Nonverbal Context Effects on Bilingual Translations

Examination Number: B000148

MSc Developmental Linguistics

The University of Edinburgh

2011

Declaration

I have read and understood The University of Edinburgh guidelines on Plagiarism and declare that this written dissertation is all my own work except where I indicate otherwise by proper use of quotes and references.

Acknowledgement

I would like to express my gratitude to all those who gave me the possibility to complete this dissertation. I am deeply indebted to my supervisor Dr. Mits Ota whose help, stimulating suggestions and encouragement helped me in all the time of research and writing of this dissertation. Special thanks to my parents whose efforts brought me to where I am today.

This dissertation is dedicated to my husband Waleed Ghonaim whose love, endless support and encouragement enabled me to finish this work.

I am heartily thankful to my eldest brother Ahmed for his endless support and my sister Maha for being a great help in difficult times.

I extended my thanks to the rest of my family Wedad, Wedyan, Essam, Jalal, Medo and Nabeel for their encouragement and support.

Lastly, I offer my regards and blessings to all of those who supported me in any respect during the completion of the project.

Table of Contents

Tables and Figures

Tables:

Figures:

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Abstract

This study tested the predictions of the Revised Hierarchical Model (RHM) proposed by Kroll and Stewart (1994) and a subsequent model proposed by La Heij et al. (1996). The RHM claims that; a) backward translation is faster than forward translation b) forward translation is conceptually mediated whereas forward translation is less conceptually mediated c) as proficiency increases, conceptual links map L2 lexicon to concept develops. La Heij et al (1996) claim that backward and forward translation is conceptually mediated regardless learners' proficiency level and the time it takes to translate from L1 to L2 (forward translation) and from L2 to L1 (backward translation) is almost identical. To test the predictions of the two models, we tested the performance of less and more proficient bilinguals on a bilingual translation task and observed the effect of nonverbal semantic contexts on the translation performance. The logic of the study is that if backward translation is conceptually mediated, then we would expect to find nonverbal context effect on the performance of the two groups of participants. If, however, backward translation is lexically mediated then it should not be affected by the existence of nonverbal context. Results showed that forward translation was faster than backward translation. The magnitude of semantic context effect did not differ for backward translation and forward translation. Backward translation and forward translation were conceptually mediated regardless subjects' proficiency level. We considered the implication of these findings as evidence in support of the model proposed by La Heij et al. (1996).

Chapter One

1.1 Introduction

Early cognitive and psycholinguistic studies on the bilingual lexicon investigated the structure of bilingual memory. The question under investigation focused on how words in two languages were represented in the bilingual lexicon. Two main schools of thought emerged. The first one argued that words in the two languages were stored in two different memory systems (Brown, Sharma, & Kirsner, 1984; Gerard & Scarborough, 1989; Scarborough, Gerard, & Cortese, 1984). In other words, word meaning and form are language specific that is the two languages have independent lexical store (contains information about, for example, word form and pronunciation) and an independent conceptual memory store (contains knowledge about word meanings) (Heredia & Brown, 2004). This organization suggests that for an English-Spanish bilingual, the word 'love', for example, is stored in a separate lexical store from its translation equivalent 'amor'. Moreover, the meaning of the word 'love' is stored in a separate store from the meaning of its translation equivalents 'amor', because the meaning of the word 'love' in English involves showing emotions to objects, persons and animals whereas in Spanish it is different as it only involves showing emotions to persons (Heredia R. R., 1997). The other school of thought argued in favour of one shared memory system (Paivio, Clark, & Lambert, 1988; Altarriba, 1990; Heredia & Brown, 2004). This organization suggested that the words in the two languages shared one memory system. They argued that words in the two languages shared the same conceptual memory i.e. the meaning of the words in the two languages overlap because of their shared similarities (Heredia R. R., 1997).

Subsequent studies have revealed that these two views have not contradicted each other; but rather have actually complemented each other. Through the integration of the two views, subsequent studies have proposed that bilingual memory has actually comprised a

hierarchical structure; whereby there have been two lexical stores and one shared conceptual memory store (Potter, So, Von Eckhardt, & Feldman, 1984; Smith, 1997; Kroll & De Groot, 1997).

A question then arises, with regards to how words within the two languages are connected to each other? Initially, two models of bilingual lexical organisation were proposed. The first of which was the Word Association Model which assumed that the two lexical stores were associated; and translation was performed at the lexical level. This matched the intuition of many learners according to Potter et al. (1984). For example if a fluent English speaker translated a word from L2 (English) to L1 (French) or the other way around; they would only retrieve the lexical form of the word, that is the translation equivalent not the concept.

The second was the Concept Mediation Model which assumed that L2 words were not directly associated with L1 words. They shared one common conceptual memory store which was the only connection between the two separate lexical stores. For example, if an English speaking learner translated a word from L2 to L1 or the other way around, the lexical form activates its concept which subsequently activates the translation equivalents. Access to the concept is therefore required in order to retrieve the translation equivalent (L1) and vice versa.

