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.

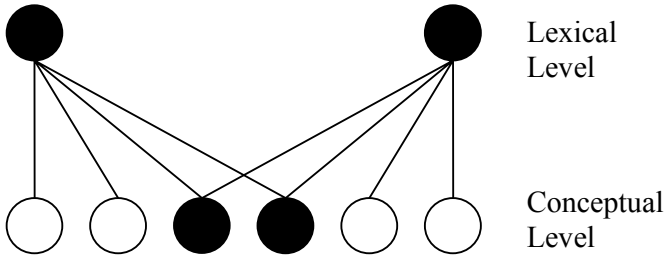

Figure 1. The Distributed Feature Model, adapted from de Groot, 1992a, p.393.

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.

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[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.

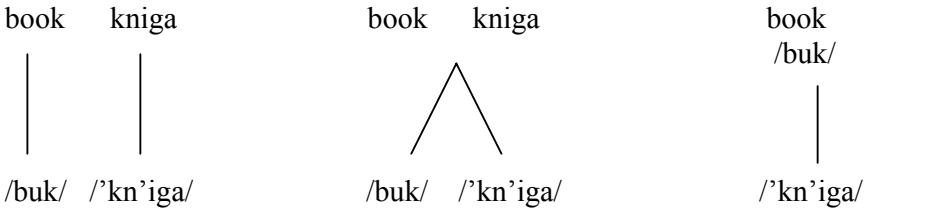

Figure 2. Schematic representation of the three types of bilinguals, adapted from Weinreich, 1953/1974, p.9-10.

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.

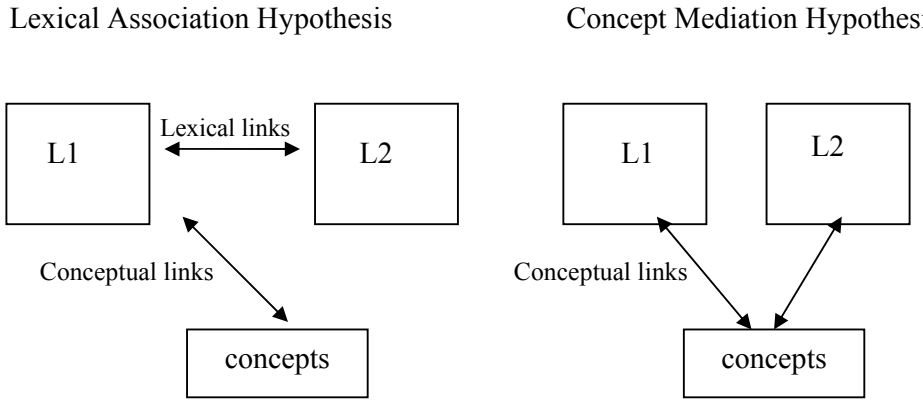

Figure 3. The Lexical Association Hypothesis and the Concept Mediation Hypothesis, adapted from Potter et al., 1984, p.25.

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 $\rightarrow$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.

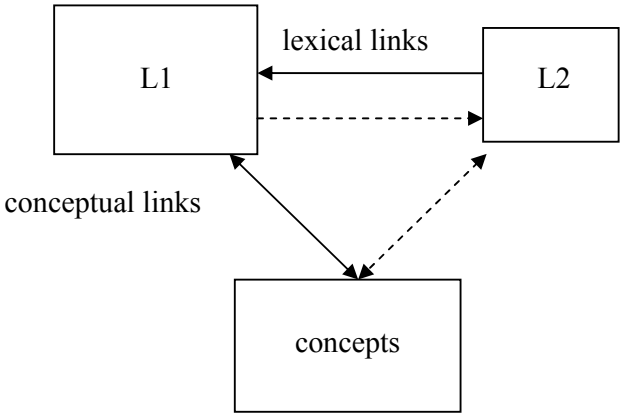

Figure 4. The Revised Hierarchical Model, adapted from Kroll and Stewart, 1994, p.158

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.

