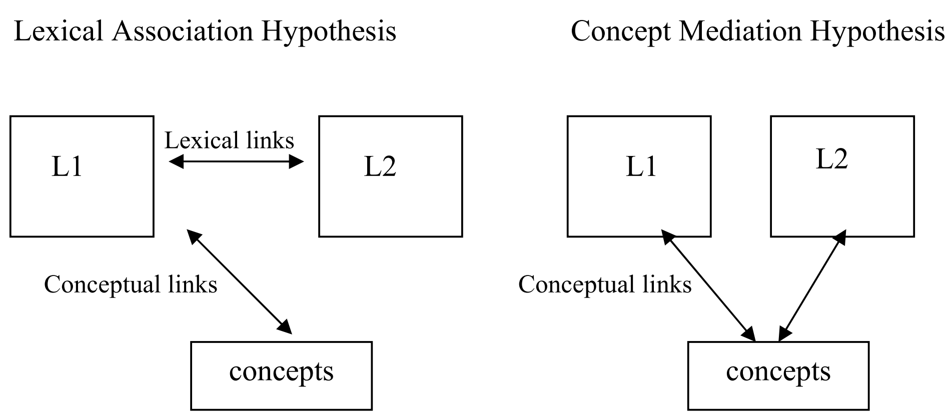


Figure 3. The Lexical Association Hypothesis and the Concept Mediation Hypothesis, adapted from Potter et al., 1984, p.25.

Using a picture-naming and translation task with proficient Chinese-English and novice English-French bilinguals, Potter et al. (1984) found that picture-naming resulted in slower RTs than word-naming in the native language. They argued that picture-naming involved two steps: participants identifying the concept and linking it to the corresponding lexical item, whereas the word-naming task did not involve accessing the conceptual store. Through a picture-naming task in the L2 and a forward translation task (L1 →L2), similar production times were obtained for both groups, a finding supporting the Concept Mediation Hypothesis at both proficiency levels.

Weinreich (1953/1974) hypothesized that a shift from the subordinate organization into a compound organization would occur as proficiency increased. Chen and Leung (1989) conducted studies requiring participants to perform three distinct tasks: picture-naming in the participants' L1 and L2, word-reading in the native language, and a translation production task in the forward direction with fluent Chinese-English bilinguals and beginning Chinese-French bilinguals. In their first experiment, participants were asked to name pictures and Chinese symbols in their L1 and provide the corresponding translation. They found that overall, participants responded faster in the word-naming task than in the picture-naming task in their L1. Proficient Chinese-English bilinguals produced similar RTs in both the picture-naming in their L2 and the forward translation task. These findings support the predictions of the Concept Mediation Hypothesis. Conversely, with the non-fluent bilinguals, they observed faster RTs for the forward translation task than for the picture-naming in the L2. This study provides evidence supporting lexical mediation for early bilinguals. Chen and Leung (1989) point out that their findings are not consistent with the results from the Potter et al. (1984) study because their non-proficient Chinese-French participants had an inferior proficiency level than the novice English-French bilinguals. These findings suggest that a shift from the subordinate organization into the conceptual organization occurs as hypothesized by Weinreich.

To test the Developmental Hypothesis, Abunuwara (1992) worked with Arabic-Hebrew-English trilingual. Participants performed a trilingual word-picture naming task. They found that picture-naming in the L2 was faster than translation in the forward direction, evidence for the Concept Mediation Hypothesis since picture-naming does not rely on the L1. Picture-naming in the L3 (English), on the other hand, was slower than translation performance from L1 to L3, suggesting that the picture-naming task was mediated by the L1. This was taken as further evidence for the Developmental Hypothesis.

De Groot and Hoeks (1995) replicated the Abunuwara study (1992). Their participants were Dutch-English-French trilinguals, English being the stronger non-native language, while manipulating word concreteness. Participants performed a translation production and recognition task in the forward direction. Their proficiency in the L2 was confirmed since translation production and recognition from Dutch to English was faster than from Dutch to French. Also, the researchers hypothesized that a concreteness effect should not be observed in a translation task from Dutch to French because, as non-fluent bilinguals, the participants should only have access to lexical links. Indeed, they observed a concreteness effect when participants translated to English, but not to French. These findings were taken as further support for the developmental hypothesis since advanced bilinguals accessed the conceptual store and the novice group does not.

These findings are very important for the development of a model of lexical representation in the mental lexicon in two ways. First, they demonstrated that two types of organization may co-exist within a single bilingual speaker, and more importantly that word-type is an important factor underlying the representation of lexical items in the mental lexicon. Before discussing word concreteness in more detail, we will consider another important model of mental lexical representation for bilinguals: the Revised Hierarchical Model (Kroll and Stewart, 1994).

1.2.3. The Revised Hierarchical Model

Although the results from the studies previously discussed provided mixed support for the Developmental Hypothesis, no predictions regarding directionality effects (L1→L2 versus L2→L1) in relation to proficiency were postulated. Kroll and Stewart (1994) conducted an experiment using translation tasks in both the forward and backward directions with fluent bilinguals. Items were organized in semantically and randomized word lists. They obtained longer time latencies in the forward translation task than in the backward translation task. These results provided evidence for the existence of direct links at the lexical level in the backward direction. The slower production times with the semantically organized word list in the forward direction indicated that the conceptual store was accessed and that a direct link at the lexical level was not available. These results provided further evidence for the access of a common conceptual store in the forward direction.

The Revised Hierarchal Model (1994), shown in Figure 4, captured the asymmetry between translation directions. The RHM depicts a larger L1 lexicon since regardless of fluency in the L2, native speakers know more words in their native language. It also captures the idea that during the early levels of acquisition, learners rely on the L1 knowledge prior to accessing the conceptual information of the word in the L2 which is shared across both languages (Weinreich, 1953/1974). Because of this strategy, the strength of the links in the backward direction is argued to be stronger than the links in the forward direction.

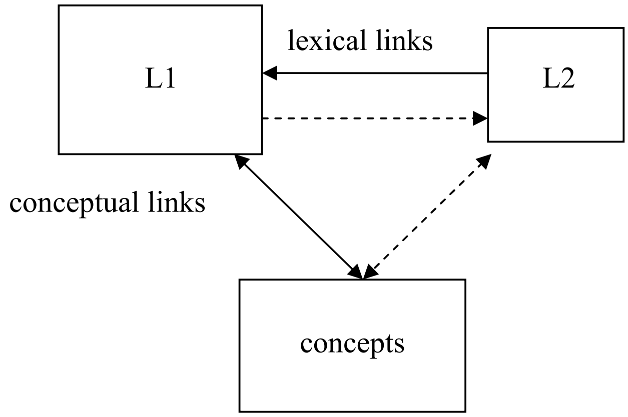


Figure 4. The Revised Hierarchical Model, adapted from Kroll and Stewart, 1994, p.158

Although early studies seemed to support the RHM, subsequent empirical data contradicted the predictions of the model. De Groot and Poot (1997) conducted a translation task with Dutch (L1) and English (L2) bilinguals in the forward and backward directions. Their participants were non-fluent, advanced and fluent bilinguals. They claimed that the degree of conceptual involvement could be measured by considering the concreteness effects. They found that concreteness did not affect the performances across the three groups, suggesting that at all levels of proficiency, participants relied on conceptual links.

Talamas, Kroll and Dufour (1999) later conducted a translation task with English-Spanish bilinguals. The target words and their translation equivalents had similar semantic representations or form representations. If non-fluent bilinguals relied on the lexical associations, performance should be affected by form-related words, because hypothetically, the conceptual store is not accessed. Moreover, if more fluent bilinguals relied on conceptual-mediation, performance should be affected by semantically related words, since the semantic features are stored in the conceptual store. They found that with the false translation pairs, the less fluent bilinguals' performance was more affected by form interference as predicted by the lexical mediation links. Yet contrary to the predictions of the RHM, they observed that when lexical items were presented to more fluent bilinguals in their L1, there was more form interference than semantic interference. With the correct translation pairs, they observed that the recognition times for both groups were faster in the backward than in the forward directions, suggesting access to direct lexical links regardless of fluency levels. Their findings suggest that more-proficient bilinguals can rely simultaneously on lexical and on conceptual links to access words in the mental lexicon. In a third experiment, Talamas et al. (1999) sought to identify whether the degree of semantic similarity between items correlated with proficiency levels. With non-fluent bilinguals, a semantic interference was observed only with word pairs with a high semantic similarity rating. Conversely, with fluent bilinguals, a semantic effect was observed regardless of the degree of semantic similarity. Of relevance to the present investigation, their study provides evidence that the similarity of semantic features between items is an important determiner of the representation of lexical items in the mind, an observation unaccounted for under the RHM.

Cross-linguistically, concrete words and cognates are believed to have stronger links between the lexical and the conceptual level than abstract and non-cognate words because they are easier to perceive and have more similar forms and/or meanings (de Groot and Nas, 1991; de Groot, 1992a,b; Sanchez-Casas, Davis and Garcia-Albea, 1992). Through a series of translation recognition studies in the forward and backward directions with fluent Dutch (L1) English (L2) bilinguals, de Groot (1992a) and de Groot et al., (1994) observed that word concreteness affected performance in both directions. In de Groot’s (1992a) study, 48 participants performed a translation recognition task under two Stimulus-Onset-Asynchrony (SOA) conditions (conditions 0 and condition 240). In the SOA 0, Dutch and English words appeared on the screen at the same time. In the SOA 240, Dutch words appeared first and the English words followed after 240 ms. Participants responded faster to concrete words than to abstract words under both SOA conditions. If conceptual memory is hypothesized to be accessed in the forward direction, it remained unanswered why concrete words were recognized faster than abstract words.

De Groot, et al., (1994) extended de Groot's (1992a) study in two important ways; Dutch-English bilinguals also performed a backward translation task, and the researchers included participants with higher L2 proficiency levels. Participants from the same population, who had performed the forward translation task in de Groot's (1992a) study, performed a backward translation task. A comparison of the results from the present and the earlier study showed that conceptual memory is accessed in both the forward and backward translation directions. The second experiment included very proficient Dutch-English bilinguals. Participants performed the translation task in both the forward and backward directions. Results confirmed the previous finding indicating that conceptual memory is accessed in both directions. Taken together, these results provided empirical evidence against a strong version of the RHM.

1.2.4. The Distributed Feature Model

The findings that conceptual memory is accessed in both forward and backward directions were problematic for the RHM. Moreover, the RHM made no predictions regarding word type effects. Hinton, McClelland and Rumelhart (1986) proposed a distributed representation approach. Under this view, information at the conceptual level consists of a collection of nodes "one for each of the various meaning elements that constitute the concept" (de Groot, 1992a, p.1002). De Groot (1992a) investigated whether concreteness effects could be explained in relation to the number of shared nodes at the conceptual level across the two translation equivalents such that concrete words might share more nodes at the conceptual level than abstract words. Fluent Dutch-English bilinguals performed a normal translation production task and a cued-translation task in the forward direction. In the cued-translation task, participants were provided with a letter cue for the correct response. In both experiments, participants responded faster to concrete words than abstract words and made fewer errors with the concrete words.

To explain these findings, de Groot turned to the amodal system of distributed conceptual representations and proposed the Distributed Feature Model (DFM, 1992a). The claims under the DFM are that words are composed of a lexical and a conceptual level where the latter contains distributed meaning specification nodes with each node representing an individual meaning element. The DFM (Figure 5) depicts the lexical node for concrete words mapping onto all the feature nodes at the conceptual level. The overlap between the two languages is complete across the two languages. The lexical node for abstract words map onto fewer shared nodes at the conceptual level across the two languages, which would account for the slower and often less accurate performance for abstract words in translation tasks. For example, the word *girl* in English and *niña* in Spanish can be divided into several feature nodes at the conceptual level: +human, -male, - adult, which are shared between the word meanings across the two languages. These elements at the conceptual level are linked to a language independent node at the lexical level. More abstract concepts such as the English word *Christmas* do not share the same feature nodes at the conceptual level as the Spanish word *Navidad* (Hall, 1997). For example, the concept *Christmas* might make reference to Santa Claus whereas the concept *Navidad* may have a stronger link to the three Wise Men.

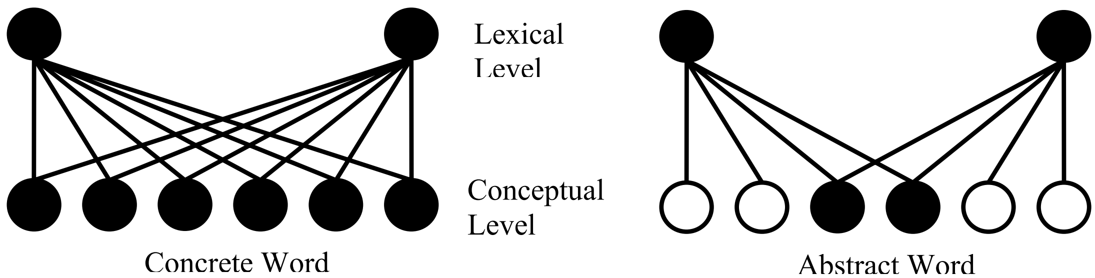


Figure 5. DFM for concrete an abstract words, adapted from de Groot, 1992a, p.1016.

The idea of distributed feature information was proposed earlier by Schreuder and Flores d'Arcais (1989) for the monolingual mental representation of words. In their view, there are three levels of representation (Figure 6). At the word level, information related to acoustic or visual patterns are coded. Levelt (1989) referred to this as the lemma level. The word level is activated through acoustic and/or visual input. The conceptual level, usually connected to the word level, is the level of knowledge representation. The third level is the semantic structure, which includes the separate conceptual elements. The semantic structure is available once the conceptual node is activated. Under the DFM, the semantic level can be understood as the mapping process between the lexical and the conceptual level that follow from the acoustic and visual activation. The conceptual node is the level containing the distributed features that make up the nonlinguistic meaning, i.e. the concept. Schreuder and Flores d'Arcais (1989) argued that the semantic representations consist of two classes of elements: Perceptual elements (P elements) and Functional elements (F elements). P elements refer to physical characteristics based on perceptual information, and F elements are based on more abstract knowledge. A given concept can be represented by both P and F elements, for example the word *firework* such that the P elements correspond to the visual representation of a firework and the F elements correspond to the notion of celebration that is associated with the concept. The strength of activation of a concept also depends on the salience of the elements. If the semantic information contains P elements with high conceptual salience and F elements, strong links will be created. Contrarily, if the semantic information contains P elements with low conceptual salience, weaker links will be created. Interestingly, the researchers obtained evidence that P and F elements are not activated simultaneously. In a primed lexical decision task, primes were either unrelated to the target or related in P and/or F elements. For example the words *ball-cherry* were considered pairs of words with shared P elements whereas *banana-cherry* shared F elements. They observed that P elements had a stronger effect in the lexical decision task such that P elements are more readily available in the earlier stages of lexical processing due to their more salient perceptual features.

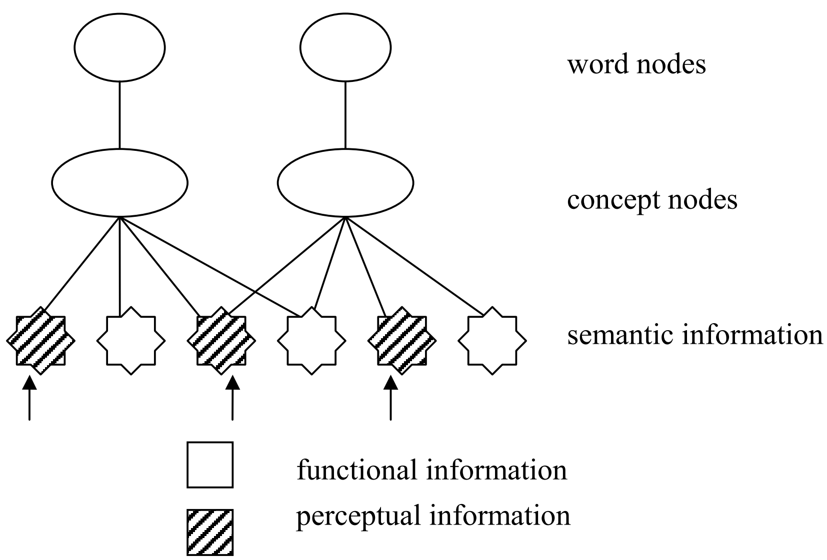


Figure 6. Three levels of representation in the monolingual mental lexicon, adapted from Schreuder and Flores D'Arcais, p.424.

Further evidence for the DMF comes from research investigating the correlation between context availability and concreteness. Van Hell and de Groot (1998b) performed a series of tasks manipulating context availability and word concreteness with Dutch-English bilinguals. Dutch-English translation pairs were either matched on context availability or confounded with context availability. They found that concreteness effects were not significant when concrete and abstract words were matched on their context availability rating. These findings suggest that concreteness alone cannot account for the concreteness effects observed in previous studies.

1.3. Translation Ambiguity

Speakers notice that words sometimes have multiple meanings or have multiple forms to express a single meaning. Because lexical ambiguity is quite common in the monolingual lexical repertoires, researchers have investigated polysemy and number of meaning (NOM) effects (Jastrzembski, 1981; Hino and Lupker, 1996; Azuma and van Orden, 1997; Hino, Lupker and Pexman, 2002). Yet Klepousniotou (2001) criticizes psycholinguistic research, claiming that the semantics and the different types of lexical ambiguity are often overlooked. She discriminates between homonymous words that have a single lexical form to express two or more different meanings and polysemous words that have a single lexical form to express different but related meanings. Klepousniotou (2001) used the word *punch* to illustrate a homonym where *punch* may refer to *a blow with a fist* or to *a drink*. She used the word *mouth* to illustrate a polysemous word where the latter can refer to *the organ* or to *the entrance of a cave*. General findings show that higher frequency words with fewer meanings are recalled faster than lower frequency words with more available meanings (Klepousniotou, 2001).

Ambiguity also exists in lexical repertoires of bilinguals. Schönpflug (1997) investigated the mean number of translation equivalents for German and English words in both the forward and backward directions. He observed that abstract German stimulus words had the most translation equivalents, followed by English abstract words, then concrete English words, and finally German abstract words. He also found that performance in a recall task with unambiguous abstract words is better than for unambiguous concrete words. This has led Tokowicz (2000) and Tokowicz and Kroll (2000; in press) to further investigate the relation between word concreteness and ambiguity.