In testing the predictions of the two models, Potter et al. (1984) compared the performance of relatively fluent Chinese-English speakers on a bilingual translation and picture naming task. There is a general agreement in literature that picture naming is conceptually mediated. According to the Word Association Model, translation from L1 to L2 is lexically mediated and does not involve concept activation whereas the Concept Mediation Model assumes that translation from L1 to L2 is conceptually mediated. Thus, Potter et al. compared the time needed to translate words from L1 to L2 and the time needed to name pictures in L2. They

hypothesised that if word translation from L1 to L2 is conceptually mediated, then it should take the same time as picture naming in L2. Results showed that word translation took the same amount of time as picture naming in L2, thus it is conceptually mediated.

Potter et al. (1984) tested another group of less proficient English-French learners and found the same pattern of results. Therefore they concluded that the Concept Mediation Model was the most accurate model that best characterised the bilingual lexicon of less and more proficient bilinguals. However, the results obtained for less proficient learners were thought to be biased as less proficient participants were about to spend their summer vacation in France and thus might have been motivated to learn French and be taking extra courses (Kroll & Sunderman, 2005; Chen & Leung, 1989). For this reason their performance might be similar to highly proficient learners.

1.2 Recent Models of Bilingual Lexicon

Subsequent studies on bilingual memory have proposed three different models all of which have agreed on the hierarchical structure of bilingual memory; but have differed in the factors believed to determine the nature of the connection between the lexical and semantic representations: a) the Intermediate hypothesis b) the distributed feature model and c) the Revised Hierarchical Model.

Firstly, the intermediate hypothesis argues that the pattern of lexical organisation is determined by the proficiency level of L2 speakers, age of acquisition and learning strategy (Chen & Leung, 1989; Chen H.-C. , 1990). As shown in Figure (1), the intermediate hypothesis suggests the involvement of three models of bilingual processing of words and pictures. For more proficient bilinguals, L2 words are associated to the corresponding L1 words via a shared conceptual memory store as proposed by the Concept Mediation Model. For less proficient learners, L2 words are processed through either L1 words or pictorial

representation depending on their learning strategy and age of acquisition. In other words, if less proficient subjects learn L2 words through associating them to L1 words, then they would rely on L1 words to retrieve the corresponding L2 words as proposed by the Word Association Model. If however, less proficient subjects learn L2 words through associating them to pictures, then they would rely on pictures to retrieve the L2 words. Moreover, younger less proficient bilinguals would rely on pictorial representation than L1 words. In short, the intermediate hypothesis proposed that the nature of the interlanguage connections is determined by three factors (L2 proficiency, age of acquisition and strategy of learning).

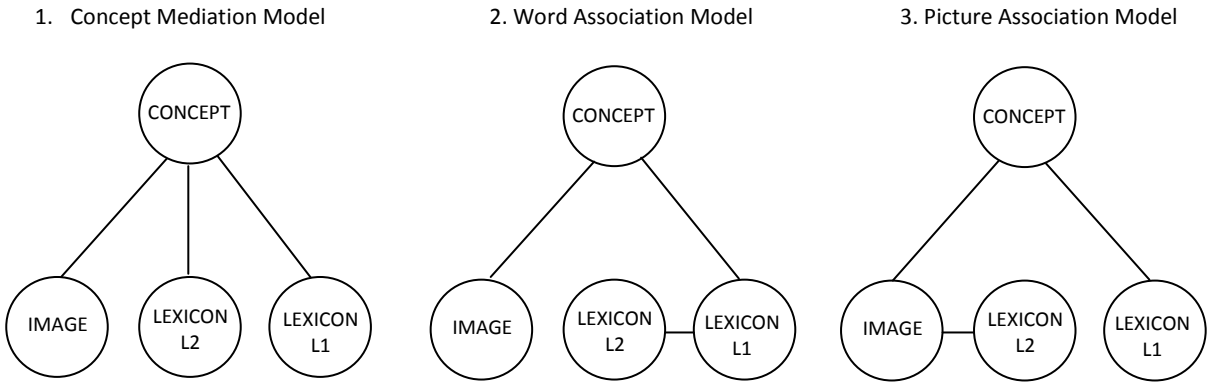


Figure 1

The Three Models of Bilingual Processing of Picture and Word Stimuli (adapted from Chen H.-C. , 1990).

Secondly, the distributed feature model has argued that *word type* can play an important role in determining the degree to which words share the same concepts (De Groot, 1992; De Groot, Dannenburg, & Van Hell, 1994). Unlike the previous models of bilingual lexicon, the model does not regard the concept as similar or different for words in the two languages. In this model as shown in Figure (2), words in the two languages share one concept but the degree of shared semantic features differs according to word types (Kroll & Sunderman, 2005). The two main word dimensions are the cognate status of words (cognates are translation equivalents that are similar in orthographic or phonological form; non-cognates

are translation equivalents that are different in orthographic or phonological form) and imageability (concrete Vs. Abstract). Cognates share more semantic features than noncognates and concrete words share more semantic features than abstract.

The main finding of the studies which have tested this factor in word translation tasks (e.g. De Groot & Poot, 1997; De Groot, 1992; De Groot, Dannenburg, & Van Hell, 1994) was that the translation of concrete and cognate words was faster than the translation of abstract and non-cognate words. In other words, the more overlap between semantic features of the words in the two languages, the more quickly translation equivalent will be retrieved.