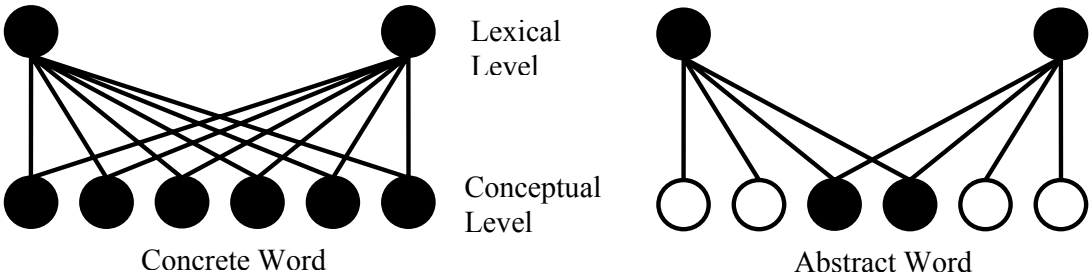

Figure 5. DFM for concrete an abstract words, adapted from de Groot, 1992a, p.1016.

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.

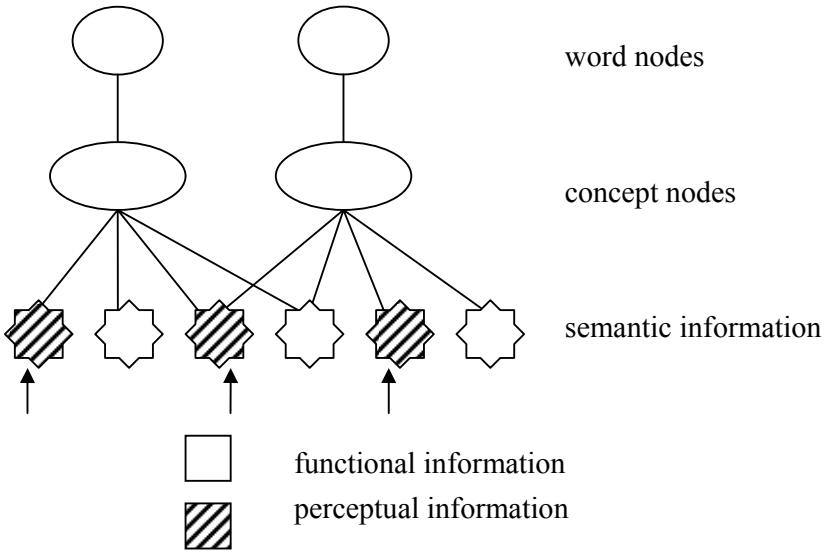

Figure 6. Three levels of representation in the monolingual mental lexicon, adapted from Schreuder and Flores D'Arcais, p.424.

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.