Tokowicz and Kroll (2000) investigated the effects of concreteness and the number of translation equivalents using a translation production task with fluent bilinguals. An overall ambiguity effect was observed; words with multiple translations were translated more slowly than those with a single translation equivalent. The researchers did not find a concreteness effect when words had a single dominant translation; instead they found a concreteness effect when words had multiple translations. Ambiguous concrete words were translated faster than ambiguous abstract words. In order to account for these findings, Tokowicz and Kroll proposed a model of language production that considers the mapping between three levels of representation: the lemma level, the lexeme level (together forming the lexical level) and the conceptual level.

Figure 7 depicts the mapping process for the unambiguous concrete concept *casa*. When the lexical form for the word *casa* is activated at the lexeme level, (either through visual or aural input) it will activate its meaning representation at the lemma level and consequently activate the feature at the conceptual level. The black nodes represent activated features. Because the concepts *casa* and *house* share features at the conceptual level, (represented by the overlapping black nodes) the meaning in the target language is activated. In this case, the meaning for *house* would be activated thereby leading to the retrieval of the orthographic/phonological representation at the lexeme level.

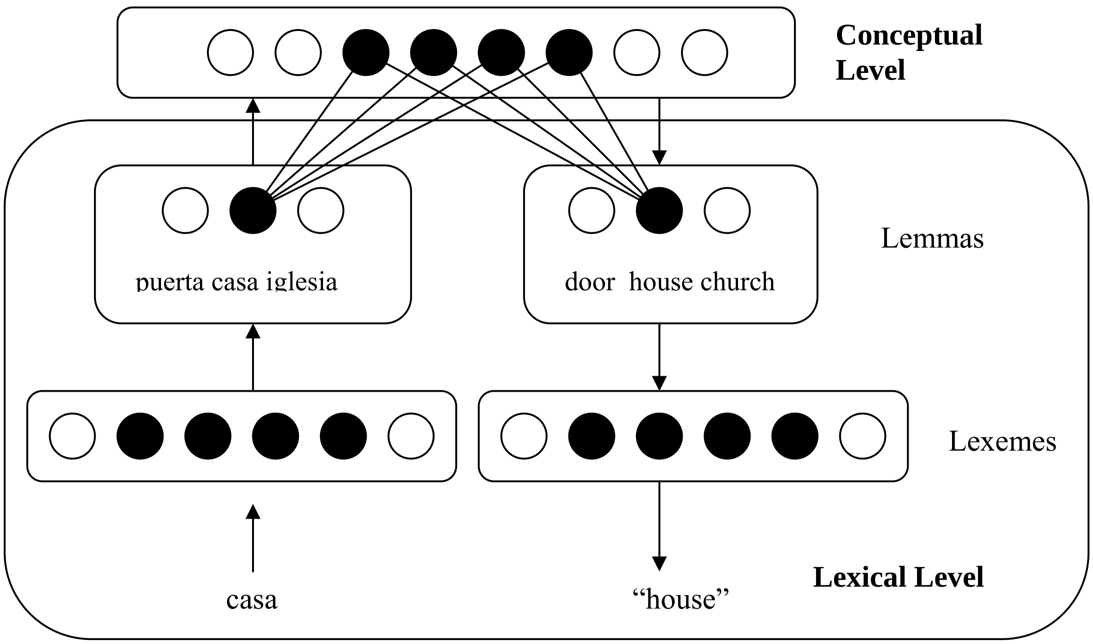


Figure 7. Tokowicz and Kroll's model of language production for unambiguous words, adapted from Tokowicz and Kroll, 2000, p.78.

The mapping process for ambiguous words slightly differs. Figure 8 schematically represents the mapping process for the ambiguous concrete concept *reloj*. In Spanish the concept for *reloj* has a single lexical representation but in English the concept for *reloj* has two orthographic representations that have slightly different meanings. At the conceptual level, multiple features are activated. This in turn may activate all the possible meanings in the target language causing competition at the lemma level between *clock* and *watch*. The simultaneous activation of multiple meanings is illustrated by the dark and dotted lines. Once the meaning resolution is complete at the lemma level, then the corresponding orthographic/phonological form representation may be activated. In this example, the meaning for *clock* was activated and mapped to its corresponding form representation.

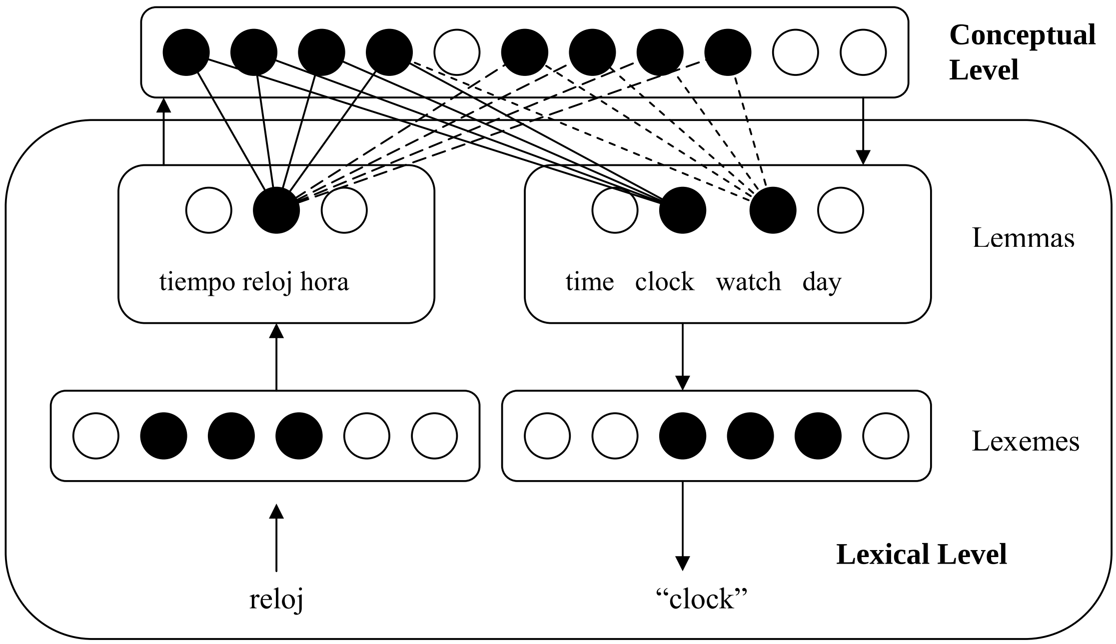


Figure 8. Tokowicz and Kroll's model of language production for words with multiple related meanings, adapted from Tokowicz and Kroll, 2000, p.78.

The model predicts that competition may also occur at the lexeme level for synonyms (Figure 9). The concrete Spanish concept *cárcel* may be expressed in English as either *jail* or *prison*. Since these are near-synonyms there should not be significant competition at the lemma level. Rather, the competition occurs at the lexeme level between one of the possible orthographic/phonological representations.

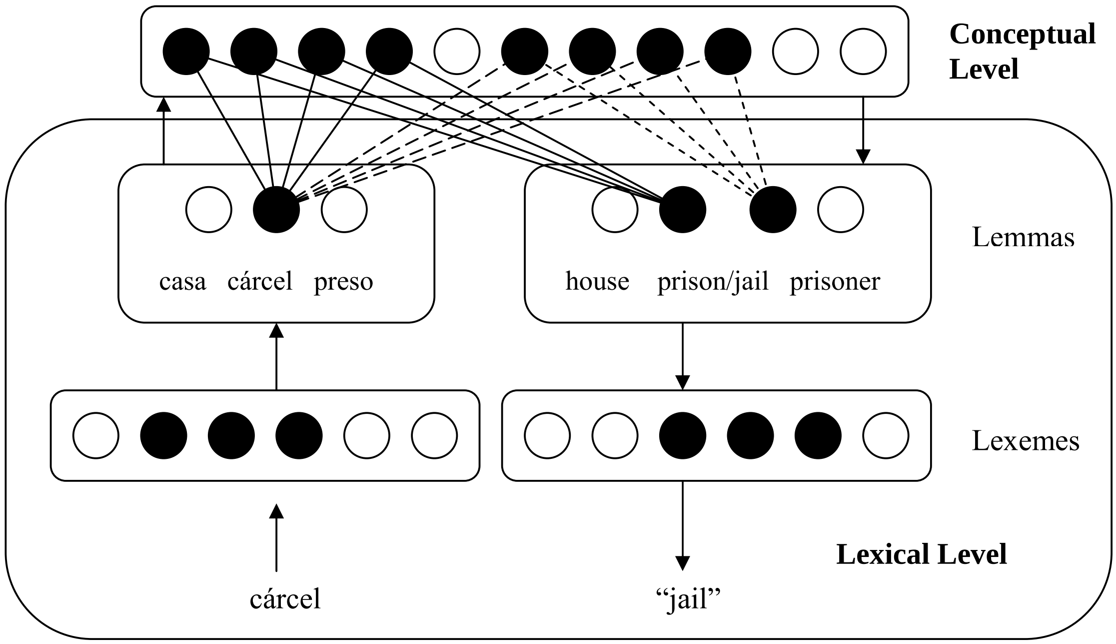


Figure 9. Tokowicz and Kroll's model of language production for synonyms, adapted from Tokowicz and Kroll, 2000, p.78.

Tokowicz and Kroll (2000) reported no concreteness effects for unambiguous concrete and abstract words. The lack of competition at the lexical level in the target language may account for the finding. Also, they reported slower RTs for ambiguous abstract words than ambiguous concrete words. This can be explained because of the fewer overlapping nodes for the abstract words leading to more severe competition between the different levels during the mapping process.

Although Tokowicz and Kroll (2000) attempted to discriminate between the types of lexical level ambiguity for their stimuli (multiple meaning and multiple lexical forms), limitations were identified. Importantly, the number of meaning norms was calculated independently of the direction of the task. In other words, in one direction, a word may have multiple translations with similar and/or unrelated meanings, whereas in the other direction, the same word could have only a single meaning. For example the word *apple* in English only has one meaning whereas the Spanish translation, *manzana,* may refer to the meaning *apple* or *street block*. Tokowicz (2000) points out it might have underestimated the effects of ambiguity. She further considered the interaction of concreteness, the number of meanings and translation equivalents and cognates in a translation production task in the forward and backward direction with Dutch-English bilinguals. Concrete words were found to be translated faster and with greater accuracy than abstract words. She also observed that the number of meanings and the number of translations affected translation production performance. Ambiguous words led to slower RT's than unambiguous words but the effect was greater for concrete words. Because Tokowicz and Kroll's model of language production (2000) predicted that ambiguity effects were greater for abstract words, these findings appeared to be problematic.

The relation between concreteness and translation ambiguity was further explored by Tokowicz and Kroll (in press). They conducted an experiment relying on a forward and backward translation production task using high frequency concrete and abstract words with a single dominant translation equivalent, for example *arrow* and *flecha*. They did not find an overall concreteness effect, which contradicted earlier findings (de Groot, 1992a). In light of these findings, Tokowicz and Kroll (in press) conducted a second translation production task, controlling the number of translation equivalents such that concrete and abstract words had either single or multiple translation equivalents. They found that the number of possible translations did not influence the translation of concrete words, resulting in equal RT's. Yet abstract words with one translation were translated more quickly than abstract words with multiple translations. They concluded that the number of translation for a given abstract word affected translation latencies and reduced translation accuracy. They posited a correlation between word-type and translation ambiguity. They explained these findings by hypothesizing a lack of competition at any level of representation when there are no alternative translation equivalents. Yet, when there are translation equivalents, the effects are stronger for abstract words since these have fewer overlapping nodes at the conceptual level.

1.4. Summary of Results

Concreteness effects have been observed with monolingual and bilingual speakers. Empirical support has been obtained from a wide range of experimental designs, namely recall tasks, lexical decision tasks, picture-naming, word-naming, translation production and recognition tasks. An apparent limitation with the previously discussed studies is the inconsistent way of treating ambiguity. In light of this discussion, it is important to further research the lexical representation of concrete and abstract words while taking into account the possible translation equivalents these may have. The research strategy and the proposed hypotheses for the present study are discussed next.

1.5. Research Strategy and Hypotheses

It is important that the number of translation equivalents for concrete and abstract words be further explored in order to reach a better understanding of lexical organization in the bilingual mental lexicon, thereby possibly obtaining stronger evidence regarding the DFM. The present study reports the results of an experiment with low-intermediate bilinguals performing a translation recognition task where the number of translation equivalents in the forward direction (Spanish →English) for concrete and abstract words was manipulated. In a timed translation recognition task, participants were asked to determine as quickly as possible whether two written word forms were true translation equivalents or not.

According to the DFM, all the feature nodes overlap for concrete words at the conceptual level. Yet the DFM makes no specific claims regarding the mapping between the conceptual level and the lexical level and ambiguity for concrete words. Because all the feature nodes at the conceptual level are shared for concrete words with single translations, it was hypothesized that the number of translation equivalents for concrete words would not affect reaction times in the forward direction in a translation recognition task (assuming that all the translation equivalents are concrete words). In Figure 10, in a modified version of the DFM, the representation for concrete words with single and multiple translation equivalents is illustrated. The dark nodes represent an overlap between the lexical and the conceptual level. For concrete words, regardless of the number of translation equivalents, complete overlap is argued to exist between the two languages and their corresponding translation equivalent. The first hypothesis was:

1. Translation recognition reaction times in the forward direction for concrete words with a single dominant translation will be as fast as those for concrete words with multiple translations.

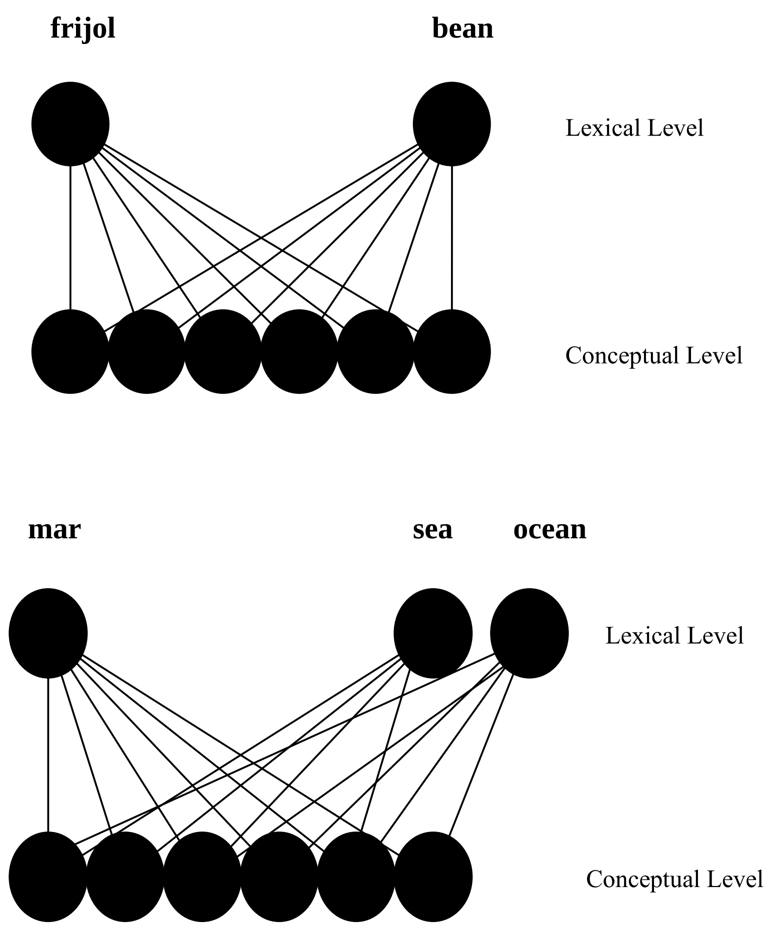


Figure 10. Representation of concrete words with single (top) and multiple (bottom) translation equivalents.

Given that the nodes at the conceptual level do not all overlap for abstract words with a single translation equivalent because of cross-linguistic differences in meaning, equal reaction times should not be obtained for abstract words with single and multiple translations. In other words, the number of translation equivalents would be an important determiner for abstract words, leading to slower reaction times when these have multiple translation equivalents. Figure 11 schematically represents the links between the lexical and the conceptual levels. The white nodes indicate that there is no overlap. When multiple translations are available grey nodes are depicted representing overlap of the feature nodes between the multiple translations across the two levels which will further delay the translation equivalent selection process. The second hypothesis was:

2. Translation recognition reaction times in the forward direction for abstract words with a single dominant translation will be faster than those for abstract words with multiple translations.

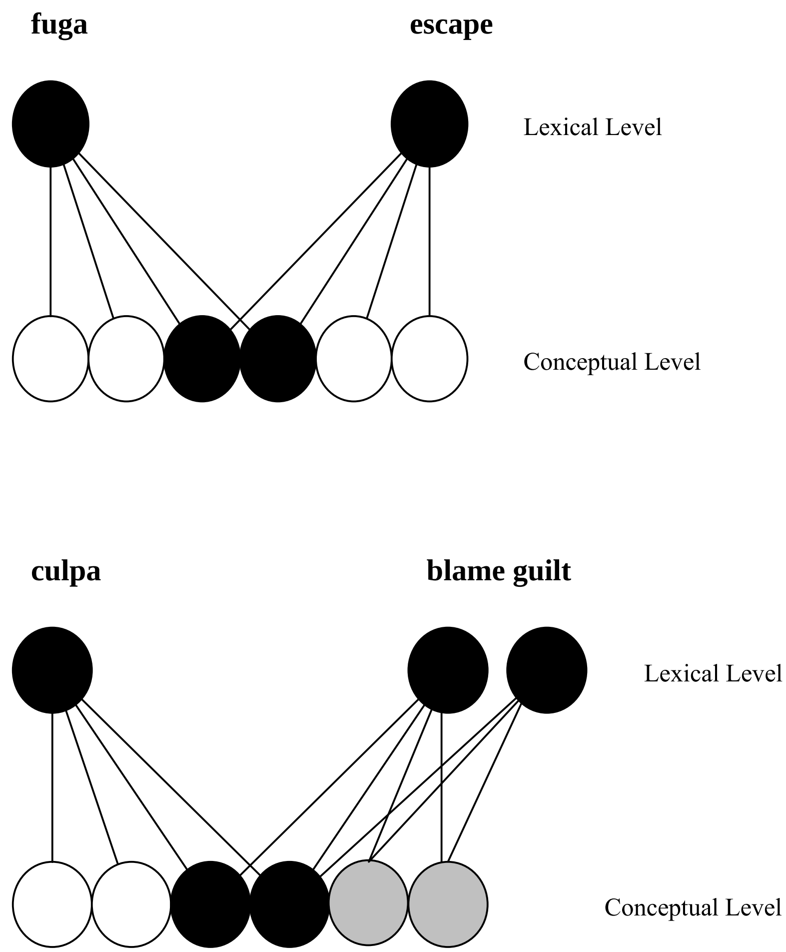


Figure 11. Representation of abstract words with single (top) and multiple (bottom) translation equivalents.