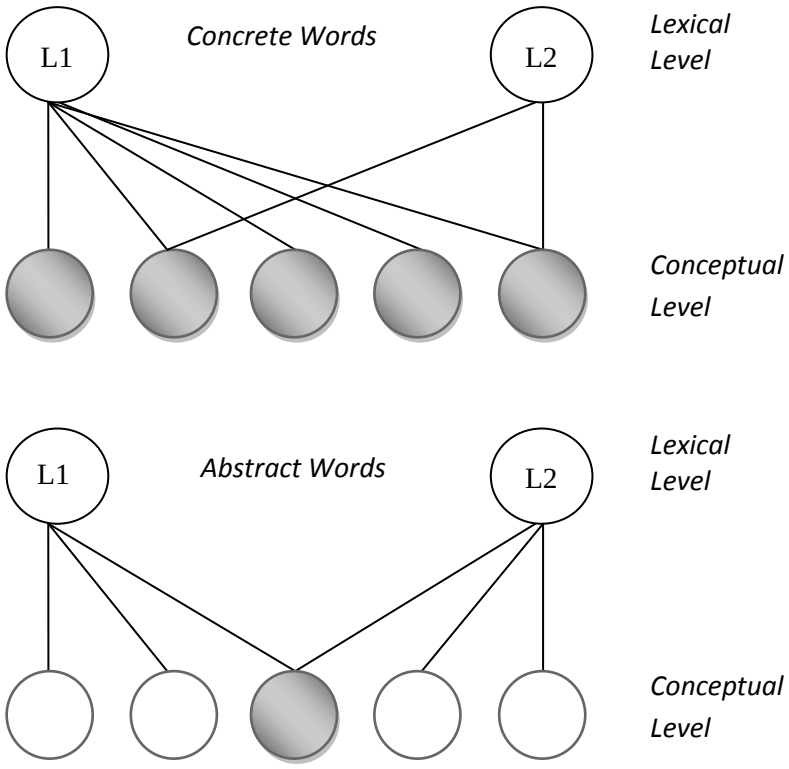


Figure 2

The Distributed Feature Model (adapted from Van Hell and De Groot, 1998).

Thirdly, the Revised Hierarchical Model which was proposed by Kroll and Stewart (1994) to account for the differences of proficiency level. The model, as shown in Firgure (3), assumes

an independent lexical store for each language and a shared conceptual memory store. Also, it assumes that the lexical store of L1 is larger than the lexical store of L2 words, because for most bilinguals even the relatively fluent ones, more words in L1 are known than in L2. The model focuses on the nature of connections between the concepts and the lexical stores (Kroll & Sunderman, 2005). It has assumed that there is an asymmetry in the strength of connections between words in the two languages and concepts. At the lexical level, L2 words are strongly associated to L1 words whereas there is a weaker link that maps L1 to L2 words. At the conceptual level, L1 words are strongly connected to its concept than L2 words and it can access its meaning more readily than L2 words (Kroll & Sunderman, 2005). A huge debate has surrounded this model and several studies have tested the predictive potential of the model and have thus provided evidence in support or against its prediction (Heredia & Brown, 2004).

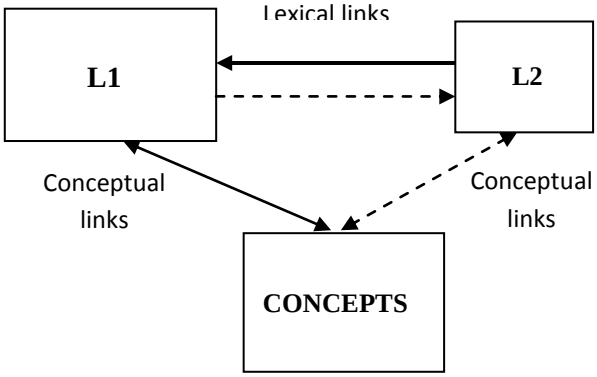


Figure 3

The Revised Hierarchical Model (adapted from Kroll and Stewart, 1994).

The main focus of this paper is to further examine this proposal, and thus the author will dedicate the following section of this paper to discuss in detail the model and its predictions and provide a detailed account of the debate that has surrounded this model.

1.2.1. A detailed Account of the Revised Hierarchical Model

This paper is concerned with the assumptions of the Revised Hierarchical Model as proposed by Kroll and Stewart (1994). The model accounts for the development of conceptual processing with increasing L2 proficiency level. It claims that for less proficient learners, there is a strong direct link that maps the L2 lexical store to L1 lexical store. Therefore L2 words indirectly get access to the concept via the L1 lexicon. With increasing proficiency in L2, direct links that maps L2 to concept develop. However, links that maps the L1 lexicon to concepts are stronger than the links that maps L2 lexicon to concept for all but high proficient bilinguals. The model predicts that backward translation (from L2 to L1) is faster than forward translation (from L1 to L2). The reason behind this asymmetry in translation performance is the asymmetric connections between the concept and the lexical stores. In other words, since lexical links map L2 to L1 are stronger, fast retrieval of the corresponding L1 word is expected. According to this model, backward translation is accomplished at the lexical level. On the other hand, when subjects translate words from L1 to L2, additional processing is required that is the retrieval of the concept since there are strong links that map L1 to concept. Subsequently, the concept spread activation to the lexical form that corresponds to the L1 word. This additional processing and the lexical competition to choose the corresponding L2 word would cause slow processing of L2 words (Heredia & Brown, 2004). Moreover, the model predicts that as L2 proficiency increases and L2 words become directly associated to concepts, the magnitude of assumed translation asymmetry would decrease.