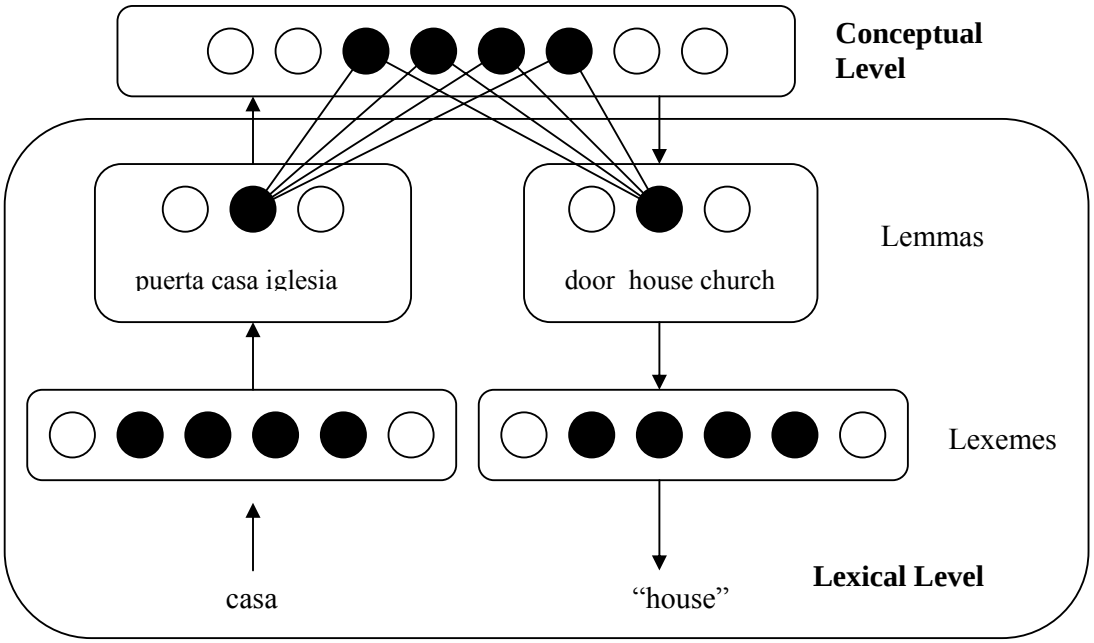

Figure 7. Tokowicz and Kroll's model of language production for unambiguous words, adapted from Tokowicz and Kroll, 2000, p.78.

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.

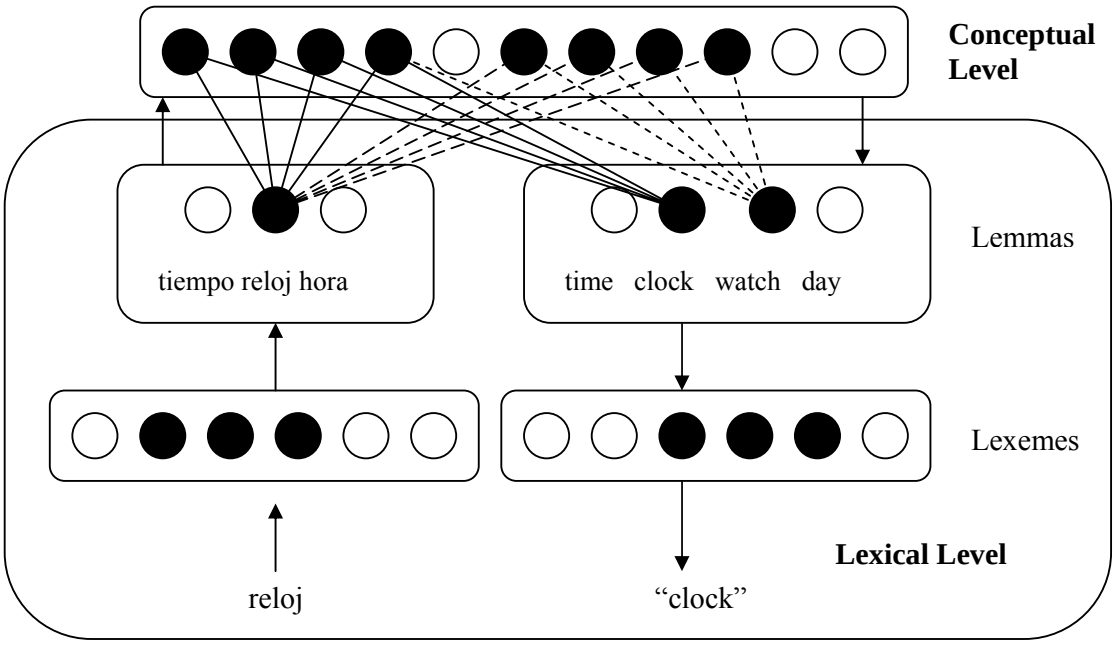

Figure 8. Tokowicz and Kroll's model of language production for words with multiple related meanings, adapted from Tokowicz and Kroll, 2000, p.78.

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.