According to the DFM, a concreteness effect is expected to surface when comparing concrete and abstract words but the model makes no explicit predictions for concrete and abstract words when these have single or multiple translation equivalents.

In the present study, it was hypothesized that concrete words with single translations would be recognized as quickly as abstract words with single translations since no competition from other possible translation equivalents would occur. Figure 12 depicts less overlap across the nodes between the two levels for the abstract words but for both concrete and abstract words, there is no competition from other possible translation equivalents resulting in equal RTs for concrete and abstract words when these have a single translation equivalent. The third hypothesis was:

3. Translation recognition reaction times in the forward direction for concrete words with a single dominant translation will be as fast as those for abstract words with a single translation equivalent.

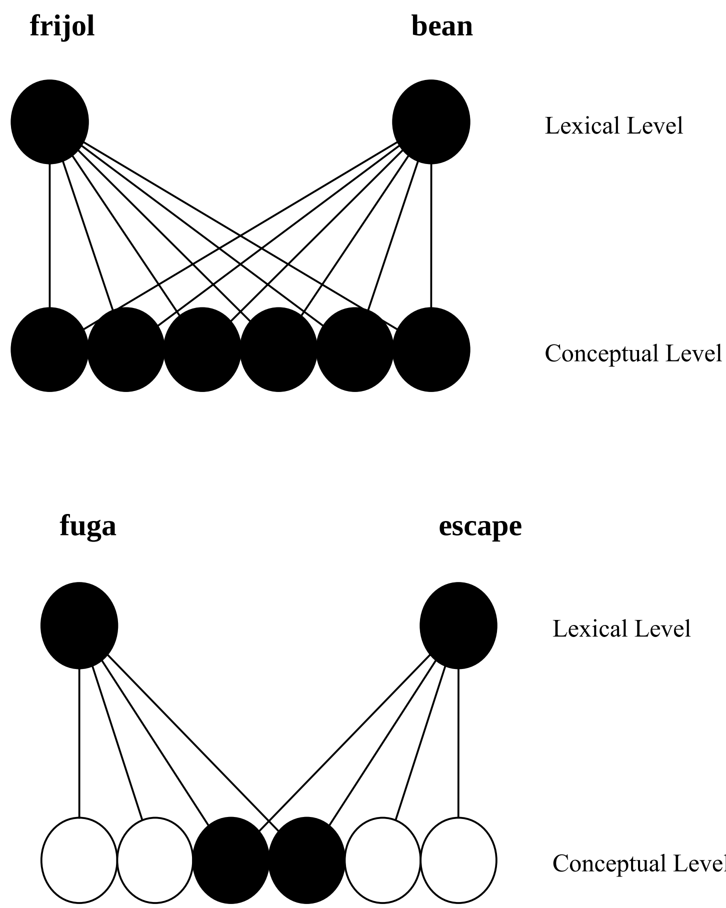


Figure 12. Representation for concrete (top) and abstract (bottom) words with a single translation equivalent.

The DFM makes no explicit predictions for a concreteness effect when words have multiple translation equivalents. Figure 13 represents a modified version of the DFM to accommodate concrete and abstract words when they have multiple translation equivalents. The black nodes again represent the complete overlap between the nodes for concrete words. The white nodes indicate that there is no overlap and the grey nodes illustrate the activation of conceptual features of possible translation equivalents that would cause competition for abstract words. For the present experiment, it was predicted that concrete words with multiple translation equivalents would result in faster translation reaction times than abstract words with multiple translation equivalents. This follows from the claim that competition for translation resolution would be greater for abstract words because of the partial overlap of the conceptual nodes with their respective translation equivalent. Thus the fourth and final hypothesis is:

4. Translation recognition reaction times in the forward directions of concrete words with multiple translations will be faster than those for abstract words with multiple translations.

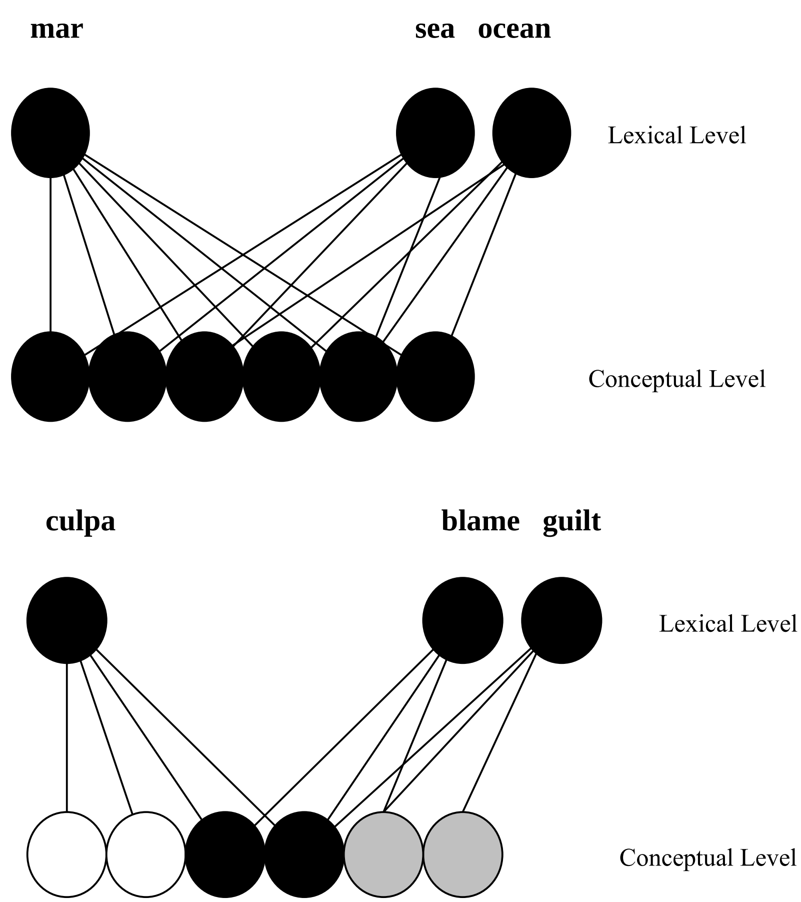


Figure 13. Representation for concrete (top) and abstract (bottom) words with a multiple translation equivalents.

The hypotheses were tested through a timed translation recognition task comparing the RTs for the stimuli for each of the four conditions. The following chapter presents a thorough description of the participants, the stimuli design and the experimental procedures.

Chapter II

A detailed description of the different stages of the experiment is provided in this chapter beginning with a description of the population who participated in the experiment followed by a discussion describing the different stages of the elaboration of the stimuli and concluding with the report of the actual experiment.

2.1. Participants

Forty-six native Spanish speakers from Mexico, enrolled in a private Mexican university, between the ages of 18-25, participated in the experiment. At the time of the study, all the participants were registered in a low-intermediate English as a foreign language (EFL) course. In order to register in this particular course, students must obtain a minimum score of 460 on the TOEFL test.

Although 11 intact English language groups were involved during the pre-testing and the testing phases, participants from five of the eleven intact groups performed the actual experiment and earned extra academic credit for their participation.

2.2. Materials

2.2.1. Stimuli

The final stimuli set consisted of 176 Spanish-English translation pairs. There were 88 true Spanish-English translation pairs and 88 false Spanish-English translation pairs (see Table 1. for examples). The translation pairs were presented in four conditions, including 22 Spanish-English translation pairs per condition. Condition one, the concrete multiple condition (CM), included concrete Spanish-English words which had multiple translation equivalents in English. Condition two, the abstract multiple condition (AM), included abstract Spanish-English words which had multiple English translations. The multiple translation equivalents in English were either synonyms or homonyms. Condition three, the concrete single condition (CS), included concrete Spanish-English translation pairs. A single translation equivalent for the given Spanish word was identified in English. Condition four, the abstract single condition (AS), included abstract Spanish-English translation pairs. A single dominant equivalent for the given Spanish word was available in English. Appendix A lists the true translation pairs per condition. The false translation set consisted of 44 concrete and 44 abstract Spanish-English translation word pairs. The false translations served as distracters and were not taken into account in the data analysis. The number of translations for these was not evaluated because they were nonsense translation equivalents created for the purpose of the experiment.

Condition	Definition	Spanish	English Translation Equivalent One	English Translation Equivalent Two
Condition One - Concrete Single (CS)	One translation available in the English Language	*labio*	*lip*	*X*
Condition Two - Concrete Multiple (CM)	Two or more translations available in the English Language	*piedra*	*rock*	*stone*
Condition Three - Abstract Single (AS)	One translation available in the English Language	*creencia*	*belief*	*X*
Condition Four - Abstract Multiple (AM)	Two or more translations available in the English Language	*alma*	*soul*	*spirit*

Table 1. A sample list of the stimuli, per condition.

For the translation recognition task, participants needed receptive knowledge of the stimuli in order to determine whether the English words were true translation equivalents of the Spanish words (i.e. *mar* – *sea*) or were false translation equivalents of the Spanish words (ie. *cocina* – *lamp*). Receptive knowledge is the ability to recognize a word and its translation equivalent without necessarily being able to produce a written or oral translation equivalent (Nation, 2001). Moreover, since ambiguity effects were under investigation, it was important that participants have receptive knowledge of multiple possible translation equivalents for stimuli in Condition one (CM) and Condition two (AM).

The next section describes the stages involved in the creation of the stimuli, starting with the initial translation production task to the final experiment. These satges are summarized in *Figure 14*.

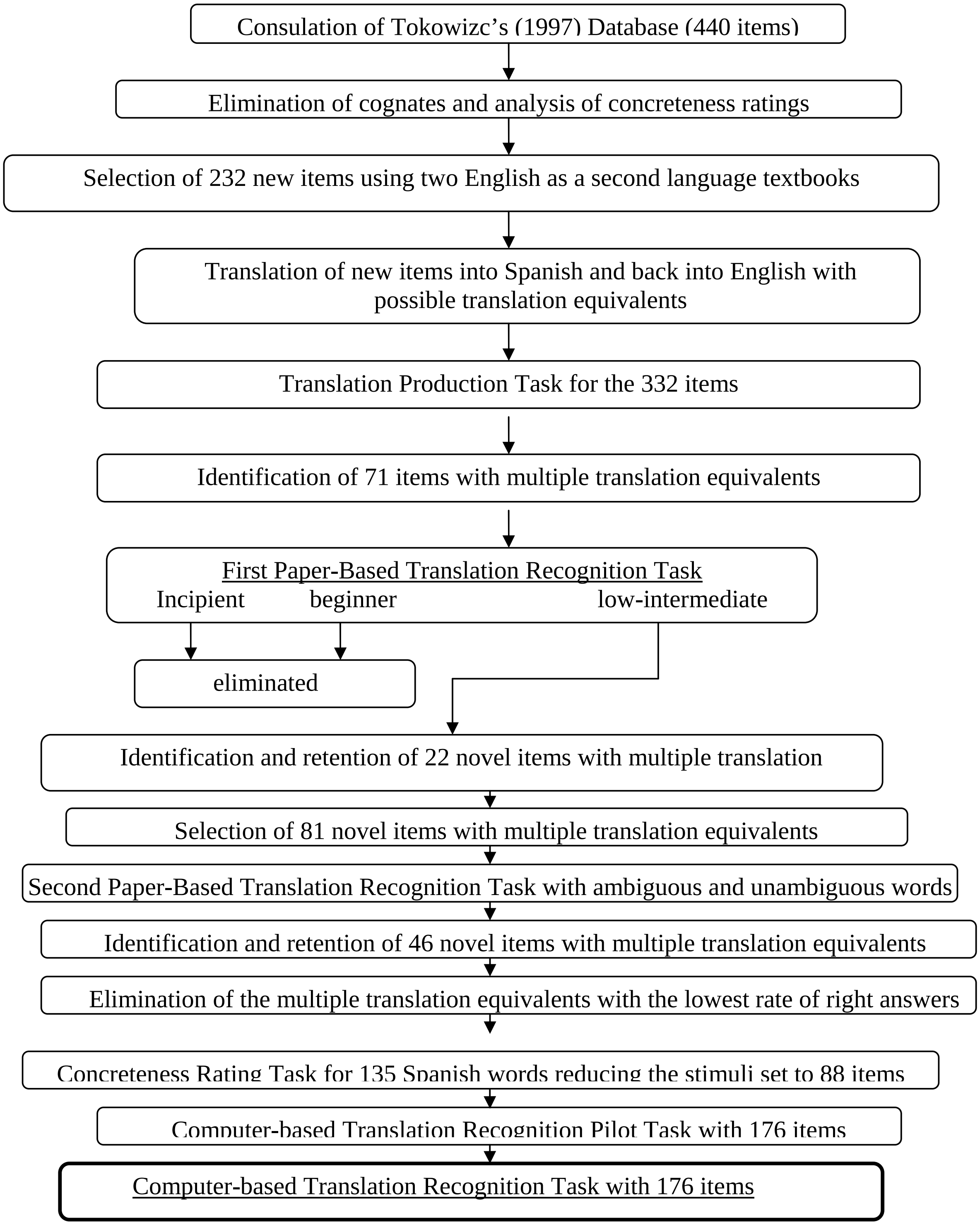


Figure 14. Map of the processes involved in the creation of the stimuli.

In order to create the true translation pairs, a database consisting of 440 items, previously used by Tokowicz (personal communication, November, 2005) in a translation production experiment, was consulted. This database included Spanish-English translation equivalents and number of translation equivalents in each language. Concreteness, context availability, imagery and word length norms were also available. A careful analysis of the items led to the identification of some limitations. A considerable number of words were cognates. Cognates are words that share phonological and/or orthographic form between two languages and that may also be semantically related (Hall, 2002). Given that this study was not interested in typology effects, no cognates were included. The second limitation surfaced after closely analyzing the concreteness ratings. It was not made clear whether the concreteness ratings had been obtained for the English words, the Spanish words or both. Although translation equivalents are believed to be linked to a shared conceptual representation in the bilingual mental lexicon, concreteness ratings can differ. This can primarily be observed with homonyms which are two different concepts that link up to a single word form in one language (Hall, 2005). Let us return to the previously mentioned example *manzana*. In Spanish, the word *manzana* is the translation equivalent of the English word *apple*. Here, both the L1 and the L2 forms share the same syntactic category and link-up to the same semantic features at the conceptual level. Nonetheless, in Spanish, the word *manzana* can also mean a *street block*, a more abstract concept. If concreteness ratings were obtained from a native Spanish speaker for the word form *manzana*, both concepts could have been evoked, affecting the concreteness rating. Finally, cultural experience can affect how word forms are perceived and linked to a conceptual representation. For instance, the concreteness norms from Tokowicz study included the word *market* as abstract. From a North American perspective, this can be understood if one assumes that this word form is linked to the abstract notion of *financial market*. In Mexico, *mercados* are still very present (in a physical sense) in the society and are not considered abstract concepts.

In light of these arguments, the database was highly scrutinized and consequently reduced to 100 items. It was imperative to expand the list since the receptive knowledge of these items and their concreteness rating had yet to be evaluated with the target population. The English as a second language textbooks Northstar (Haugnes and Maher, 1998) and Skyline (Skyline, 2001), presently used at the private Mexican university where the experiment was conducted, were consulted. Two hundred and thirty two new items were identified. These items were translated into Spanish by the researcher (a balanced English-Spanish bilingual with knowledge of the regional and national cultural backgrounds of the participants) and preliminary translation equivalents were confirmed by consulting the Spanish-English Collins Dictionary (2000) and confirmed by a balanced native Spanish-English bilingual.

Since the lexical knowledge of the participants was tested in the translation recognition task, it was important to consider multiple translation equivalents that reflected the participants' English vocabulary knowledge. The initial translation equivalent norms were obtained by conducting a translation production task adapted from Schönpflug's (1997) first translation method, with 23 native Spanish participants from an intact English class with a slightly more advanced level. It was hypothesized that their productive knowledge would resemble the receptive knowledge of the target population. Each participant was given a list of 166 words and was asked to provide the translation equivalent, a task which lasted approximately 10 minutes. Five distinct lists were created (randomized using the random function in Excel), to eliminate any ordering effects. Participants received written and oral instructions in Spanish and were instructed to write the first English translation equivalent that came to mind for each Spanish word (see Appendix B for the instructions). If a word evoked more than one possible translation, they were asked to provide it.

The results were compiled manually in an Excel worksheet. Each different translation equivalent and occurrence of a given response was recorded. Spelling mistakes were ignored. All words with multiple translations were included in the stimuli list that would later be piloted in a paper-based translation recognition task with the target population. This led to the identification of 71 new items.

The following stages involved a series of paper-based translation recognition tests designed to test the participants' knowledge of the multiple translation words. Participants were given a list of translation pairs and asked to identify true and false translation pairs by writing an *S* (for true) and *N* (for false) (see Appendix C for instructions). Individual participants only saw one of the two possible translation pairs in order to avoid any priming or familiarity effects. For example, List A included the Spanish word *cuadro* and the true English translation equivalent *square* and List B included the true English translation equivalent *painting* (for the word *cuadro*). Moreover, each list included an equal number of false translation pairs that were both concrete words (*piel* – *tool*) and both abstract words (*bostezo* – *people*). Ten distinct randomized lists were created to eliminate any ordering effects.

The tests were performed by incipient, beginner and low-intermediate groups in order to identify participants with knowledge of multiple translations. The yes/no answers for each participant were manually recorded into an Excel worksheet. To score the true translation pairs, correct answers received a score of one and wrong answers received a score of zero. For each true translation pair, the correct answer percentage was calculated, and words that had a response rate of 70% and over were kept. This stage was crucial for a successful timed translation recognition task and confirmed that incipient and beginner learners of English could not perform a test investigating the effects of lexical ambiguity since only one of the possible translation equivalents was known by a high percentage of the participants. After analyzing the responses, the low-intermediate group was chosen for the experiment. The results from 37 participants from the four intact low-intermediate English groups were retained, producing a total of 22 word pairs, namely 11 abstract and 11 concrete Spanish-English pairs, with multiple translation equivalents in English.