To test this model, Kroll and Stewart (1994) examined the presence of category interference on the performance of relatively fluent Dutch-English speakers on bilingual translation and a picture naming task. Subjects were presented with a list of words that belonged to one

particular semantic category (semantically related words) for example: spoon, fork, knife etc; and another list that was semantically unrelated, for example, table, shark, fruit etc.

The logic of the study was that if L2 words are directly connected to the L1 lexicon, then backward translation should be faster than forward translation. Because L2 words have a direct and strong access to the translation equivalent (L1) therefore it would just be retrieving the equivalent lexical form. Also backward translation would be less sensitive to semantic manipulation as there is no semantic processing involved in this direction. If L1 words are directly associated to the concepts then forward translation would show a greater semantic interference effect and thus slower than backward translation.

Results showed that backward translation was faster than forward translation. Moreover, the category interference effect was present in only forward translation in the context of categorized list. The results have thus confirmed the predictions of the RHM and have provided evidence for the assumed translation asymmetry.

1.2.1.1 Supporting Studies

Subsequent studies have tested the predictions of the RHM and have provided evidence in support of its claims. Talamas, Kroll, and Dufour (1999) tested less and more proficient bilinguals on the translation recognition task. Subjects had to decide whether the two words were translation equivalents or not (e.g. man–hombre [man]). The study also included distracters that were form related to the L2 words (e.g. man–hambre [hungry]); and meaning related (e.g., man–mujer [woman]). Results showed that less proficient learners were more distracted by form related distracters than meaning related distracters; whilst more proficient learners were affected to a greater extent by meaning related distracters.

The results confirmed the prediction of the RHM that less proficient learners were relying on lexical links unlike more proficient learners who were mainly relying on conceptual links.

Moreover, Dufour and Kroll (1995) tested fifty-one more and less fluent English-French bilinguals in a category decision task. Subjects were presented first with the category name (e.g. vegetables) and had to decided whether a target word (e.g. lemon) was a category member or not. Both category name and the target words were presented to subjects in English as well as French. Results showed that for fluent bilinguals, the time needed to categorize target words was not affected by the language in which words were presented. Accordingly, they concluded that fluent bilingual were able to conceptually mediate L1 words as well as L2 words. On the other hand, the less proficient bilinguals categorized words faster when the language of the category name matches the language of the target words (category name in English and target word in English) than when the language of the category name and the target word was different. Moreover, for less fluent bilinguals, it took longer to categorize English to French words than French to English words. Their results showed that fluent bilinguals rely on conceptual links whereas less fluent bilinguals rely more on lexical links and they have a limited access to concept for L2 words. Their findings were in accordance with the prediction of the RHM.

The most compelling evidence in support of the RHM came from a study conducted by Sholl, Sankaranarayanan, and Kroll (1995) in which they tested the prediction of the RHM by using a transfer paradigm. They requested English-Spanish bilinguals who were relatively fluent in Spanish to name pictures in L1 and L2. Subsequently they ran a bilingual translation task in which they presented subjects with the same words that were produced in the picture naming task and new words. Assuming that the picture naming required concept mediation, translation that required concept mediation would benefit from the previous conceptual processing; and a facilitation effect would thus be present.

Results showed that only forward translation benefited from the previous semantic processing; and no facilitation effect was present in backward translation. This finding has supported the prediction of the RHM in that forward translation is conceptually mediated and thus was the only route that benefited from previous semantic processing.

Additional support to the claims of the RHM came from a study conducted by Kroll, Micheal, Tokowicz, and Dufour (2002). They tested less and more proficient French-English bilinguals on word naming and bilingual translation tasks. Results showed that backward translation was faster and more accurate than forward translation for both less and more proficient learners. Moreover, results showed that in forward translation and naming word in L2, less proficient bilinguals were slower and more error prone than the fluent bilinguals. Also, the two translation directions differed in terms of translation latencies significantly and the difference was noticeably larger in less proficient learners than more proficient learners. This finding has confirmed the prediction of the RHM which has suggested that as proficiency increases, translation asymmetry (in terms of translation latencies) decreases.

1.2.1.2 Counter evidence

However several studies have investigated the predictions of the RHM and have provided counter evidence to the proposed asymmetry. De Groot and Poot (1997) tested 3 groups of English-Dutch bilinguals who differed in their proficiency level in L2 (high, average, and low). They evaluated the performance of subjects on a bilingual translation task in which they manipulated word imageability. The stimuli consisted of concrete (perceptible) words e.g. chair; and abstract words i.e. words low in imageability (imperceptible) e.g. beauty. The logic of their argument was that if forward translation was conceptually mediated then the imageability effect would be greater in forward translation than backward translation.