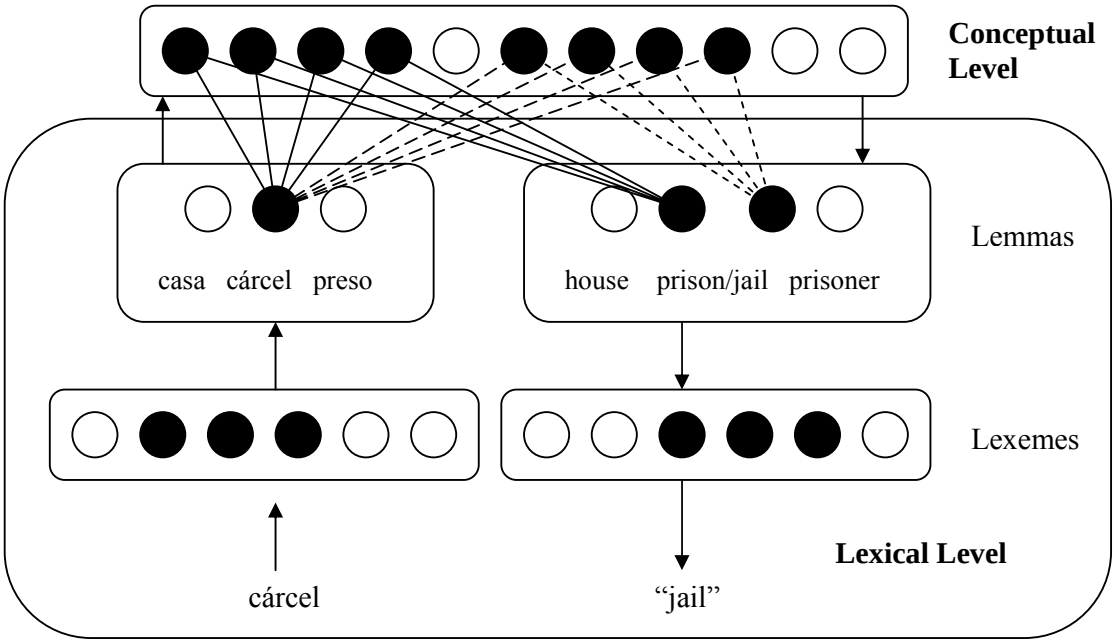

Figure 9. Tokowicz and Kroll's model of language production for synonyms, adapted from Tokowicz and Kroll, 2000, p.78.

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.