These findings called for a second pre-testing phase with low-intermediate participants to expand the stimuli set. In order to generate a new stimuli set with multiple translation equivalents, 81 English words were taken from the British National Corpus (Leech, Rayson, and Wilson, 2001). Because high-frequency words are often learned in the earlier stages of vocabulary development, it was hypothesized that the low-intermediate participants would already have knowledge of translation equivalents and possibly have learned some second translation equivalents. Words from the entire corpus with a minimum frequency of 75 per million words could be included. In order to obtain English translation equivalents, the researcher first provided a Spanish equivalent for the English words and translated these back into English while providing multiple translations (when possible).

The translation production task stage was eliminated at this point because the multiple translation word pairs obtained during the production task were often not recognized in the translation recognition task. The knowledge discrepancy of ambiguous English words between low-intermediate and advanced learners of English was noticeable. The second, paper-based translation recognition task was performed by 38 participants from two intact low-intermediate classes. This list further integrated possible single translation equivalents that had been established during the translation production phase. Here, 6 distinct randomized lists were created, using the random function in Excel, to eliminate any ordering effects.

The responses were tabulated using the same method as the first translation recognition task. Again, Spanish words with single or multiple translation equivalents, that had a mean correct response rate between 70% and 100%, were accepted. Forty-six new items with multiple translations were identified, creating a word bank of 68 items with multiple translations.

For the multiple translation pairs, only one of the possible translation equivalents was included in the final stimuli set. Therefore, the translation equivalent with the lowest correct answer rate was eliminated. If results from the experiment demonstrate that ambiguous words are recognized slower than unambiguous words, keeping the dominant translation equivalent would provide stronger evidence for ambiguity effects. If the translation pairs with the lowest correct answer rate were kept and an ambiguity effect would surface, it would remain unclear whether this could be attributed to the weaker connections between the lexical and the conceptual level. Figure 15 presents the distribution of the percentage of correct answers for the translation pairs with multiple translation equivalents that were included in the study. Sixty-four percent of the abstract translation pairs and 61 percent of the concrete translation pairs were known to all the participants.

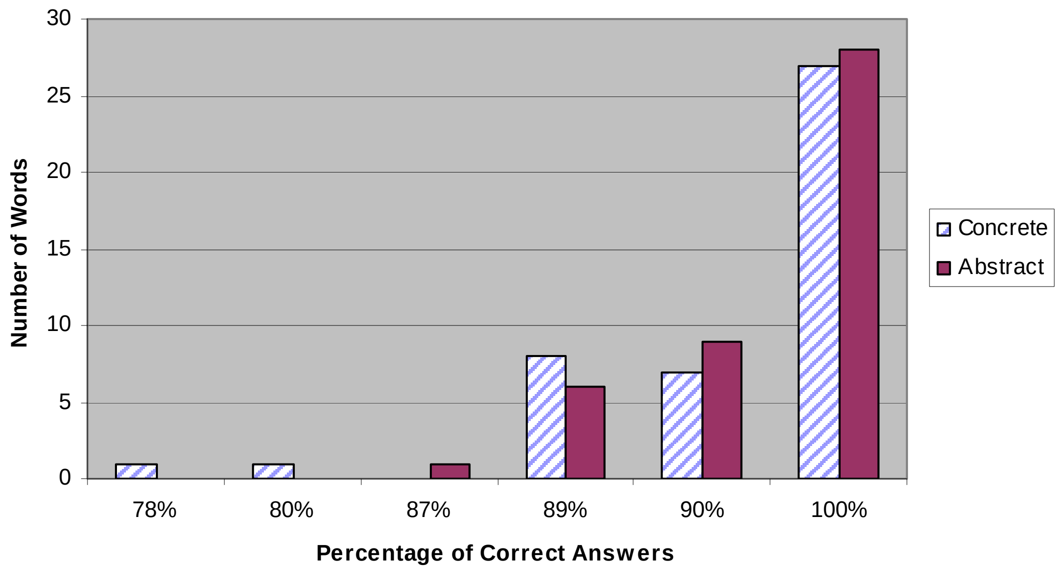


Figure 15. Distribution of the percentage of correct answers for paper-based translation recognition task for the 88 translation pairs separated by concreteness.

2.2.2. Concreteness Norms

In order to create a reliable stimuli set, concreteness ratings were obtained for the Spanish words from the true translation pairs. Twelve other randomly selected Spanish native speakers provided concreteness ratings for 135 Spanish words, using a 1 to 7 point Likert scale, 7 being the most concrete and 1 the most abstract (Paivio, Yuille and Madigan, 1968). Participants were given oral and written instructions in Spanish to ensure that they had the same interpretation of the terms *concrete* and *abstract* (described in Appendix D). For this experiment, a concrete term was defined as a word for a tangible concept that could be experienced by our senses. An abstract concept is one that cannot be perceived by one of our senses. Participants were reminded to use the entire scale providing the first rating that came to mind. They were given three sample words, to get them to think about the subtle differences between concrete and abstract words. Again, five distinct randomized lists were created, using the random function in Excel, to eliminate any ordering effects. Concreteness ratings were manually recorded in an Excel worksheet. For each item, the sum was calculated and divided by the number of participants. The results from one participant were eliminated because the instructions were misinterpreted and the grading scale was inverted. Although the majority of the abstract words obtained a rating of four or below, one item, whose rating was slightly above the 4.0 cut-off, namely 4.2, was included in the stimuli set. Similarly, a word whose rating fell slightly below 5 points was included in the concrete category, with a rating of 4.83 (see Appendix E for a complete listing). Figure 16 presents the distribution of the concreteness ratings and the number of words included under each range.

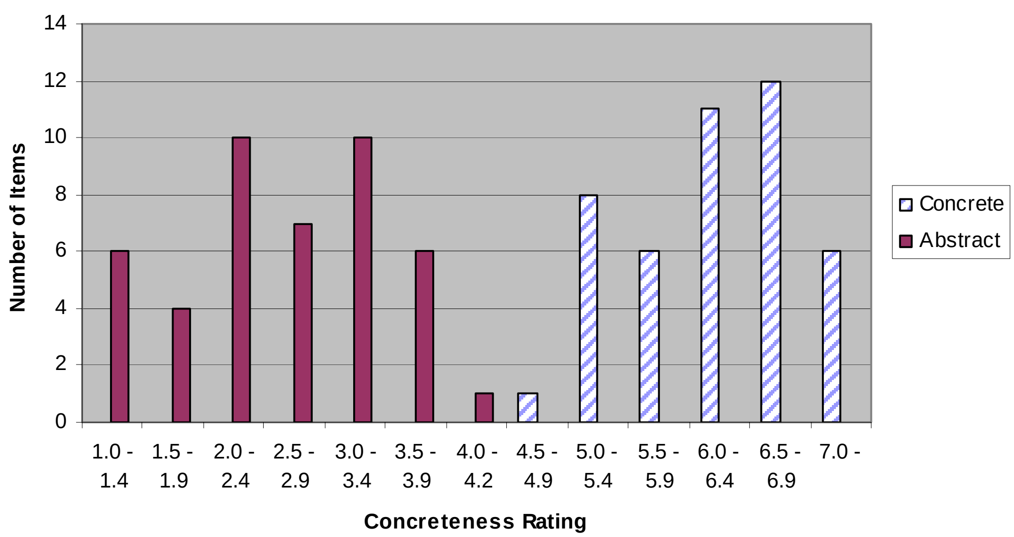


Figure 16. Comparison of concreteness rating distribution for abstract and concrete words.

The distribution shows how concepts are seldom perceived as purely concrete or purely abstract, since words are distributed across the scale of 1-7. Moreover, the concrete word distribution tends to be denser in the upper scale (between 6 and 7), and the abstract words are more equally distributed across the scale. Again, this can be explained by the greater perceptual salience for concrete words.

Another variable that was controlled was the number of letters for both the Spanish word and the target translation equivalent. The majority of the words had between 4 and 6 letters. Figure 17 illustrates the distribution of letters across the words for the two languages. A higher number of longer Spanish words was expected since Spanish is a highly inflectional language. In order to reduce any possible effects related to word length, the number of letters was balanced across false translation pairs which produced a mirror effect of this distribution.

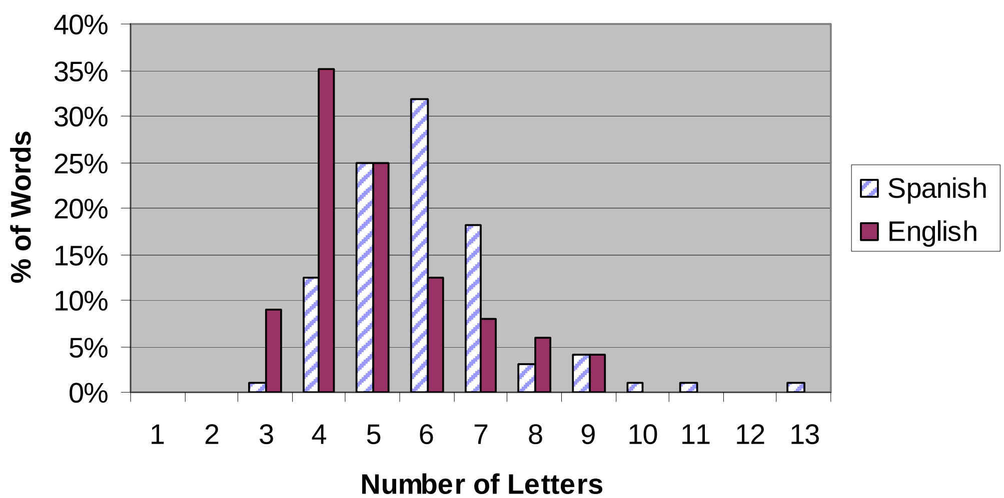


Figure 17. Number of letters for the true translation pairs.

Originally, only concrete and abstract nouns would make up the stimuli set, yet because a word and its translation equivalent do not always share the same syntactic category, the final stimulus set included both words that were either nouns, verbs or adjectives.

2.2.3. Pre-Test: Piloting the Software

A pilot session with the final stimuli set was conducted in the psycholinguistic laboratory at the Universidad de las Américas, Puebla, on 9 Dell PCs, using DMDX software. The clarity of instructions, the length of the task and the speed of appearance and disappearance of individual items on the screen was evaluated. Nine undergraduate students, registered in a psycholinguistics course, performed two versions of the task. For group A, after 88 items, a prompt appeared on the screen informing them that they had reached the half-way mark. They could choose to break and resume with the experiment at their convenience. For group B, such a prompt was not presented. Feedback, obtained from a questionnaire (see Appendix F and G), showed that continuous running was preferred by participants from group A and group B confirmed that such a break was no necessary. Given that a few participants would have preferred a longer practice trial, extra practice translation pairs were incorporated. The final modifications were made to the software instructions and the final stimuli list was embedded in the DMDX software specifications.

2.3. Procedure

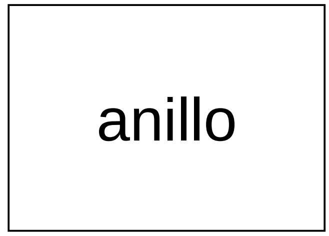
2.3.1. DMDX Software

The experiment was run on 4 Dell PCs in the psycholinguistics laboratory at the Universidad de las Américas, Puebla. The stimuli were presented on computer screens using DMDX, which permitted the recording of reaction times per participant and per item across the four conditions. The successful recording of the reaction times is guaranteed by first running the TimeDX software (see Appendix H for a complete description of the TimeDX).

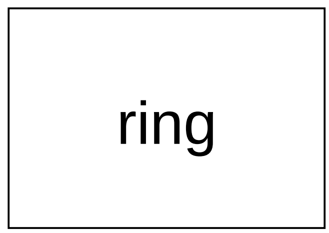
The words appeared in Arial Black font, size 24 on a white background as illustrated in Figure 18. Data presentation in a translation recognition task can follow various timing sequences. Under an SOA of 0 milliseconds, words in both languages are presented at the same time. Under an SOA condition greater than 0 milliseconds, words are presented at two different times. Based on previous work (de Groot, 1992a), it was decided that the Spanish word would appear on the screen first for 472 milliseconds and then disappear to be immediately followed by the English translation for 708 milliseconds. The next item followed after 2810 milliseconds[1]. This timing sequence was selected to provide participants with enough time to read and recognize the word in their L1, but not have enough time to think of a translation. Each sequence lasted 4000 msec. If no answer was provided, the next item would automatically appear on the screen. An SOA 0 condition was not chosen because it would be impossible to discriminate between the time needed to read and process the word in the L1 and the time needed by the participant to recognize the translation in the L2.

---

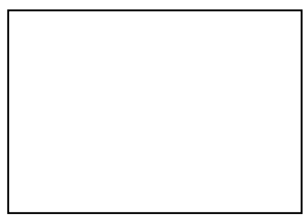
[1] These numbers are not round numbers since DMDX requires that the SOA be measured in a unit labeled ticks, where one tick equals 11.80 milliseconds.



Screen 1 appearing for 472 milliseconds and disappearing



Screen 2 appearing for 708 milliseconds and disappearing



Screen 3 appearing for 2810 milliseconds and disappearing

Figure 18. The sequence of three screens that each participant saw for the 176 experimental items.

Each session began with a greeting written in Spanish. In order to begin the experiment, participants had to press the wheel of the mouse. This was specified at the bottom of the screen. The next slide explained that they were participating in an activity designed to help the Language Department gain insight into students' knowledge of English vocabulary. It specified that they would first see a word written in Spanish, followed by a word written in English. Their task was to decide, as quickly as possible, whether the word pairs were true or false translation equivalents. Next, they were told to keep their finger on the wheel of the mouse at all times, between answers. They were told that when a true translation pair appeared on the screen, they had to click on the right button of the mouse, marked by a green sticker. When a false translation appeared on the screen, they had to click on left button of the mouse, marked by a red sticker. At this point, they were informed that they would begin with a practice trial and were reminded that they had to provide an answer as quickly as possible. After the practice trial, a message appeared on the screen informing them that the researcher would enter the room shortly to provide any clarifications. Next, participants were informed that they could begin the experiment by pressing the wheel of the mouse. Once they had viewed the 176 items, a final message appeared on the screen asking them to remain silent until all the participants had concluded the task and the researcher entered the room.

Each student was received in the control room in the psycholinguistic laboratory at the Universidad de las Américas, Puebla. They were invited to go into the experiment room and choose one of the four computers. They were also asked to turn off their cellular phones. They were then orally informed that they would be taking part in an experiment conducted by the Language Department in which they were asked to determine, as quickly as possible, whether word pairs were true or false translation pairs by pressing the right button of the mouse for a positive response and the left button of the mouse for a negative response. At this point, they were informed that they would receive written instructions, followed by a practice trial, in order to familiarize themselves with the task and the hardware. From the control room, the researcher could identify when all participants had completed the practice trial. She then entered the experimental room in order to clarify any questions or concerns they might have. After clarifying any doubts, they were asked to press the wheel of the mouse for the next written instructions and were reminded to keep quiet throughout the entire experiment. Once all participants completed the task, the researcher entered and informed them that they had concluded the experiment.

In the last stage of the experiment, participants were asked to fill out a language questionnaire adapted from Tokowicz (2000), which was designed to measure individual language learning experiences (see Appendix I). Although participants from intact English classes were invited to participate in the study to ensure homogeneity across proficiency level, the results showed that participants had very distinct experiences learning English. The mean number of years learning English was 10 years. Previous studies considered their participants to be advanced or fluent after such a high number years of exposure which could lead one to believe that their proficiency level was underestimated. Yet, it is important to note that more than 50% of the participants had some experience living in an English speaking country. Nonetheless, only 60% of these participants obtained formal instruction classes. Moreover, these participants are not required to use English for educational purposes. Because the TOEFL test requirement for this class is 460, it was concluded that the participants did not have a high proficiency level at the time of the study (see Appendix J for a discussion of the results). The claim that they have a low-intermediate level of English is sustained.

This concluded the experimental task. Participants were then thanked for their interest and for their voluntary participation. The next chapter presents the results obtained from the experiment.

Chapter III

The following sections present the results and discuss the statistical analyses performed on the data to identify the possible interactions between the conditions.

3.1. Data trimming

In a translation recognition task, it is important for the participants to have knowledge of the stimuli. Data from participants who obtained a 10% error rate or above were eliminated from the analysis, reducing the final sample size from 46 to 35 participants. It was considered that these participants did not have representative knowledge of the stimuli for the target population. Table 2 summarizes the total error rates and specifies the number of participants. The mean error rate for the 46 participants was 7%, and 5% for the 35 participants which suggests that the words were accurately chosen for the translation recognition task.

Error Rate	Total Number of Participants	Removed
0%	1	
1%	3	
2%	3	
3%	6	
4%	2	
5%	4	
6%	7	
7%	3	
8%	2	
9%	4	
10%	3	X
11%	1	X
12%	1	X
15%	4	X
19%	1	X
21%	1	X

Table 2. Error rates with respective number of participants

The overall mean RTs across 35 participants and 88 items was calculated and the standard deviation was obtained, summarized in Table 3. A difference between the mean reaction times across the participants and items surfaced after the elimination of the data from the 11 participants. Also, all the RTs below or above two and a half times the standard deviation were discarded from the analysis to eliminate any outliers.

	Mean Reaction Time (M)	Standard deviation (SD)	Sample size (N)
Participant Means	840.3279627	184.36	35
Item Means	846.6679	158.05	88

Table 3. Participant and item mean reaction times.

3.2. Results

Empirical results have traditionally identified a concreteness effect where concrete words are recognized faster than abstract words (de Groot, 1992a; de Groot et al.,1994; van Hell and de Groot; Schönpflug, 1997; Tokowicz and Kroll, in press). In order to identify a concreteness effect for the present data, the mean reaction times were obtained across participants and items and are summarized in Table 4. The mean reaction time for concrete words is faster than the mean reaction times for abstract words across items and across participants.