Results showed that the performance of the three groups was the same and there was no effect of proficiency level on the bilingual translations. Furthermore, there was a similar effect of imageability (concreteness) on the performance of the three groups on the two directions of translation. De Groot and Poot (1997) interpreted this finding as evidence that the three groups with different proficiency levels did not differ in the way they involved concepts in translation. In addition, forward as well as backward translation was conceptually mediated.

Additional counter evidence comes from a study which examined the performance of less and more proficient English–Spanish bilinguals on a translation recognition task conducted by Altarriba and Mathis (1997). In the first experiment, they trained monolinguals on a set of Spanish words, and they examined whether the performance of those early bilinguals and another group of expert bilinguals would be affected by lexical distracters. They presented subjects with a Spanish word (e.g. HILO) and 3 English words: the correct translation equivalent (e.g. THREAD), an orthographically related English word (e.g. THREAT) and an unrelated English word. In the second part of this experiment, they tested the effect of semantically related distractors on the performance of the less and more fluent bilinguals. Subjects were presented with a Spanish word (e.g. HILO) and 3 English words: the correct English translation (e.g. THREAD), a semantically related English word (e.g. NEEDLE) and an unrelated English word.

Results showed that lexical distractors produced interference effect for more and less proficient learners and that the effect was larger for the less proficient learners. This finding made them conclude that lexical links between the two lexical stores L2 and L1 existed for less and more proficient bilinguals. In addition, results showed more and less proficient learners experienced semantic interference effect and the effect was larger for more

proficient learners. They suggested that conceptual links existed for L2 words for more proficient bilinguals and less proficient learners even after a single learning session.

To avoid the possibility that the semantic interference effect occurred through conceptual links with L1 due to subjects translating the Spanish words into English first, Altarriba and Mathis (1997) ran another experiment that emphasized the semantic prosperities of words. They evaluated the performance of novice and more proficient bilinguals on a Stroop colour-word task. Results showed that interference was present in the performance of the two groups. This finding has thus provided evidence that links map L2 to concept develop as early as the first encounter with the L2. The novice were monolinguals that receive a single learning session on the Spanish words before they took the test. However, the fact that Altarriba and Mathis trained monolinguals on a small vocabulary size has been considered unrealistic as it was unrepresentative of the actual learning experience of L2 (Kroll, Van Hell, Tokowicz, & Green, 2010).

Likewise, La Heij et al., (1990) tested the performance of English-Dutch bilinguals on a Stroop-like task in which a soon to be translated word in L2 was followed by a word that was semantically related or unrelated to the translation equivalents in L1 (Dutch). Results showed that semantically related distractors had a great effect on backward translation than unrelated distractors. This indicated that backward translation was conceptually mediated; unlike the prediction of the RHM.

In 1996, La Heij et al., run four Stroop-like experiments in which a to-be-translated word was accompanied by a picture or a colour. In the first experiment, they tested the performance of Dutch-English bilinguals on a word naming task and the bilingual translation task of four colour words. Subjects were requested to name and translate colour words and ignore the colour in which words were printed in. Colour words were presented

to subjects in two conditions: a) a congruent condition where colour word was printed in congruent colour (colour word 'Green' was printed in green colour) and b) an incongruent condition where the colour word was printed in incongruent colour (e.g. colour word 'GREEN' was printed in blue colour). The objective of this experiment was to test whether the experimental paradigm was suitable to test the non-verbal context effects (i.e. the colour) in word naming and word translations. Results showed that a significant effect of context could be obtained.

Firstly, subjects were slower in translating words than reading words. In addition, the congruency effect was greater in the translation task than the naming task and the effect was similar for backward and forward translation.

However, La Heij et al., (1996) speculated that such results may have been the subject of bias due to the fact that they used small numbers of stimuli (only four colour words). Besides which subjects received heavy training on these words before taking the test and several trials sessions were conducted.

Thus, La Heij et al. ran another experiment in which they tested Dutch speakers relatively fluent in English, and included a larger set of stimuli. Subjects were requested to read and translate words and ignore the accompanying pictures. Pictures were either congruent (the word SHARK was accompanied by a picture of a shark) or incongruent (the word SHARK was accompanied by a picture of a TIGER). Results showed that, similar to the first experiment, reading words took less time than translating words. The congruent effect was larger in the translation than the reading task. Specifically, words were translated faster when accompanied by a congruent picture than an unrelated picture. Moreover, forward translation was faster than backward translation.

This finding according to La Heij et al. is thus contrary to the general observations that suggest backward translation to be usually faster than forward translation. They speculated that it may have been the result of training subjects on the correct translation equivalent before the taking of the real test. Of interest, results showed that the context effect was larger in backward translation than forward translation. This has been considered as evidence with regards to the fact that backward translation is conceptually mediated. Yet to avoid the possibility that subjects were faster at word translation in the congruent condition mainly because they may have developed a strategy to name the accompanying picture instead of the words; they ran a third experiment.

In this experiment instead of using congruent pictures they used semantically related or unrelated pictures; and again asked subjects to react to the verbal part of the stimuli (i.e. words) ; and to ignore the non-verbal parts (i.e. pictures) when reading or translating words.