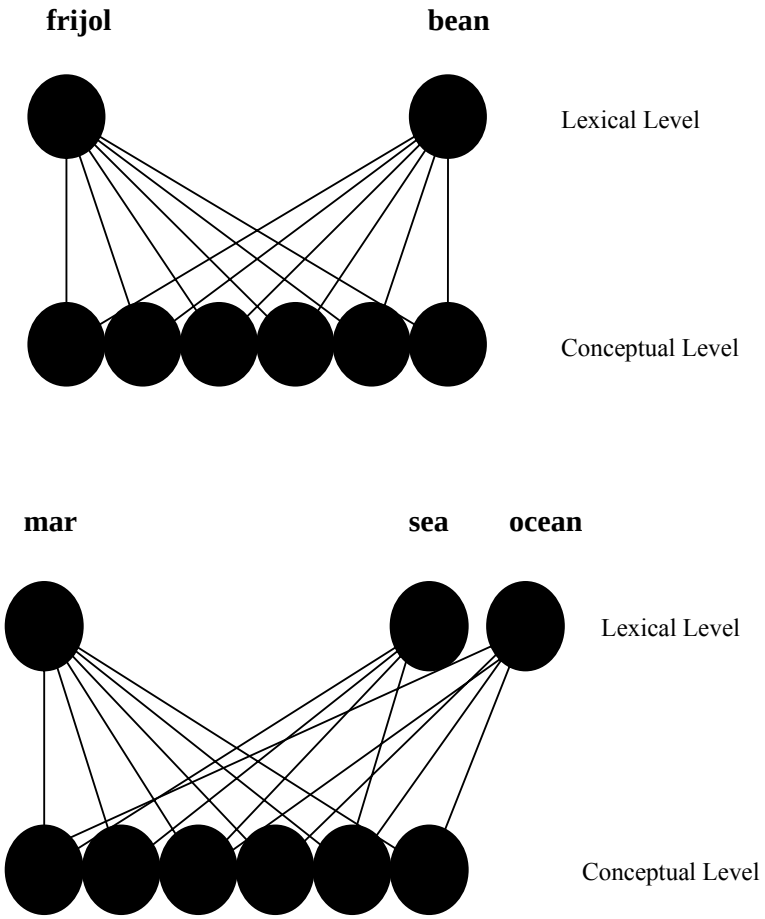

Figure 10. Representation of concrete words with single (top) and multiple (bottom) translation equivalents.

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.

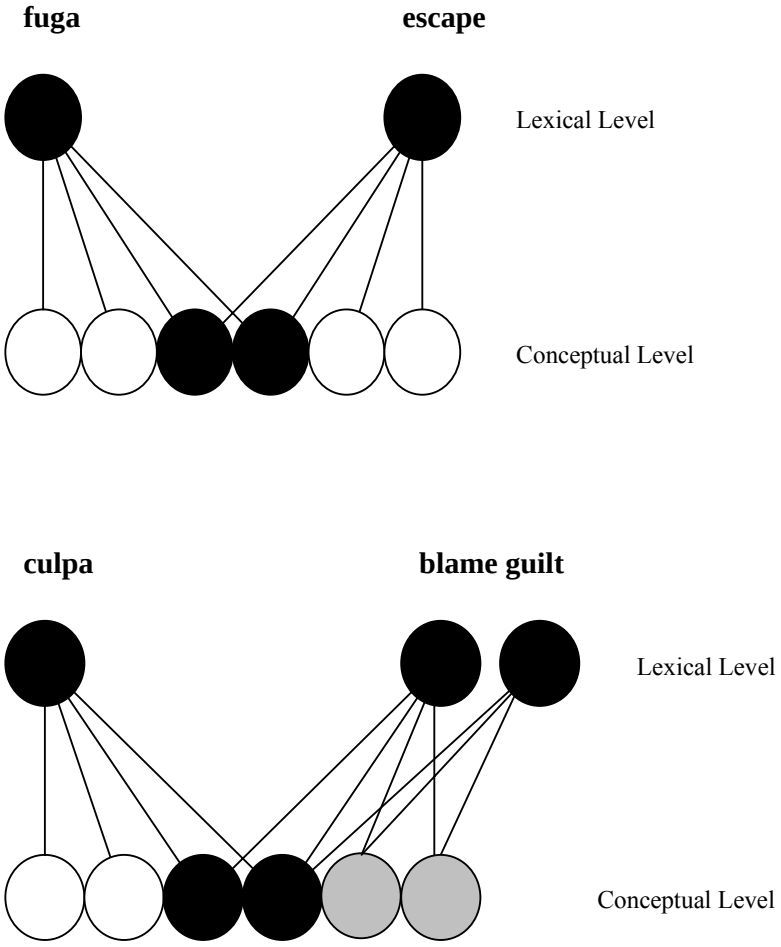

Figure 11. Representation of abstract words with single (top) and multiple (bottom) translation equivalents.

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.