	Mean Reaction Time (M)	Standard deviation (SD)	Sample size (N)
Participant Means			
Concrete	740.1418484	111.74	35
Abstract	785.9603368	111.4	35
Item Means			
Concrete	738.8469663	75.615	44
Abstract	786.275085	96.584	44

Table 4. Participant and item mean reaction times, standard deviations and sample size for concrete and abstract words

In order to test whether these means were significantly different, an unpaired t-Test was performed. With an alpha level of 0.05, the difference across participants was not considered quite significant. The difference across items on the other hand was considered to be statistically significant, $F = 6.58$, $p < 0.0121$.

Empirical results from previous studies further shown ambiguity effects (Tokowicz and Kroll, 2000; in press). It was thus important to identify whether ambiguity effects manifested themselves independently of concreteness effects for the present data. The mean reaction times were obtained across participants and items summarized in Table 5. The mean reaction times for the multiple translation equivalents are slower across participants and items than for the single translation equivalents.

	Mean Reaction Time (M)	Standard deviation (SD)	Sample size (N)
Participant Means			
Multiple Translation Equivalents	780.269126	106.11	35
Single Translation Equivalents	744.6388388	117.38	35
Item Means			
Multiple Translation Equivalents	781.9731334	89.832	44
Single Translation Equivalents	743.148918	85.768	44

Table 5. Participant and item mean reaction times, standard deviations and sample size for multiple and single translation equivalents.

In order to test whether these means were significantly different, an unpaired t-Test was performed. With an alpha level of 0.05, the difference across participants was not statistically significant. The difference across items was considered significant, $F = 4.3$, $p < 0.0411$.

The present study sought to identify an interaction across the four conditions. The mean reaction times were obtained across the four conditions for participants and are summarized in Table 6. Only the correct data from the true translation pairs were considered in the statistical analysis. The mean reaction time for concrete words with single translations was recognized faster, followed by concrete words with multiple translations, than abstract words with single translations and finally, the abstract words with multiple translations were recognized the slowest.

Condition	**Mean Reaction Time (M)**	**Standard deviation (SD)**	**Sample size (N)**
Condition 1 Concrete Single (CS)	723.3736615	123.04	35
Condition 2 Concrete Multiple (CM)	755.3380616	107.55	35
Condition 3 Abstract Single (AS)	766.9873261	119.49	35
Condition 4 Abstract Multiple (AM)	805.1497692	92.781113.96	35

Table 6. Mean reaction times, standard deviation and sample size across participants.

In order to test whether these means were significantly different, a one-way Analysis of Variance (ANOVA) test was performed. With an alpha level of 0.05, the difference across participants was statistically significant, $F(3, 136) = 2.96$ $p < 0.0347$.

In light of these findings, a Tukey-Kramer Multiple Comparisons Test was performed to identify significant differences between the individual conditions. A significant difference between Condition 1 (CS) and Condition 4 (AM) is reported where q is greater than 3.683 and is $p<0.05$. The reaction times for participants under Condition 4 were slower than those from Condition 1.

A second analysis was performed on the items' means. The mean reaction time and the standard deviation were obtained and are summarized in Table 7. Similar results were obtained to the participant analysis where concrete words with multiple and single translations were recognized faster than the abstract words with single and multiple translations.

Condition	**Mean Reaction Time (M)**	**Standard deviation (SD)**	**Sample size (N)**
Condition 1 Concrete Single (CS)	720.183637	69.657	22
Condition 2 Concrete Multiple (CM)	757.5102957	78.266	22
Condition 3 Abstract Single (AS)	766.114199	95.421	22
Condition 4 Abstract Multiple (AM)	806.4359711	95.626	22

Table 7. Mean reaction times, standard deviation and sample size across items

In order to test whether these means were significantly different, an ANOVA test was performed. With an alpha level of 0.05, the difference across items was statistically significant, $F(3, 84) = 3.77$, $p < 0.0136$, indicating a significant difference between these conditions.

In light of these findings, a Tukey-Kramer Multiple Comparisons Test was performed to identify significant differences between individual conditions. Similar results were again obtained where the means from the abstract multiple and the concrete single interact significantly where abstract words with multiple translations are recognized more slowly than concrete words with single translations. The value of q was greater than 3.716 and the P value is less than 0.05.

In both the analyses for participants and for items, the abstract multiple and concrete single conditions are significantly different in the expected direction. The mean reaction time is greater for the abstract multiple condition than the single concrete condition. Let us now consider these results in detail in light of the DFM (de Groot, 1992a).

Chapter IV

General Discussion

In this chapter, results are discussed and linked back to the predictions of the Distributed Feature Model (de Groot, 1992a), identifying its strengths and weaknesses in light of the new empirical data. Following this discussion, the results are discussed through the theoretical framework of Tokowicz and Kroll's model of language production (2000). The discussion concludes by presenting methodological limitations and proposing future studies that could complement the present research.

Empirical findings suggest a concreteness effect with monolingual speakers (Paivio, 1971; Kieras, 1978; Schwanenflugel and Shoben, 1983). In light of this claim, concreteness effects have been researched with different bilingual populations and the early findings congruently support a concreteness effect (de Groot, 1992a; de Groot et al., 1994; de Groot and Comijs, 1995; de Groot and Keijzer, 2000; van Hell and de Groot, 1998a). Nonetheless, there is a lack of empirical evidence documenting an interaction between concreteness and ambiguity effects.

In this study, a concreteness effect was found only across items. A concreteness effect across participants was considered not quite significant. This partially replicated earlier empirical findings which were obtained using translation production tasks primarily with fluent bilinguals in both the forward and backward directions (de Groot, 1992a; de Groot et al.; Tokowicz and Kroll, in press). The concreteness advantage can be explained under the DFM which schematically represents the links between the lexical level nodes and the conceptual level nodes for unambiguous concrete and abstract words. Under the claims of the DFM, the lexical level contains language-specific information related to word form, grammatical properties and syntactic specifications. The conceptual level, on the other hand, consists of information related to meaning specifications. It is argued that the lexical node for concrete words in one language is linked to all the nodes at the conceptual level. These in turn are linked to the corresponding translation equivalents' lexical node in the other language. The overlap at the conceptual level between the two languages is argued to account for the faster recognition and production times for concrete words. The lexical nodes for abstract words in one language, on the other hand, are linked to fewer nodes at the conceptual level. Moreover, fewer nodes are shared between abstract words across the two languages due to greater cross-linguistic meaning variance. The limited overlap at the conceptual level may account for the slower reaction times for abstract words.

Equally important, the results of this study confirmed the reliability and validity of both the stimuli and the experimental design since the typical concreteness effect surfaced when translation ambiguity was not taken into consideration across items.

Previously, Tokowicz and Kroll (2000) observed an overall ambiguity effect with bilingual speakers, where ambiguous words were translated more slowly than unambiguous words. Although the aim of the current study was to identify an interaction between concreteness and ambiguity, it was important to determine whether ambiguity effects surfaced, independently of word concreteness. Results support an ambiguity effect across items where ambiguous words were recognized slower than unambiguous words in the forward direction (Tokowicz, 2000; Tokowicz and Kroll, 2000; in press). The present results also confirm the validity and reliability of the number of translation norms.

Finally, the concreteness effects and the number of translation effects surfaced independently from one another, confirming the adequacy of the translation recognition design for the low-intermediate population. At this point, the specific hypotheses will be discussed in light of the results.

4.1. Theoretical Implications

4.1.1. The Distributed Feature Model

The investigation sought to identify an interaction between concreteness and ambiguity effects. At the onset of the research, four specific hypotheses were formulated. The first hypothesis posited that concrete words with a single translation would be recognized as fast as concrete words with multiple translations. The second hypothesis posited that abstract words with a single translation would be recognized faster than abstract words with multiple translations. The third hypothesis posited that concrete words with a single translation would be recognized as fast as abstract words with a single translation equivalent. Finally, the fourth hypothesis posited that concrete words with multiple translations would be recognized faster than abstract words with multiple translations. Table 8 summarizes the four hypotheses. Let us now consider each hypothesis in the light of the results from the present study.

Hypotheses	Conditions	Description
Hypothesis One	CS=CM	Concrete words with a single translation would be recognized as fast as concrete words with multiple translations
Hypothesis Two	AS<AM	Abstract words with a single translation would be recognized faster than abstract words with multiple translations
Hypothesis Three	CS=AS	Concrete words with a single translation would be recognized as fast as abstract words with a single translation equivalent
Hypothesis Four	CM<AM	Concrete words with multiple translations will be recognized faster than abstract words with multiple translations

Table 8. Summary of the hypotheses.

The results show that no significant differences between the mean reaction times for concrete words with single and multiple translation equivalents exist, suggesting that the number of translation equivalents does not interact with concreteness. The results are therefore consistent with the hypothesis. Moreover, they replicate earlier findings from a translation production task (Tokowicz and Kroll, 2000; in press), in which the number of translation equivalents did not influence the translation latencies for concrete words.

The DFM does not make claims regarding the role of ambiguity in the representation of concrete words. De Groot's (1992a) original schematic representation appears to account for the concrete words when they have a single translation equivalent. The DFM was slightly modified in order to account for concrete words with multiple translation equivalents (see Figure 19). A lexical node was added to represent the multiple translations in the L2 such that the translation equivalents available in the L2 have, independently of one another, a complete overlap with the nodes at the conceptual level. For example, the word *reloj* in Spanish has two available translations in English, namely *watch* and *clock*. Under this model, some nodes at the conceptual level are linked to both translation equivalents and some are linked to only one. Nonetheless, both translation equivalents have multiple overlapping nodes from the conceptual level to the lexical level. This could explain in part why there are no concreteness effects for ambiguous and unambiguous concrete words. The complete overlap might eliminate strong activation of lexical competitors. Such a claim requires more empirical support.

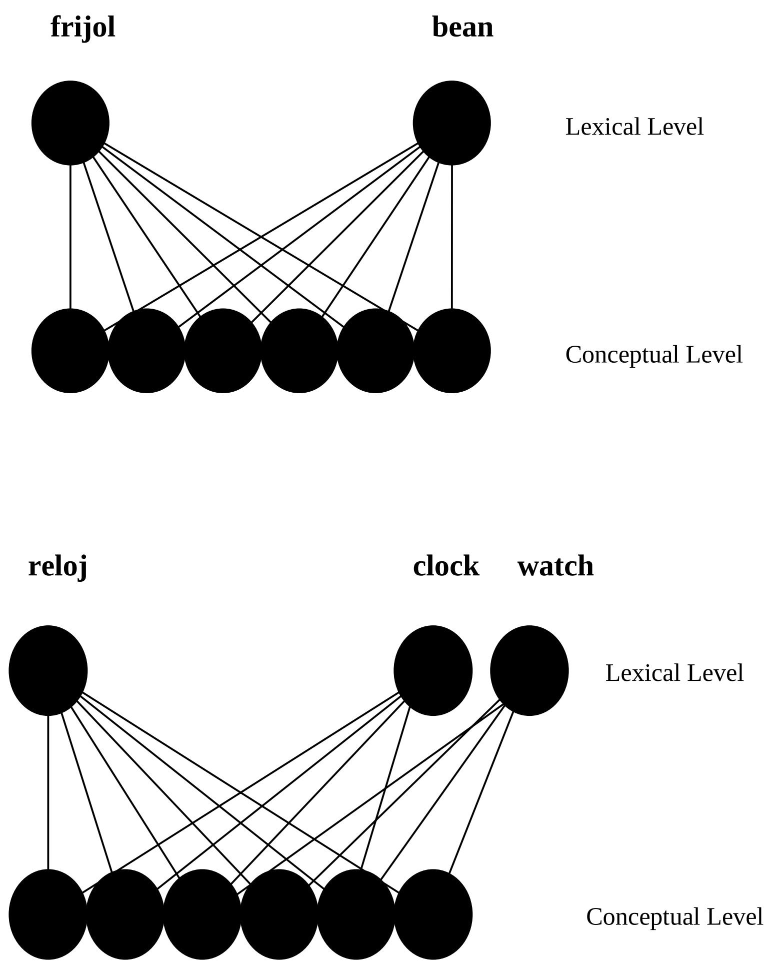


Figure 19. A modified version of the DFM illustrating the multiple translation equivalents at the lexical level (bottom representation).

Second, a concreteness effect was hypothesized to surface for ambiguous abstract words such that unambiguous abstract would be recognized faster than ambiguous abstract words. This hypothesis was motivated by the idea that translation equivalents for abstract words have fewer overlapping nodes at the conceptual level and have more meaning variation cross-linguistically, which could result in slower recognition of the translation equivalent. Although Schönpflug (1997) observed a complex interaction between concreteness and ambiguity for German and English words, in the present study the Tukey-Kramer test did not reveal significant differences between the mean reaction times for abstract words with single and multiple translation equivalents. This finding suggests that abstract words are not affected by the number of translations available in the target language. On the basis of this observation, the second hypothesis is rejected. These results further contradict the findings from the translation production study conducted by Tokowicz and Kroll (in press), where abstract words with single translations were translated more quickly than abstract words with multiple translations. A possible explanation lies in the distinct processes underlying language production and language comprehension. If we accept the idea that unambiguous abstract words have fewer links between the conceptual and the lexical level, when abstract words have multiple translations, the time needed to eliminate competing lexical candidates during production might account for the observed concreteness effect in previous studies. During recognition, the lexical competitors are not activated as strongly thus allowing for a quicker identification of the target translation. The weaker activation is represented by the grey nodes between the lexical and conceptual levels and by the dashed lines connecting the two levels (Figure 20). To support such a claim, more empirical evidence comparing the differences between these modalities for ambiguous abstract words is necessary.

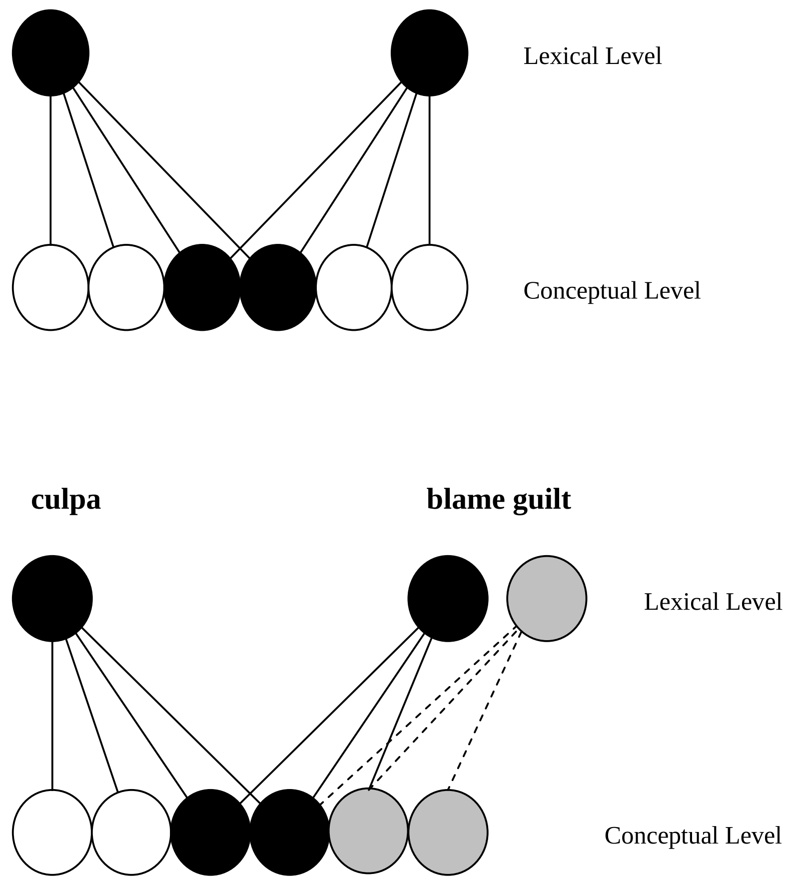


Figure 20. Representation of abstract words with single (top) and multiple (bottom) translation equivalents.

The third hypothesis predicted that concrete words would be recognized as fast as abstract words, when these had a single translation equivalent. This hypothesis was motivated by the finding that concreteness did not affect reaction times in a translation production task when a single translation equivalent was available (Tokowicz and Kroll, in press). In the present study, the Tukey-Kramer test revealed that a significant interaction between the conditions does not exist. In other words, the mean reaction time differences are not significant, consistent with the third hypothesis. The reported results from this study and those from the Tokowicz and Kroll (in press) study, challenge the ubiquitous concreteness effect. Controlling the number of translation equivalents for concrete and abstract words may have the effect of voiding potential concreteness effects in both production and recognition tasks.

The observed interaction between concreteness and ambiguity are problematic for the DFM, which does not consider ambiguity at the lexical level. It can therefore be hypothesized that when a single lexical node is available in the target language, no other competitors are activated at the lexical level (Figure 21). The lack of lexical competitors results in a rapid lexical resolution for unambiguous concrete and abstract words and can explain in part why no concreteness effect surfaced for these. Interestingly, the lack of lexical competitors for concrete and abstract words is equally important in both productive and receptive translation tasks.

This finding is important in the development of models of mental representation because concreteness effects have been reported with both monolingual and bilingual speakers. Yet these earlier reports failed to consider the number of meanings and of available translation equivalents, thereby challenging the reported concreteness effects.

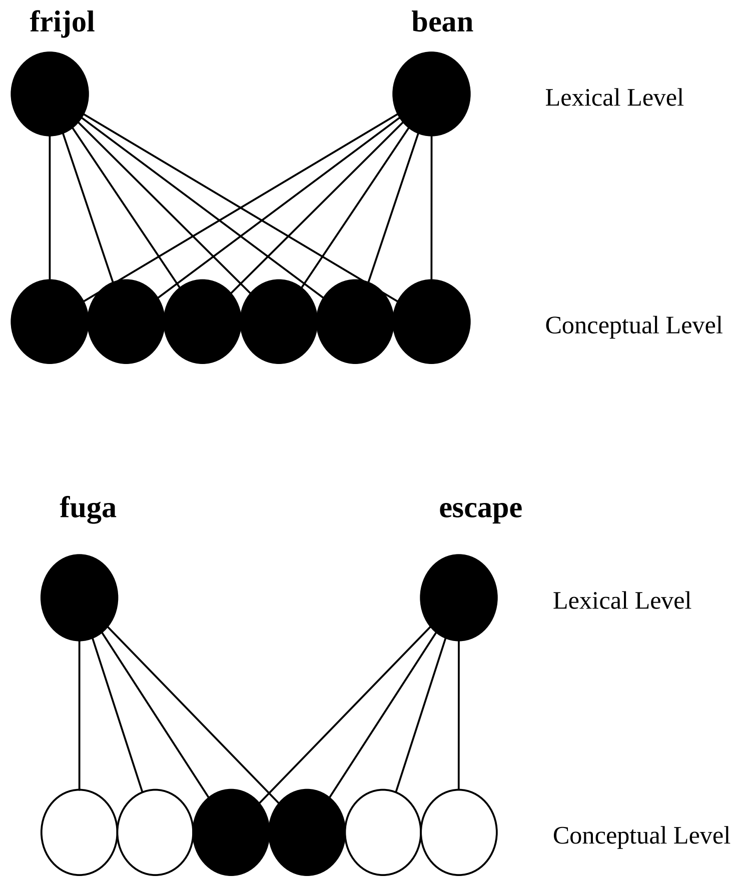


Figure 21. Representation for concrete and abstract words with a single translation equivalent.