Similar findings were obtained; the naming of words took less time than translating words. Subjects took less time to translate words when accompanied by semantically related rather than unrelated pictures. The same effect was obtained in the two directions of translation. The critical finding was that the semantic effect was almost the same for backward and forward translation contrary to the findings of the second experiment.

The findings of the last two experiments were mainly in support of the idea that forward and backward translation was conceptually mediated which thus has contradicted the RHM. However, it could be argued that La Heij et al., (1996) were barely attempting to eliminate any source that may have biased their conclusions. Kroll and Stewart (1994) tested subjects without any pre-training sessions; whereas La Heij et al., (1996) ran training sessions before the real test. To avoid the possibility that this procedural difference may have affected the

results, they ran the fourth experiment without providing any training sessions to the subjects.

Similar results were obtained; firstly, the naming of words was faster than the translation of words. Secondly, semantically related pictures facilitated translation in both directions. Thirdly, the context effect was larger in backward translation than in forward translation. The findings of La Heij et al (1996) led them to propose a model in which a) forward and backward translation are conceptually mediated; b) L1 words activated their concepts more efficiently than L2 words. In other words, forward and backward translations shared the same underlying processes and the differences between them were therefore quantitative. They claimed that the problem in backward translation is concept activation and not the lexical retrieval of L1 word. That is longer translation latencies were observed in backward translation because of the concept activation of the translation equivalent not the lexical activation. On the other hand in forward translation, the problem is lexical retrieval of the translation equivalent in L2.

1.3 Research Problem

To sum up, there is a general consensus regarding the finding that forward translation is conceptually mediated. Yet a large debate is still on-going with regards to backward translation. Evidence in support of the claim that backward translation is conceptually mediated has come from studies using Stroop–like tasks (La Heij, De Bruyn, Elens, Hartsuiker, Helaha, & Van Schelven, 1990; La Heij, Hooglander, Kerling, & Van der Velden, 1996; Altarriba & Mathis, 1997); translation production and recognition tasks (De Groot & Poot, 1997; De Groot & Comijs, 1995; Salamoura & Williams, 1999); number-word translation tasks (Duyck & Brysbaert, 2004) and Semantic Simon tasks (Duyck & De Houwer, 2008).

Evidence in support of the claim that backward translation is less conceptually mediated comes from studies which have used the transfer paradigm from naming pictures to translating words (Sholl, Sankaranarayanan, & Kroll, 1995); translation recognition tasks (Talamas, Kroll, and Dufour, 1999; Kroll, Michael, Tokowicz, and Dufour 2002) and translation production tasks (Kroll and Stewart, 1994).

The current study investigates the predictions of RHM by employing a partial replication of La Heij et al's (1996) study. La Heij et al's study only tested relatively fluent bilinguals and from my personal point of view this cannot be considered a fair judgement of the RHM. First, according to RHM as proficiency increases, link maps L2 to concept might develop. There may therefore be a chance that the subjects associated with the study by La Heij et al may have been proficient enough to develop strong links to connect L2 words to the concept and thus the difference between backward and forward translation may therefore be insignificant. Finding nonverbal context effects for less as well as more proficient learners would have provided a conclusive evidence for La Heij et al. claims.

Thus, we examine and compare the performance of more and less proficient learners on the two directions of translation. If backward and forward translation is conceptually mediated, according to La Heij et al, then the nonverbal semantic effect should be greater in both directions for less and more proficient learners; and no significant difference should be found.

If, however, backward translation is lexically mediated, according to RHM, then forward translation should be affected by nonverbal contexts more than backward translation and the same result should be obtained for less and more proficient learners.

Moreover, Kroll and Tokowicz (2005) have argued that La Heij et al's failure to find the assumed asymmetry by Kroll and Stewart (1994) in the translation task was due to three

procedural factors. First, La Heij et al intentionally used high frequency word and thus all subjects were familiar with these words whereas Kroll and Stewart used words that were much lower in frequency. Second, they repeated the concepts in different conditions (the same word appeared twice for each participant), so there was a great chance for repetition priming effects where retrieval of the concepts becomes faster and thus results in faster translation latencies (Sholl, A., Sankaranarayanan, A. and Kroll, J.F., 1995). On the other hand, Kroll and Stewart did not use the same word twice in their study. Third, unlike Kroll and Stewart, La Heij et al trained their participants prior to the real test which resulted in noticeably fast translation RTs in comparison to other translation studies The last two procedural factors were thought to be the reasons why forward translation was faster than backward translation in La Heij et al's study.

Thus, in the current study, no words will be represented to participants more than one time and words will be much lower in frequency than La Heij et al's. Also, no training sessions will be conducted for participants.

1.4 Structure of the dissertation

The current chapter has introduced the main issues, concepts, our motivation and a literature review on the bilingual lexicon and the proposed models. Chapter two will present the research questions, methods and procedures used to test our hypothesis and a detailed analysis of results. Chapter three will focus on a detailed discussion of the findings and implications of the current study.