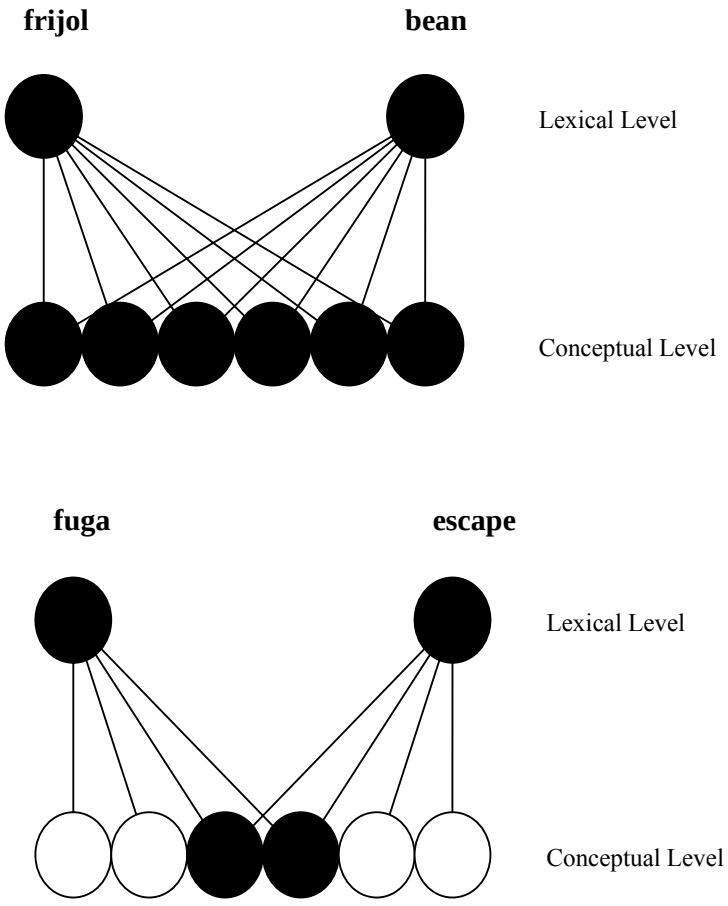

Figure 12. Representation for concrete (top) and abstract (bottom) words with a single translation equivalent.

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.

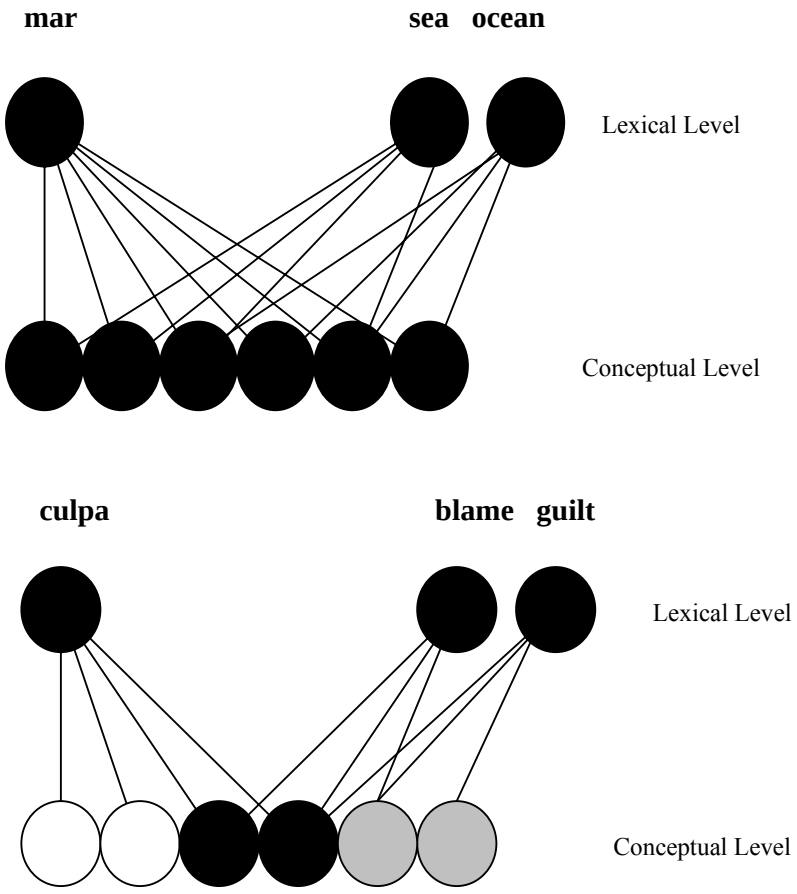

Figure 13. Representation for concrete (top) and abstract (bottom) words with a multiple translation equivalents.

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.