The fourth and final hypothesis was that concrete words with multiple translation equivalents would result in faster translation reaction times than for abstract words with multiple translations. Since the Tukey-Kramer test did not reveal significant interactions the fourth and final hypothesis is rejected. These findings are not congruent with those obtained from translation production tasks (Tokowicz and Kroll, in press). To explain this, it is important to consider the different translation tasks. Producing language requires retrieval and production of a translation equivalent. When a word has multiple translations, multiple translations may be activated meaning that more time is needed to eliminate the non-target translations before producing the target translation. In recognition, because the translation equivalent is provided, the other existing translation equivalents may not be activated as strongly. Therefore the time needed to complete the lexical selection process is faster. To illustrate the weaker activation of lexical competitors during recognition, the links between the lexical and the conceptual levels for these are represented by dashed lines (Figure 22). To support such a claim, more empirical evidence is necessary.

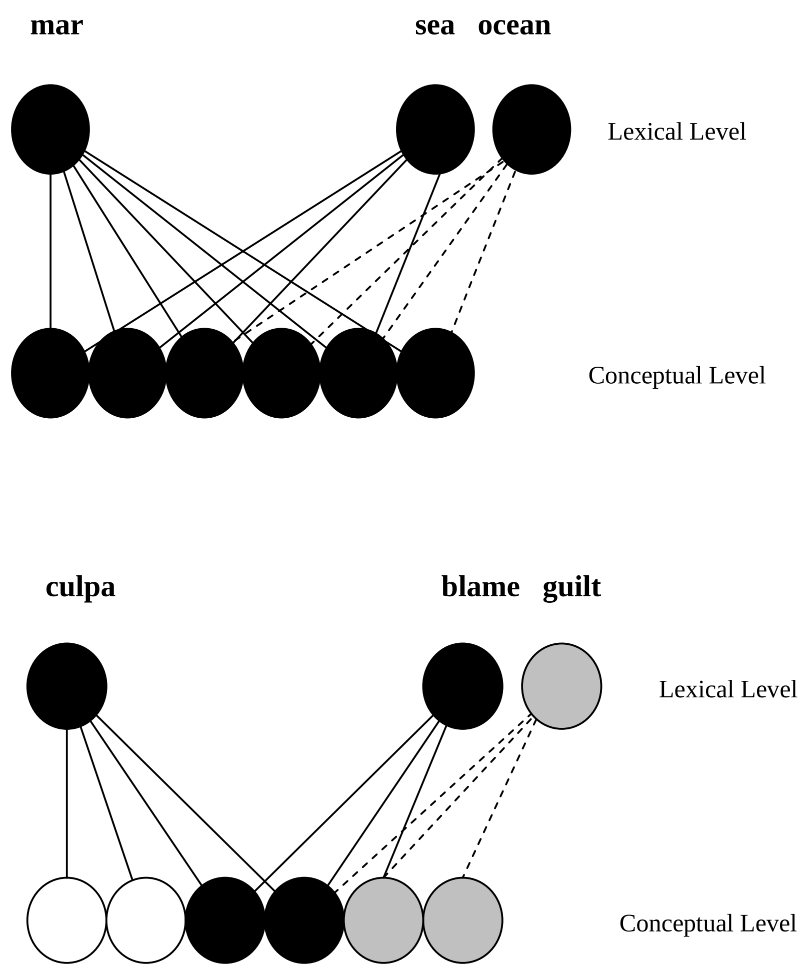


Figure 22. Representation for concrete and abstract words with a multiple translation equivalents.

Although no hypothesis was put forth regarding possible interactions between concrete words with a single translation equivalent and abstract words with multiple translation equivalents, the Tukey-Kramer revealed significant differences between abstract words with multiple translations and concrete words with single translations such that the latter were recognized faster than the former.

These results are very interesting since they reveal a more subtle and complex interaction between ambiguity and concreteness that was originally conceived. This result supports the general predictions of the DFM (and other models such as the CAM, DCT), in terms of apparent concreteness effects. Concrete words are expected to be recognized faster than abstract words since concrete words have a greater number of overlapping feature nodes at the conceptual level. But the interaction is more complex than simply perceiving a concreteness effect as it shows a summative effect between concreteness and ambiguity. Interestingly, both the concreteness and the ambiguity effects are in the directions predicted by the DFM and the model of language production proposed by Tokowicz and Kroll (2000). A preliminary explanation for the results can be provided when taking into account competition between translation equivalents at the lexical level. Let us briefly consider the results under the prediction of the model of language production proposed by Tokowicz and Kroll (2000).

4.1.2. Summative Effects of Concreteness and Ambiguity Factors

The finding that unambiguous concrete words were recognized faster than ambiguous abstract words cannot be explained under the DFM since the latter only supports an interaction between concrete (single or multiple) and abstract (single or multiple) words. This suggests that the DFM is too simplistic. Tokowicz and Kroll's model of language production (Figure 23 and 24) assumes two representations at the lexical level and that competition between the lemma (meaning) and the lexeme (orthographic/phonological) and the conceptual level may explain the different time latencies across the different word-types. Let us consider the representation of Spanish concrete words with single translation equivalents in English and Spanish abstract words with multiple translation equivalents in English, respectively.

Figure 23 represents the mapping for unambiguous concrete words. The orthographic representation of the Spanish word at the lexeme level led to activation of its respective meaning at the lemma level. When only one meaning exists, the feature nodes at the conceptual level would be quickly activated since no competition at the lexical level exists in the L1[1]. In accord with the predictions of the DFM, the conceptual nodes for concrete words and the translation equivalents completely overlap. Because only a single translation equivalent is available, the mapping from the conceptual level to the lexeme level in the L2 is quickly resolved. In other words, lateral competition at the lexical level does not exist for unambiguous concrete words. This could account for the faster recognition times for concrete words with a single translation equivalent observed in the present study.

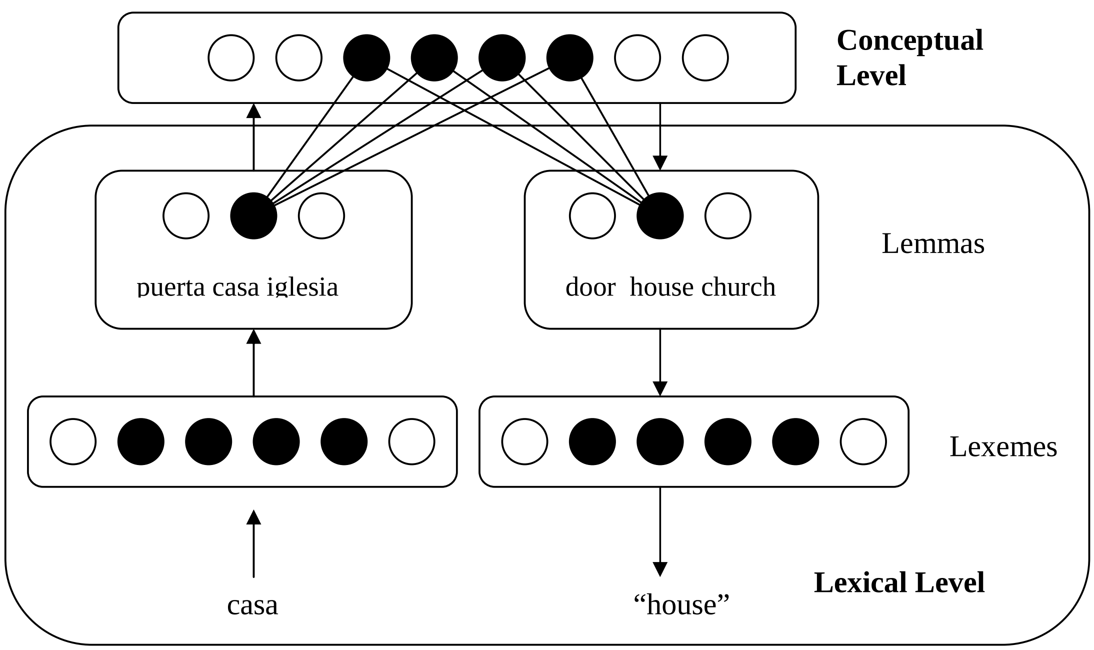


Figure 23. Tokowicz and Kroll's model of language production for unambiguous words, adapted from Tokowicz and Kroll, 2000, p.78.

[1] Note that this study did not control any lexical ambiguity in the native language. When a word has multiple meanings (NOM), then competition is argued to exist at the lexical level in the native language. This in turn could further affect the mapping process from the lexical to the conceptual level in the native language.

When abstract words have multiple translation equivalents, the mapping process is more complex and results in significantly slower RTs. Figure 24 represents the mapping for ambiguous abstract words. The orthographic representation of the abstract Spanish word at the lexeme level activates its respective meaning at the lemma level. When only one meaning exists, there is no competition at the lexical level which will lead to a quick activation of the corresponding conceptual nodes (at the conceptual level). According to the DFM, partial overlap of the feature nodes at the conceptual level exists for abstract words. Yet, when abstract words have only a single translation equivalent, performance does not appear to be affected due to the absence of competition at the lexical level in the target language. This could potentially result in an equally fast mapping process across the different levels of representation. But, when abstract words have multiple translation equivalents in the target language, it could be argued that there is increased competition between the possible translation equivalents at the lemma level. The process of suppressing the activated competitors slows the process of lexical selection. Only once the meaning resolution is completed can the corresponding orthographic/phonological information at the lexeme level be retrieved.

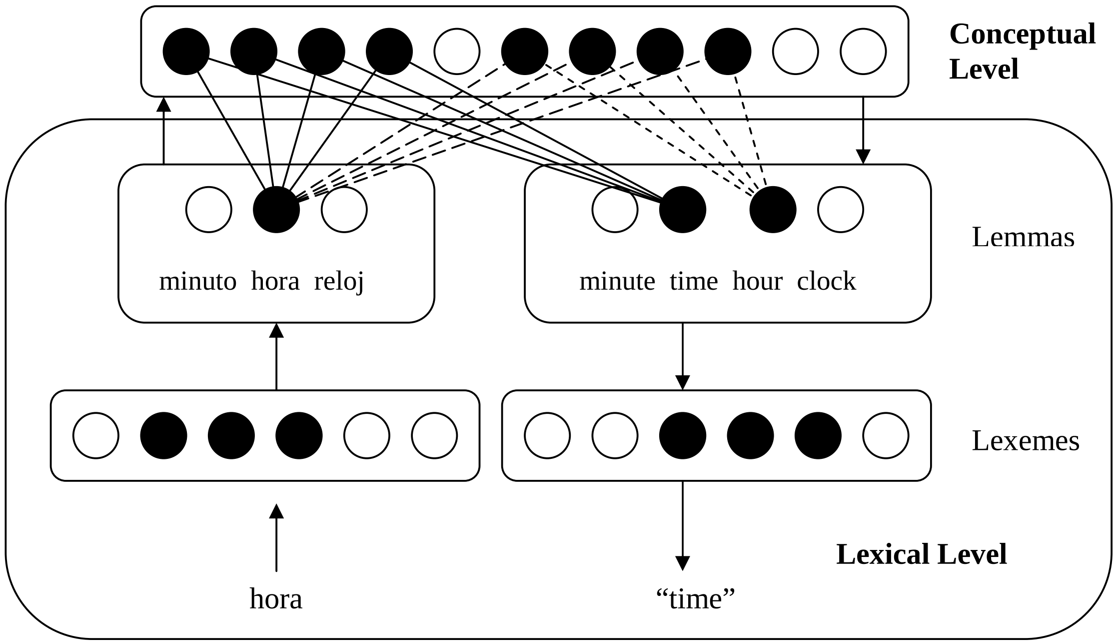


Figure 24. The Tokowicz and Kroll Model, adapted from Tokowicz and Kroll, 2000, p.78.

If we posit that there is increased activation at the lemma level when there are multiple available translation equivalents for abstract words, we should observe similar effects with ambiguous concrete words where competition at the lexical level should slow the process of lexical identification. Recall that under the DFM, strong links are in place between the L1 lexical information and the conceptual information for concrete words. Also, the conceptual representations are more similar cross-linguistically. Although there are multiple competitors at the lemma level, the results from the study support the claim that a complete overlap between the conceptual level and the lemma is available for each concrete entry and reduces the effects of competition. The selection of the appropriate translation equivalent is therefore faster than for abstract words. This is true for both productive and receptive translation tasks.

Notice from the discussion that the findings from the present study can not easily be explained under any of the current models. As we have just explored, the

DFM is too simplistic since it fails to consider lexical ambiguity, yet the model of language production supposes three levels of representation, even though work in psycholinguistics supports the existence of two levels of representation. More empirical investigation needs to be carried out in order to understand and propose a sophisticated model describing the interaction between concreteness and ambiguity factors during language production and language recognition tasks.

4.1.3. Pedagogical Implications

More practical motivations for this work relate to second language acquisition issues. At the onset of the investigation, the following question was proposed: is there evidence suggesting that concreteness effects correlate with the number of translation equivalents in the target language? The results demonstrate that unambiguous concrete words are recognized faster than ambiguous abstract words. This finding has some implications for teaching vocabulary practices. Many individuals begin learning a second language during adulthood in a formal educational setting, characterized by overt instruction, thereby having limited contact with the target language and with native speakers outside the classroom environment. Reduced input consequently increases the difficulties of vocabulary acquisition. A word, in the monolingual mental lexicon, is composed of a phonological/orthographic, a syntactic and a conceptual representation. The links between these are created during the early stages of vocabulary acquisition. Because concrete words make reference to concepts that can be perceived, the conceptual representations are more similar cross-linguistically. Yet, unambiguous abstract words appear to have a significant overlap of the feature nodes at the conceptual level. In light of these observations, teachers may choose to present unambiguous concrete and abstract words in the early levels of vocabulary development.

Since ambiguous abstract words are those with greater cross-linguistic variance at the conceptual level, learning these in a second language requires learning the subtle differences between the conceptual representation already in place for the native word and the target word. Learners must not only retain the novel form representation but also consider a modification of the conceptual representation to accommodate the subtle cross-linguistic differences for each possible translation equivalent. In the early stages of vocabulary development, students should not be expected to learn abstract words with multiple translation equivalents. Clearly, more advanced learners will need to learn how more abstract concepts may be spoken of in different contexts and therefore begin to construct conceptual representations that parallel the knowledge of a native speaker.

4.2. Limitations and Future Work

Reliability and validity of quantitative research is only guaranteed to the extent that the researcher controls all the possible factors that could affect the outcome of the study. In this experiment, the language proficiency level, the knowledge of the translation pairs and the concreteness ratings, were controlled by the researcher to the best of her knowledge. Yet, after a careful analysis of the results from the language questionnaire, from the pre-test and post test, some weaknesses have been identified.

Although all the participants who performed the translation recognition task were enrolled in the same English language course (offered by different teachers in different sections following the same official syllabus), each participant's personal experience with the learning of English was unique. Undoubtedly, the knowledge discrepancy had an effect on the reaction times and consequently on the general means reported. An analysis of the responses shows that a greater number of items from the multiple translation equivalent conditions were removed from the analysis because participants either failed to provide a response or provided an erroneous response. The means from the multiple translation condition represent a smaller sample, more sensitive to individual differences. Consequently, the data might not be a representative sample of the low-intermediate population. Future research should identify participants with more homogeneous backgrounds or have more participants perform the study to mitigate possible effects related to individual experiences.

The second limitation was identified after considering the measures taken in creating the stimuli. The stimuli for the four conditions were carefully selected by relying on a series of paper-based translation recognition pre-tests. Words with a correct response rate of 70% and over were accepted. For example the Spanish word *culpa* was translated into *blame* and *guilt*. The word *blame* received a 100% answer rate whereas the word *guilt* received a 78% correct answer rate. Only the word *blame* was kept for the experiment. Unfortunately, the cut-off might have been too low. It is possible that the word with the highest rating was the only translation known to some participants and was for them an unambiguous word. Future work should only include words with a 100% answer rate to confirm the validity of the stimuli in each condition.

Also words are seldom perceived as either concrete or abstract. This is evident from the distribution of concreteness rating obtained for the stimuli used in this study (see Figure 25). In order to determine whether a more significant interaction could be identified between concreteness and ambiguity, a post-hoc analysis was performed on the stimuli using only words that were considered very abstract or very concrete (ratings between 1-2 and 6-7). Interestingly, no significant interactions were identified across the four conditions. These findings appear to contradict the results from the present study. To explain this, it is important to consider that the stimulus was reduced from 88 items to 28 items (7 words per condition). The small sample of words might have nullified any possible effects. Future research should include a greater number of very concrete and very abstract words.