Chapter Two

2.1 Aim of the Experiment

The objective of the study is to test the predictions of the RHM and La Heij et al's (1996) claims. To conduct this test we will compare the performance of less and more proficient bilinguals on a bilingual translation task and observe the effects of nonverbal contexts on the performance of translation. The contrasting hypothesis is that of Kroll and Stewart (1994) who claim that; A) L2 words are strongly connected to their translation equivalent (L1 words) and that this lexical link is stronger than the lexical link that maps L1 to L2. B) L1 words are strongly associated to the concept. C) Access to concepts for L2 words is mediated through L1 words. D) As proficiency increases, links that maps L2 to concept develop. Accordingly, they predict that backward translation is faster than forward translation. Forward translation is conceptually mediated and more error prone whereas backward translation is mainly accomplished at the lexical level; making it apparent why semantic context will affect forward translation more than backward translation. The asymmetry in translation performance will decrease for highly proficient and balanced bilinguals whose links that map L2 to concept are stronger than those for less proficient bilinguals.

Thus, if backward translation is mainly accomplished at the lexical level as Kroll and Stewart propose, then it would be unlikely to find nonverbal context effects on the performance of less proficient learners. If however, as La Heij et al 1996 claim, backward translation is conceptually mediated just like forward translation, then we should find that the nonverbal semantic context has an effect on both backward and forward translation similarly.

To test this hypothesis the following questions were formulated, adding in an additional element to measure the impact of proficiency on the variables:

1. Is backward translation faster than forward translation?
2. Does the magnitude of nonverbal semantic effect differ for backward and forward translation?
3. Does the magnitude of the nonverbal semantic context differ in the two directions of translation in conjunction with differences in proficiency level?
4. Does semantically related nonverbal context induce faster translation latencies?
5. Is the performance of the highly proficiency group in the two translation directions different from the performance of less proficient bilinguals in the two translation directions?

To find the answers to these the test method was carefully designed to measure relatedness from both translation directions using participants from two groups based on proficiency level.

2.2 Method

2.2.1 Participants

The research participants are twenty four Arabic-English bilinguals of varying competencies who speak Arabic as their native language; the group is comprised of fifteen female and nine male. Subjects' age ranged from 19 to 34 years-old. They were paid for taking part in the experiment.

The participants are of Saudi nationality, but at the time of the experiment were UK residents pursuing academic studied at UK universities. Fifteen of the subjects are postgraduates and four are undergraduates. In addition to their academic courses they are also enrolled at the English Language Teaching Centre at the University of Edinburgh taking English language courses (academic and general). All of the participants have taken the International English Language Testing System (IELTS) as it is a prerequisite for admission to UK universities.

Accordingly, the participants' IELTS scores have been taken as a proficiency measure. By taking the median of the IELTS scores as a cut off, participants were divided into two groups; students whose score is 6 or more will be considered as more proficient learners; whereas students whose score is 5. 5 or less will be considered to be less proficient learners.

A one-way ANOVA was performed on the IELTS scores and a statistically significant difference was found between the highly proficient and less proficient group, $F(1, 22) = 31.273$ $P < .000$. A Language History questionnaire was used to provide information about their linguistic background. The participants' first exposure to L2 was uniformly found to be at the age of thirteen. All the participants learned English as a second language primarily through formal classroom teaching. All participants received instruction at school (elementary, intermediate and high school) in Arabic. Only six of the participants had received instruction at university in English (five of them were included in the highly proficient group) and the rest had been instructed in Arabic. Participants were asked to estimate their use of L1 and L2 on a daily basis. As shown in Table (1), for the highly proficient group, the average estimation of L1 and L2 usage per day was 30% and 67% respectively. For the less proficient group, the average estimation of L1 and L2 usage per day was 55% and 45% respectively. The mean average of residence in UK was 14.08 months for the highly proficiency group and 25.17 for the less proficient group. Several of the participants in the less proficient group had experienced a long period of residence in the UK but they had spent the majority of that period without studying or taught at any institute, and were rarely involved in English conversations as they were waiting for their scholarship from the Saudi government. Upon receipt of their funding they had enrolled at the English Language Teaching Centre at the University of Edinburgh. For this reason, we depended only on IELTS scores and did not include their UK residence as a measure of proficiency.

Table 1

Descriptive Statistics for Participants.

Proficiency Level		Minimum	Maximum	Mean	Std. Deviation
More Proficient (N=12)	Age	23	34	28.0	3.6
	IELTS	5.0	7.0	6.4	.6
	UK residence	6	24	14.0	6.3
	L1 Usage per day	10	50	30.8	17.7
	L2 Usage per day	50	90	67.9	16.7
Less Proficient (N=12)	Age	19	34	26.0	4.5
	IELTS	4.0	6.5	4.8	0.8
	UK Residence	6	48	25.2	14.4
	L1 Usage per day	20	80	55.0	18.5
	L2 Usage per day	20	80	45.0	18.4

2.2.2 Materials

2.2.2.1 Stimuli Selection

To create the test, the stimuli, 36 pairs of Arabic-English translation equivalents were selected. Words were selected according to the following criteria: a) all words should be frequent words; b) All words should be concrete nouns. Several studies reported that the differences in translation performance among subjects could be due to words frequency and concreteness status; frequent and concrete words translated faster than infrequent and abstract words (De Groot, 1992; De Groot, Dannenburg, & Van Hell, 1994). To avoid any artefact, only frequent words (but not rated as high in frequency) and concrete nouns were selected. The words were selected from three semantic categories (Food, animals and furniture). Arabic words were selected from the top 100000 most frequently words used in Modern Standard Arabic as well as widely spoken Arabic dialects based on a 30-million-word corpus of Arabic which includes written and spoken material (Buckwalter & Parkinson, 2011). Words were intentionally selected to be much lower in frequency than those for La

Heij et al. The mean rank of these words were 14073 whereas the mean familiarity rating of the words used in La Heij et al's was 8.18 on a scale from 1 to 9. The mean length of the selected Arabic words was 3.9 letters with a range from 2 to 6 letters. The mean length of translation equivalents (English words) was 5.2 letters with a range from 3 to 8 letters.