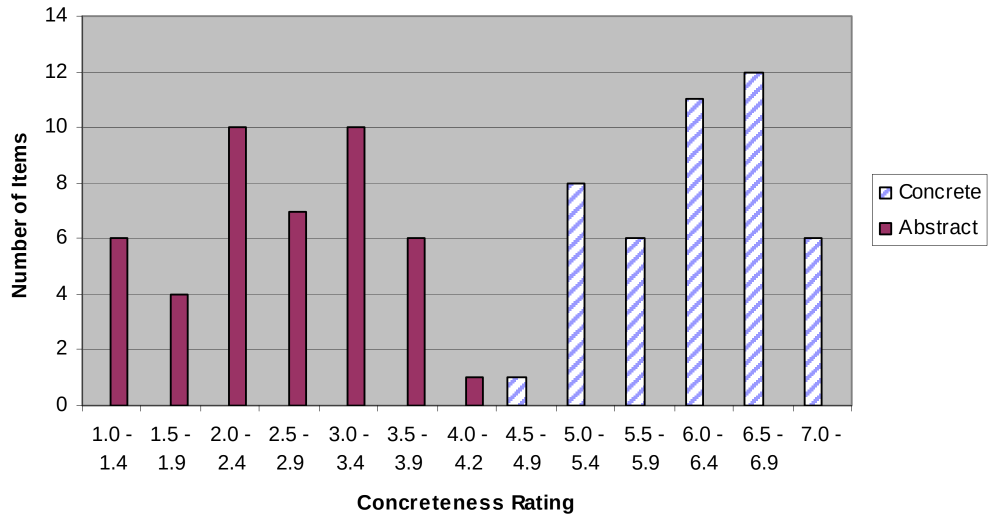


Figure 25. Concreteness rating distribution for abstract and concrete words.

Klepousniotou (2001) argued that psycholinguist research with monolingual subjects has often overlooked the different types of lexical ambiguity. In the present bilingual study, the different types of ambiguity at the lexical level were not discriminated against. Consider the English translation for the Spanish lexical item *enfermedad*; *illness* and *sickness.* The translations are near-synonyms. Also consider the English translation for the Spanish lexical item *cuadro*; *square* and *painting*. These are homonymous since they are translations with unrelated meanings. The DFM does not consider any type of lexical ambiguity. Since ambiguity has been identified as a variable that partially explains the organization of words in the bilingual mental lexicon, it would be interesting to further consider the representation of homonyms and synonyms. Further work investigating concreteness and ambiguity should attempt to discriminate between homonymous and synonymous words.

Conflicting evidence supporting translation directionality effects has been attested by studies in the field of psycholinguistics. Some theorists argue that forward translation requires conceptual mediation which leads to slower recognition and production times than backward translation because the latter relies more heavily on lexical links[2]. In this experiment participants performed a translation recognition task in the forward direction only. It would be interesting to conduct a similar study in the backward direction in order to identify whether an asymmetry exists and further, if this asymmetry correlates with the concreteness and the ambiguity of words.

Finally, the results from previous language production experiments and those from this language recognition experiment are incongruent. To identify whether the difference is due to the different modalities or the participant's proficiency levels, it would be important to conduct a translation recognition task with fluent bilinguals.

4.3. Conclusion

The ubiquitousness of the concreteness effect has been challenged by the present results. The number of potential translation equivalents plays an important role in the representation of words in the bilingual mental lexicon. Abstract words with multiple translations are recognized slower than concrete words with single translations. These findings have important theoretical implications. The predictions of the DFM are thus too simplistic and a revised version of the model is required in order to account for the ambiguity effects that surface in the different translation tasks. The language

[2] Empirical findings suggest that asymmetry interacts with proficiency. For a complete discussion, refer to section 1.2.3 The Revised Hierarchal Model.

production model proposed by Tokowicz and Kroll (2000) assumes that competition between the different levels of representation exists and can explain in part the observed findings. Future work should carefully consider the interaction of number of meanings and also the number of translations. For the time being, the results satisfactorily demonstrate that strong links in the mental lexicon can be created for both concrete and abstract words and that the apparent difficulty underlying L2 vocabulary acquisition for intermediate level bilinguals is the range of available meanings and translations.

References

Abunuwara, E. (1992). The structure of the trilingual lexicon. *European Journal of Cognitive Psychology*, 4, 311-322.

Azuma, T. & Van Order, G.C. (1997). Why SAFE is better than FAST: The relatedness of a word's meanings affects lexical decision times. *Journal of Memory and Language*, 36, 484-504.

Chen,H.-C., & Leung, Y.-S. (1989). Patterns of lexical processing in a nonnative language. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 15, 316-325.

Collins Dictionary. (2000). Great Britain: HarperCollins Publishers

de Groot, A.M.B. (1992a). Determinants of word translation. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 18, 1001-1018.

de Groot, A.M.B. (1992b). Bilingual lexical representation: A closer look at conceptual representations. In R. Frost & L. Katz (Eds.), *Orthography, Phonology, Morphology , and Meaning*. (pp. 389-412). Elsevier Science Publishers B.V.

de Groot, A.M.B., & Comijs, H. (1995). Translation recognition and translation production: Comparing a new and an old tool in the study of bilingualism. *Language Learning*, 45, 467-509.

de Groot, A.M.B., Dannenburg, L., & van Hell, J.G. (1994). Forward and backward word translation by bilinguals. *Journal of Memory and Language*, 33, 600-629.

de Groot, A.M.B., & Hoeks, J.C.J. (1995). The development of bilingual memory: Evidence from word translation by trilinguals. *Language Learning*, 45, 683-724.

de Groot, A.M.B., & Keijzer, R. (2000). What is hard to learn is easy to forget: The roles of word concreteness, cognate status, and word frequency in foreign-language vocabulary learning and forgetting. *Language Learning*, 50, 1-56.

de Groot, A.M.B., & Nas, G.L. (1991). Lexical representation of cognates and noncognates in compound bilinguals. *Journal of Memory and Language*, 30, 90-123.

de Groot, A.M.B., & Poot, R. (1997). Word translation at three levels of proficiency in a second language: The ubiquitous involvement of conceptual memory. *LanguageLearning*, 47, 215-264.

Hall, Christopher J. (1992). Making the right connections: Vocabulary learning and the mental lexicon. Unpublished manuscript, Universidad de las Américas, Puebla: *ERIC Document Reproduction Service* No. ED 363 128.

Hall, C. J. (1997). Palabras concretas, palabras abstractas y rasgos categoriales en el léxico mental bilingüe. En R. Barriga Villanueva & P.M. Butraguero (Eds.). *Varia lingüística y literaria: 50 años del CELL*. México, DF: El Colegio de México.

Hall, C. J. (2002). The automatic cognate form assumption: Evidence for the parasitic model of vocabulary development. *International Review of Applied Linguistics in Language Teaching.*

Hall, C.J. (2005). *An introduction to language and linguistics: Breaking the language spell*. London New York: Continuum.

Haugnes, N. & Maher, B. (1998). Northstar: Focus on reading and writing. New York: Longman.

Hino, Y., & Lupker, S.J. (1996). Effects of polysemy in lexical decision and naming: An alternative to lexical access accounts. *Journal of Experimental Psychology: Human Perception and performance*, 22, 1331-1356.

Hino, Y., Lupker, S.J. & Pexman, (2002). Ambiguity and synonymy effects in lexical decision, naming and semantic categorization tasks: interactions between orthography, phonology, and semantics. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 28, 686-713.

Hinton, G.E. McClelland, J.L., & Rumelhart, D.E. (1986). Distributed representations. In D.E. Rumelhart, J.E. McClelland, and the PDP Research Group (Eds.), *Parallel distributed processing. Explorations in the Microstructure of Cognition,* Volume 1: Foundations (pp. 77-109). Cambridge: MIT Press.

Jackendoff, R. (1983). *Semantics and cognition*. Cambridge, Mass.: MIT Press.

Jackendoff, R. (1992*). Language of the mind: Essays on mental representation.* Cambridge, Mass.: MIT Press.

Jastrzembski, J.E. (1981). Multiple meanings, number of related meanings, frequency of occurrence, and the lexicon. Cognitive Psychology, 13, 278-305.

Kieras, D. (1978). Beyond pictures and words: Alternative information-processing models for imagery effects in verbal memory. *Psychological Bulletin*, 85, 532-554.

Klepousniotou, E. (2001). The processing of lexical ambiguity: Homonymy and polysemy in the mental lexicon. *Brain and Language*, 81, 205-223.

Kroll, J.F., & de Groot, A.M.B. (1997). Lexical and conceptual representations memory in the bilingual: Mapping form to meaning in two language. In A.M.B. de Groot, & J.F. Kroll (Eds.). *Tutorials in bilingualism. Psycholinguistic perspectives,* 169-199. Manwah, NJ: Lawrence Erlbaum.

Kroll, J.F., & Merves, J.S. (1986). Lexical access for concrete and abstract words. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 12, 92-107.

Kroll, J.F., & Stewart, E. (1994). Category interference in translation and picture-naming: Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language*, 33, 149-174.

Leech, G., Rayson, P., & Wilson, A. (2001). *Word Frequency in Written and Spoken English*. Great Britain: Pearson Education Limited.

Levelt, W.J.M. (1989). *Speaking: From intention to articulation.* Cambridge, MA: MIT Press.

Nation, I.S.P. (2001). *Learning vocabulary in another language*. Cambridge: Cambridge University Press.

Paivio, A., Yuille, J.D. & Madigan, S.A. (1968). Concreteness, imagery, and meaningfulness values for 925 nouns. *Journal of Experimental Psychology: Monograph Supplement*, 76, 1-25.

Paivo, A. (1971). *Imagery and verbal processes*. New York: Holt, Rinehart, & Winston.

Potter, M.C., So, K., von Eckardt, B., & Feldman, L.B. (1984). Lexical and conceptual representation in beginning and proficient bilinguals. *Journal of Verbal Learning and Verbal Behavior*, 23, 23-38.

Sanchez-Casa, R.M., Davis, C.W., & Garcia-Albea, J.E. (1992). Bilingual lexical processing: Exploring the cognate/non-cognate distinction. *European Journal of Cognitive Psychology*, 4, 293-310.

Schreuder, R., & Flores d_Arcais, G. (1989). Psycholinguistic issues in the lexical representation of meaning. In W. Marslen-Wilson (Ed.), Lexical representation and process (pp. 409–436). Cambridge: MIT Press.

Schönpflug, U. (1997, April). *Bilingualism and memory.* Paper presented at the International Symposium on Bilingualism, Newcastle-upon-Tyne, United Kingdom.

Schwanenflugel, P. J., Harnishfeger, K.K., & Stowe, R.W. (1988). Context availability and lexical decisions for abstract and concrete words. *Journal of Memory and Language*, 27, 499-520.

Schwanenflugel, P. J. & Shoben, E.J. (1983). Differential context effects in the comprehension of abstract and concrete verbal materials. *Journal of Experimental Psychology, Learning, Memory, and Cognition*, 9, 82-102.

Talamas, A., Kroll, J.F., & Dufour, R. (1999). From form to meaning: Stages in the acquisition of second language vocabulary. *Bilingualism: Language and Cognition*, 2, 45-58.

Tokowicz, N. (1997). Stimuli database. Personal communication.

Tokowicz, N. (2000). *Meaning representation within and across languages*. Unpublished doctoral dissertation, The Pennsylvania State University, University Park, PA.

Tokowicz, N., & Kroll, J.F. (2000). Accessing meaning for words in two languages: The effects of lexical and semantic ambiguity in bilingual production. Unpublished manuscript, The Pennsylvania State University, University Park, PA.

Tokowicz, N., & Kroll, J.F. (in press). When translations are ambiguous: How concreteness and number of translations influence bilingual production.

van Hell, J.G., & de Groot, A.M.B. (1998a). Conceptual representation in bilingual memory: Effects of concreteness and cognate status in word association. *Bilingualism: Language and Cognition*, 1, 193-211.

van Hell, J.G., & de Groot, A.M.B. (1998b). Disentangling context availability and concreteness in a lexical decision and word translation. *The Quarterly Journal of Experimental Psychology*, (A), 51, 41-63.

Weinreich, U. (1974). *Languages in contact*. The Hague: Mouton.

Welcome to the Skyline Website (2001). Skyline. Retrieved January 15th, 2006, from http://www.skyline-english.com/.

Appendix A.

Unambiguous and Ambiguous Stimuli

Concrete words with a single translation equivalent		**Abstract words with a single translation equivalent**	
Spanish	English	Spanish	English
anillo	*ring*	*adeudo*	*debt*
cerebro	*brain*	*anfitrión*	*host*
cuchara	*spoon*	*ayer*	*yesterday*
diente	*tooth*	*chiste*	*joke*
durazno	*peach*	*creencia*	*belief*
frijol	*bean*	*entrenamiento*	*training*
herramienta	*tool*	*espera*	*wait*
hueso	*bone*	*esperanza*	*hope*
impresora	*printer*	*fuga*	*escape*
labio	*lip*	*guerra*	*war*
leche	*milk*	*hogar*	*home*
mejilla	*cheek*	*juventud*	*youth*
mueble	*furniture*	*mentira*	*lie*
oveja	*sheep*	*palabra*	*word*
pestaña	*eyelash*	*perdida*	*loss*
playa	*beach*	*peso*	*weight*
postre	*dessert*	*realeza*	*royalty*
queso	*cheese*	*semana*	*week*
tarjeta	*card*	*sonido*	*sound*
tobillo	*ankle*	*sordo*	*deaf*
ventana	*window*	*tamaño*	*size*
zapato	*shoe*	*verdad*	*truth*

Table A1. Spanish concrete and abstract words with their single translation equivalent in English.

Concrete words with multiple translation equivalents			**Abstract words with multiple translation equivalents**		
Spanish	English translation one	English translation two	Spanish	English translation one	English translation two
baño	*bath*	*toilet*	*alma*	*soul*	*spirit*
barco	*ship*	*boat*	*ayuda*	*help*	*assistance*
bolso	*bag*	*purse*	*callado*	*quiet*	*silent*
bosque	*forest*	*wood*	*cielo*	*sky*	*heaven*
camión	*truck*	*bus*	*cita*	*date*	*meeting*
cárcel	*jail*	*prison*	*culpa*	*blame*	*guilt*
casa	*house*	*home*	*daño*	*hurt*	*damage*
cerdo	*pig*	*pork*	*difícil*	*hard*	*difficult*
coche	*car*	*automobile*	*enfermedad*	*illness*	*sickness*
comida	*food*	*meal*	*enseñar*	*teach*	*show*
cuadro	*square*	*painting*	*fantasma*	*ghost*	*phantom*
maleta	*suitcase*	*luggage*	*fuerza*	*strength*	*force*
mar	*sea*	*ocean*	*hora*	*time*	*hour*
mujer	*woman*	*wife*	*ingreso*	*income*	*entrance*
niño	*child*	*kid*	*inicio*	*start*	*beginning*
pecho	*breast*	*chest*	*juicio*	*judgment*	*trial*
piedra	*rock*	*stone*	*junta*	*meeting*	*council*
plata	*silver*	*money*	*mañana*	*tomorrow*	*morning*
pueblo	*town*	*village*	*moda*	*fashion*	*style*
regalo	*present*	*gift*	*seguridad*	*safety*	*security*
reloj	*clock*	*watch*	*tonto*	*stupid*	*idiot*
tienda	*store*	*shop*	*vista*	*view*	*sight*

Table A2. Spanish concrete and abstract words with their multiple translation equivalents in English. Those labeled English translation two were not seen by the participants during the translation recognition experiment.

Appendix B

Translation Production Task Instructions

Traducción
español → inglés

En el siguiente listado encontrarás una serie de palabras escritas en español. Tu tarea es traducir esas palabras al inglés. No te preocupes por los errores de ortografía.

Si encuentras una palabra que en tu opinión tenga varias traducciones, favor de escribirlas todas.

Si no te puedes acordar de la traducción de una palabra, pasa a la siguiente palabra.

Cuando llegues a la última palabra, tendrás la oportunidad de volver a las palabras que no pudiste traducir. Si al final de logras encontrar una traducción adecuada, por favor avisa al responsable que has terminado.

¡Gracias!

Appendix C

Paper-Based Translation Recognition Task Instructions

Instrucciones
¿Traducción correcta ó incorrecta?

En el siguiente listado encontrarás una serie de palabras escritas en español y en inglés. Tu tarea es determinar si la palabra en inglés es la traducción correcta de la palabra en español. Cuando es una traducción correcta, favor de escribir un *sí*. Si es una traducción incorrecta, favor de escribir un *no*.

Por ejemplo:

Español	**Inglés**	**sí ó no**
bandera	flag	sí
flor	book	no

Si encuentras una palabra y no estas seguro(a) si su traducción es la correcta, pasa a la siguiente palabra.

Cuando llegues a la ultima palabra, favor de avisar al responsable que has terminado.

¡Gracias!

Appendix D

Concreteness Norms Instructions

Instrucciones

Un sustantivo puede hacer referencia a una persona, una emoción, una profesión, un lugar, un objeto, etc.

Usualmente, los **sustantivos concretos** hacen referencia a conceptos tangibles que pueden ser experimentados por nuestros sentidos. Los **sustantivos abstractos**, por otro lado, hacen referencia a conceptos que no pueden ser experimentados por nuestros sentidos.

El objetivo de esta actividad es evaluar la *concretividad* de algunas palabras. Es decir evaluar que tan **concreta o abstracta** es una palabra, tomando como referencia tu experiencia sensorial.

Piensa en las palabras “tortuga”, “pianista” e “independencia”.

- “tortuga” puede ser experimentado por nuestros sentidos (visual, táctil, olor) y por consecuente podría ser evaluada como palabra altamente concreta, según tu juicio.
- “pianista”, hace referencia a un humano, lo que sí puede ser experimentado por nuestros sentidos, pero la profesión es difícilmente experimentada por los sentidos. Por consecuente, dicha palabra no puede recibir una evaluación de alta ni de baja concretividad.
- “independencia” no puede ser experimentado por nuestros sentidos y podría ser evaluada como palabra bajamente concreta (abstracta), según tu juicio.

La distinción entre un concepto concreto y un concepto abstracto, es altamente sujetivo. Así que favor de evaluar las siguientes palabras según tu juicio usando toda la escala de 1 - 7, donde 1 indica un concepto abstracto y 7 indica uno concreto.

Si tienes alguna duda, favor de preguntar ahora.
Favor de usar toda la gama cuando juzgas las palabras.

¡Gracias por participar!

Appendix E

Concreteness Ratings for Stimuli

Spanish concrete words with a single translation equivalent		**Spanish concrete words with multiple translation equivalents**	
Spanish	Concreteness Rating	Spanish	Concreteness Rating
playa	5.00	*mar*	4.83
labio	5.25	*pueblo*	5.00
mueble	5.25	*niño*	5.25
durazno	5.75	*cuadro*	5.33
postre	5.75	*baño*	5.40
herramienta	6.00	*tienda*	5.40
leche	6.00	*cárcel*	5.50
anillo	6.20	*plata*	5.50
pestaña	6.25	*pecho*	5.83
ventana	6.25	*regalo*	5.83
tarjeta	6.40	*bosque*	6.17
oveja	6.50	*mujer*	6.33
mejilla	6.60	*camión*	6.40
zapato	6.60	*cerdo*	6.40
hueso	6.75	*comida*	6.40
cerebro	6.80	*reloj*	6.50
diente	6.80	*bolso*	6.67
queso	6.80	*barco*	6.80
cuchara	7.00	*maleta*	6.83
fríjol	7.00	*piedra*	6.83
impresora	7.00	*casa*	7.00
tobillo	7.00	*coche*	7.00

Table E.1 Spanish concrete words ratings with a single translation equivalents organized from the least to the most concrete.

Abstract words with A single translation equivalent		**Abstract words with multiple translation equivalents**	
Spanish	Concreteness Rating	Spanish	Concreteness Rating
creencia	1.00	*fuerza*	1.25
espera	1.25	*ayuda*	1.60
esperanza	1.25	*daño*	1.60
mentira	1.40	*fantasma*	2.17
verdad	1.40	*inicio*	2.17
juventud	1.50	*tonto*	2.33
sonido	1.75	*junta*	2.40
adeudo	2.00	*difícil*	2.50
entrenamiento	2.20	*ingreso*	2.60
perdida	2.20	*moda*	2.67
hogar	2.25	*alma*	3.00
chiste	2.40	*callado*	3.00
palabra	2.40	*enseñar*	3.00
ayer	2.50	*juicio*	3.00
semana	2.75	*seguridad*	3.00
sordo	2.75	*cita*	3.50
guerra	2.80	*mañana*	3.50
fuga	3.20	*hora*	3.83
peso	3.20	*culpa*	4.00
tamaño	3.20	*enfermedad*	4.00
anfitrión	3.25	*vista*	4.00
realeza	3.25	*cielo*	4.17

Table E.2 Spanish abstract words ratings with a single translation equivalents organized from the most to the least abstract. The concreteness rating was only obtained for the Spanish stimuli.

Appendix F

Pilot Translation Recognition Task Feedback Questionnaire
Version A

<u>Retroalimentación</u>

Favor de contestar las preguntas y agregar cualquier comentario o sugerencia para mejorar la calidad de la actividad. ¡Gracias!

Parte I **<u>Instrucciones</u>**

1. Las instrucciones escritas en la pantalla al inicio de la actividad fueron:

- muy claras **Sí** O **No** O
- claras **Sí** O **No** O
- bien **Sí** O **No** O
- no las entendí **Sí** O **No** O
- Otro comentario: ____

____

2. ¿Te hubiera gustado tener más palabras de práctica antes de empezar la actividad?

- **Sí** O **No** O
- Otro comentario: ____

____

Parte II **<u>Actividad</u>**

3. Las palabras en español **aparecían** en la pantalla:

- A una buena velocidad **Sí** O **No** O
- Si contestaste no, favor de decir por qué: ____________________________

____

4. Las palabras en español **desaparecían** de la pantalla:

- A una buena velocidad **Sí** O **No** O
- Si contestaste no, favor de decir por qué: ____________________________

____

5. En general, el ritmo de la presentación de las palabras era:

- Bueno **Sí** O **No** O

- ¿Por qué? : ____
____

6. La duración de la actividad fue
- Muy larga **Sí** O **No** O
- Larga **Sí** O **No** O
- Buena **Sí** O **No** O
- Corta **Sí** O **No** O

7. ¿Te hubiera gustado tener un descanso a la mitad de la actividad?:
   Sí O **No** O
   ó ¿te hubiera gustado que fuera más corta la actividad?
   Sí O **No** O
8. Favor de comentar sobre cualquier aspecto de la actividad al reverso de la página.

Appendix G

Pilot Translation Recognition Task Feedback Questionnaire
Version B

Retroalimentación

Favor de contestar las preguntas y agregar cualquier comentario o sugerencia para mejorar la calidad de la actividad. ¡Gracias!

Parte I **Instrucciones**

1. Las instrucciones escritas en la pantalla al inicio de la actividad fueron:

- muy claras **Sí** O **No** O
- claras **Sí** O **No** O
- bien **Sí** O **No** O
- no las entendí **Sí** O **No** O
- Otro comentario: ______________________________

____

2. ¿Te hubiera gustado tener más palabras de práctica antes de la actividad?

- **Sí** O **No** O
- Otro comentario: ______________________________

____

Parte II **Actividad**

3. Las palabras en español **aparecían** en la pantalla:

- A una buena velocidad **Sí** O **No** O
- Si contestaste no, favor de decir por qué: ______________________________

____

4. Las palabras en español **desaparecían** de la pantalla:

- A una buena velocidad **Sí** O **No** O
- Si contestaste no, favor de decir por qué: ______________________________

____

5. En general, el ritmo de la presentación de las palabras era:

- Bueno **Sí** O **No** O
- ¿Por qué? : ______________________________

____

6. La duración de la actividad fue

- Muy larga **Sí** O **No** O
- Larga **Sí** O **No** O
- Buena **Sí** O **No** O
- Corta **Sí** O **No** O

7. ¿Te gustó el descanso a la mitad de la actividad?

   Sí O **No** O

8. ¿Se te hizo necesario el descanso a la mitad de la actividad?

   Sí O **No** O

9. En vez de un descanso, ¿te hubiera gustado que fuera más corta la actividad?

   Sí O **No** O

10. Favor de comentar sobre cualquier aspecto de la actividad al reverso de la página.

Appendix H

Preparing DMDX Program Specifications

Prior to running the DMDX software, it is necessary run TimeDX which requires four initial basic tests. The *Select Video Mode* command permits the selection of a display mode. The command *Millisecond Timer Test* synchronizes the millisecond timers; imperative for a successful timed-based experiment. The *Input* command verifies the input system that will be used in the experiment; in this case the mouse was the input device. Finally, the *Refresh Rate* command indicates how the program will determine refresh rates. Once these tests are performed, it is necessary to run advanced tests, including the *Time Video Mode*, the *Video and Millisecond Timer* and the *Tachistoscopic Acid Tests*.

The DMDX software requires the elaboration of an item file, which tells the software which items to show, in what order etc. The former is separated into a header line and an item line. The header line specifications for this experiment are displayed in Table H1. The first element specified the number of items incorporated in the experiment, namely 176 word pairs excluding the practice trial. The second specification <azk> indicated that the program required Ascii Text Files. The <cr>, signified that the items are automatically presented on the screen after a response is provided or after the occurrence of timed-out. A timed-out was configured after 4000 milliseconds of exposure time. The <fd>, specified that the item would appear on the screen for a maximum of 60 ticks. The DMDX requires that timing specifications be measured in ticks, where one tick equals 11.80 milliseconds. The <d> indicated the delay between items. The <t> indicated the maximum time allocated for a participant to produce an answer, again measured in milliseconds. The, <cr>, ensured that the subsequent item appeared after the 4000 milliseconds, without having to make a request. Randomization was specified by the <s>. Here groups of 6 words were automatically reordered and randomized thereby eliminating factors related to fatigue and familiarity with the task. The <vm> referred to the preferred display, in this case 640 480 480 8 0, which is recommended for simple text presentation. The <id mouse> specified that answers would be provided using the mouse where <mr>, stood for *Mouse Request*, <pr> for *Positive Response* and <nr> for *Negative Response*. The <nfb> specified that no feedback was to be given to the participant after providing a response. Finally <dbc 255255255> and <dwc 0> specified that the default background color of the screen is white, and the default writing color for the stimuli is black.

Item Line Specification	**Interpretation**
<n 176>	Number of Items
<azk>	Ascii Text Files
<cr>	Continuous Running
<fd 60>	Frame Duration
<d 90>	Delay
<t 4000>	Time
<s 6>	Sample
<vm 640 480 480 8 0>	Video Mode
<id mouse>	Input Device Specifications
<mr +button 2>	Mouse Request
<mnr +button 1>	Mouse Negative Response
<mpr +button 0>	Mouse Positive Response
<nfb>	No Feedback
<dbc 255255255>	Default Background Color
<dwc 0>	Default Writing Color

Table H1. Details of the item line specifications with its interpretation.

The second element in the item file is the item line (Figure H2). The written instructions, the practice items, the target items and the delay between the appearance and disappearance of each word pairs are specified here. It is crucial to begin and end the instruction paragraph with a *$* sign, which voids the specifications embedded in the header line.

$0 <ln 0> “**Bienvenido**”,
<ln 4> “Presiona la rueda del ratón únicamente una vez”,
<ln 5> “para pasar a la siguiente pantalla.”;
0 <ln -2> “Gracias por ayudarnos con este proyecto”,
<ln -1> “sobre el vocabulario de inglés”,
<ln 0> “que conocen los estudiantes de la UDLA.”,
<ln 6> “Presiona la rueda del ratón para continuar.”;
0<ln -1> “En esta actividad”,
<ln 0> “verás una palabra escrita en español”,
<ln 1> “seguida por una palabra escrita en inglés.”,
<ln 6> “Presiona la rueda del ratón para continuar.”;
0 <ln -2> “Debes decidir lo más rápido que puedas”,
<ln -1> “si las palabras que aparecen son:”,
<ln 1> “· traducciones correctas”,
<ln 2> “ó”,
<ln 3> “· traducciones incorrectas.”,
<ln 6> “Presiona la rueda del ratón para continuar.”;
0 <ln 0> “Mantén tu dedo en la rueda.”,
<ln 6> “Presiona la rueda del ratón para continuar.”;
0 <ln -2> “Cuando aparece una traducción correcta,”,
<ln -1> “presiona el botón **derecho** del ratón”,
<ln 0> “marcado por la estampilla verde.”,
<ln 6> “Presiona la rueda del ratón para continuar.”;
0 <ln -2> “Cuando aparece una traducción incorrecta,”,
<ln -1> “presiona el botón **izquierdo** del ratón”,
<ln 0> “marcado por la estampilla roja.”,
<ln 6> “Presiona la rueda del ratón para continuar.”;
0 <ln -1> “Para familiarizarte con el ratón,”,
<ln 0> “la actividad y el ritmo de la actividad,”,
<ln 1> “vamos a empezar con unos ejemplos de práctica.”,
<ln 6> “Presiona la rueda del ratón para continuar.”;
0 <ln -2> “Acuérdate,”,
<ln -1> “debes contestar lo más rápido que puedas.”,
<ln 2> “Presiona la rueda del ratón para empezar.”;
+500 < % 40 > "hoja” / *“leaf"/;
+501 < % 40 > "cena” / *“dinner"/;
-550 < % 40 > " botella” / *“ cable "/;
+502 < % 40 > "amarrillo” / *“yellow"/;
-551 < % 40 > " fuente” / *“office "/;
+503 < % 40 > "amigo” / *“friend"/;
-552 < % 40 > "hermano” / *“dog"/;
+504 < % 40 > "boda” / *“wedding"/;
+505 < % 40 > "mago” / *“magician"/;
-553 < % 40 > "hambre” / *“sadness"/;
+506 < % 40 > "mercado” / *“market"/;
-554 < % 40 > "cajón” / *“door"/;

+507 < % 40 > "felicidad” / *“happiness"/;
0 <ln -1> “¡Muy bien!”,
<ln 1> “Favor de guardar silencio y esperar un momento.”,
<ln 2> “Enseguida entrará la responsable.”;
0 <ln 0> “Cuando quieras empezar,”,
<ln 1> “presiona la rueda del ratón.”;$

$0 <ln -3> “¡**FIN**!”,
<ln -2> “¡Gracias por haber participado!”,
<ln -1> “Favor de guardar silencio”,
<ln 0> “y espera a que los demás terminen.”,
<ln 2> “En un momento”,
<ln 3> “recibirás instrucciones del responsable.”;$

Figure H2. Item line specifications for the experiment.

Appendix I

Language Questionnaire

Tu experiencia con idiomas extranjeros

Esta encuesta fue diseñada para que podamos tener un mejor entendimiento de tus experiencias con el aprendizaje del inglés y otros idiomas extranjeros. Gracias por contestar de la manera más completa a cada pregunta. Si tienes una duda, favor de preguntar al responsable.

Parte A

1. ¿Cual es tu idioma materno (i.e. el primer idioma que aprendiste a hablar)? Si tienes más de un idioma materno, indica cuales son tus idiomas maternos y describe las situaciones en las cuales usarías cada uno de ellos y con quien.

   ____

2. ¿Cual consideras que es tu segundo idioma (aunque no lo domines)?

   ____

3. ¿Qué idioma se hablaron en tu casa cuando creciste y quien lo hablaba?

   ____

4. ¿Estas actualmente inscrito en un curso de idioma extranjero en una institución?

   Sí O **No** O

5. Anota el (los) idioma(s) que estas actualmente estudiando, nivel y clave del curso.

Idioma	Nivel del curso

6. Indica si has vivido afuera de México o has visitado países donde el idioma nativo era diferente a tu idioma nativo, por cuanto tiempo el indica el idioma hablado en ese país.

Nombre del país	Duración de estancia en meses	Idiomas usados del país

7. Anota todos los idiomas que sabes, aunque no hayas recibido instrucciones formales y no puedes leer o escribirlos, del más fluido al menos fluido, incluyendo tu idioma nativo.

Idioma	Edad a la cual empezaste a aprender	Contexto en el cual los aprendiste.

8. ¿Qué idiomas, salvo el español, *hablas* con fluidez?
____

9. ¿Qué idiomas, salvo el español, *lees* con fluidez?
____

10. ¿Qué idiomas, salvo el español, *escribes* con fluidez?
____

11. ¿Qué idiomas, salvo el español, *entiendes* con fluidez cuando son hablados?
____

Parte B Tu experiencia con el aprendizaje del inglés

12. Indica cuanto tiempo llevas estudiando inglés como segundo idioma, en meses ó en años. _______ meses ó _______ años

13. Evalúa tu nivel de **inglés** *leído* de 1 a 10.
    (**1 muy malo - 10 muy bueno**)
    1 2 3 4 5 6 7 8 9 10
14. Evalúa tu nivel de **inglés** *escrito* de 1 a 10.
    (**1 muy malo - 10 muy bueno**)
    1 2 3 4 5 6 7 8 9 10
15. Evalúa tu nivel de *conversación* en **inglés**.
    (**1 muy malo - 10 muy bueno**)
    1 2 3 4 5 6 7 8 9 10
16. Evalúa tu nivel de *comprensión* del **inglés hablado**.
    (1= sin comprensión, 10 comprensión perfecta)
    1 2 3 4 5 6 7 8 9 10
17. Evalúa tu nivel de **español** *leído* de 1 a 10.
    (**1 muy malo - 10 muy bueno**)
    1 2 3 4 5 6 7 8 9 10
18. Evalúa tu nivel de **español** *escrito* de 1 a 10.
    (**1 muy malo - 10 muy bueno**)
    1 2 3 4 5 6 7 8 9 10
19. Evalúa tu nivel de *conversación* en **español**.
    (**1 muy malo - 10 muy bueno**)
    1 2 3 4 5 6 7 8 9 10
20. ¿Como evalúas tus habilidades para aprender un segundo idioma?
    (**1 muy malo - 10 muy bueno**)

1 2 3 4 5 6 7 8 9 10

21. Evalúa tu nivel de *comprensión* del **español hablado**.
    (1= sin comprensión, 10 comprensión perfecta)
    1 2 3 4 5 6 7 8 9 10
22. Cuando estudias inglés, ¿qué habilidad es la más fácil para ti?
    (1 más fácil a 4 más difícil)
    Pronunciación: __________ Vocabulario: __________
    Gramática: __________ Dichos: __________

Parte C Experiencia en el extranjero con el inglés

23. ¿Has estado en algún país por más de un mes donde se hablaba inglés como primer idioma (ej. Inglaterra, Estados Unidos)
    Sí O No O

Si contestaste sí, contesta las preguntas #24-#37. Si no, pasa a la pregunta #38.

24. ¿Tomaste clases formales durante tu estancia en el extranjero?
    Sí O No O

25. Si tomaste clases formales, favor de nombrarlas. Por cada clase, favor de especificar el idioma de enseñanza. Sino, pasa a la pregunta #28
    ____
    ____

26. ¿Cuantas horas de clases tuviste por día?
    ____

27. ¿Cuantas horas de clases tuviste por semana?
    ____

28. ¿Tuviste que dejar de usar tu primer idioma en el extranjero?
    Sí O No O

29. ¿Quien te pidió que lo dejaras?
    ____

30. Describe tu situación de alojamiento en el extranjero. ¿Vivías con una familia, o en residencias? O ¿vivías solo?
    ____

31. ¿En que idioma te comunicabas con la gente que vivías?
    ____

32. Durante tu estancia, ¿hablaste inglés con gente que hablaba otro idioma como primer idioma?
    Sí O No O

33. Si contestaste sí, ¿por qué? ¿Bajo que circunstancias?
____
____
____

34. Durante tu estancia en el extranjero,
    a. ¿Qué porcentaje de tiempo hablabas en inglés _______%?
    b. ¿Qué porcentaje de tiempo hablabas en español _______%?

35. ¿Cuantas horas de televisión veías en inglés por día?
Menos de 1 hora ___ 1-2 horas ___ 3-4 horas ___ más de 4 horas ___

36. ¿Cuantas veces leías el periódico o revistas en inglés:
Nunca __ una vez a la semana __ tres o más veces a la semana __

37. Cuantas horas hablabas con nativos del inglés al día:
0 horas ___ 1-3 horas__ 3-5 horas __ más de 5 horas__

38. ¿Quieres añadir otro comentario sobre tus experiencias con el aprendizaje de un segundo idioma?
____
____

Sexo: M / F
Edad: ________
Nacionalidad ____________________

¡Gracias por tu participación!

Adaptado de Tokowicz (2000).

Appendix J
Language Questionnaire Results

Native Language	Spanish	100%
Second Language	English	100%
Participants Currently Registered in Language Courses	English	100%
	French	8%
Average Number of Years Learning English		10 years
Percentage of Participants Who Have Living Abroad Experience	Yes	52%
	No	48%
Percentage of Participants Who Have Taken Language Courses Abroad	Yes	39%
	No	61%
Gender of Participants	Female	68%
	Male	32%
Mean Age of Participants		21.4
Nationality of Participants	Mexican	100%

Table JI. Summary of some of the results from the language questionnaire.