Thirty six pictures (line drawings) were selected. The selection of the pictures included 18 semantically related ones (e.g. the word to be translated is lemon and is accompanied by a picture of a strawberry); and 18 unrelated ones (e.g. the word to be translated is cat and is accompanied by a picture of a key). Unrelated pictures were selected from four categories (food, furniture, animals and tools). Pictures were carefully selected that no picture in the related or unrelated condition should be congruent to any words in the stimuli list.

Also, a picture should be clear enough not only in size but also its content i.e. a picture of a lion should show the whole body of the animal not only part of that animal (e.g. face).

2.2.2.2. Presentation of the stimuli

Words were presented in capital letters and centred at the fixation point. A black, 28 sans serif font was used. Pictures were presented at different places around the word and oriented so that they would be easily recognisable.

The pictures were shown with the dimensions 200 x 180 Pixels. Eighteen words were accompanied by a semantically related picture and the other eighteen words were accompanied by semantically unrelated pictures. The words were assigned randomly to the two categories and they were not controlled for frequency or length of word.

The two sets of eighteen words were assigned to the two translation directions. Set one was initially assigned for forward translation and set 2 for backward translation. In forward translation, nine Arabic words were presented, accompanied by related pictures, and the

other nine were accompanied with unrelated pictures. Subjects were requested to translate words from L1 to L2. In backward translation, nine English words were presented accompanied by related pictures and the other nine words were presented accompanied by unrelated pictures. Subjects were requested to translate words from L2 to L1.

The order of presentation of the two sets was counter balanced across the subjects, that is, half of the subjects started with forward translation and the other half started with backward translation.

In addition the presentation of words within each set was randomly ordered. Each subject encountered words in the two sets in a completely different order from the other subjects.

2.2.3 Facility/Apparatus

The stimuli were presented to participants using Samsung M22332 22" monitors, operating at 1680x1050 resolutions, with a refresh frequency of 100Hz. In cm, the dimensions were 47cm horizontal, 30cm vertical, and the viewing distance was 60 cm. The computers were Apple Mac Mini (2.4GHz processor, 4GB RAM, 320GB disk drive).

The experiment was designed using E-Prime version v2.0.8.90 (Psychology Software Tools). Vocal latencies were measured by means of voice key with an accuracy of 1 ms. Subjects' responses were recorded using Logitech 960 usb headset microphone.

2.2.4 Design

The experiment was of mixed design with proficiency representing the between subject factor and direction and relatedness the within subject factors, which means all the participants in the less proficient group and higher proficiency group had to translate words in the four experimental conditions (forward–semantically related, forward-unrelated, backward–related and backward-unrelated).

2.2.5 Experimental procedures

The present study is a partial replication of La Heij et al. (1996) study, thus we used a similar experimental procedures they had applied in their study. Participants were tested individually in a sound proof lab. They were placed in front of a desktop computer at a viewing distance of 60 cm. They were requested to perform a bilingual word translation task. They had to translate words from L1 to L2 (forward translation) and from L2 to L1 (backward translation). Participants received oral and written instructions. Oral instructions were given before subjects started the test and the written instructions were delivered throughout the test on screen. The experimenter was not present when subjects start the test. Subjects were informed that they had to respond to the verbal element and ignore the nonverbal element on the screen. They were requested to respond as fast as possible and to say 'no' if they did not know the answer. Participants were also requested to avoid saying undesirable responses like 'ah' or 'uhm' when thinking and to avoid laughing as this would trigger the voice key.

The test started with a nine trial question training session which was performed with completely different words to those in the real test. Therefore subjects will have two training sessions, one before performing forward translation and the other one before performing backward translation. The test starts initially when a fixed point appears on screen for (500 ms). Then the context picture appears on the screen, and after 240 ms the word to be translated appears on the screen. The context picture and the word will then remain on the screen for another 360 ms. Translation latencies will be measured from the onset of the word. In addition response time was set to 2500 ms. The subject is moved to the next trial as soon as they have responded to the stimuli. However, if they fail to respond within 2500 ms, the trial will disappear and they will be moved on to the next trial. The responses of the participants were recorded by a Logitech 960 USB headset microphone and the experimenter had to go back to the recordings to transcribe subject responses.

2.2.6 Results

2.2.6.1 Reaction Times

The results of four subjects were excluded from the analysis. Due to malfunctions, we could obtain neither reaction times nor recorded responses for three of the four subjects. As for the other subject, we obtained reaction times but failed to obtain recorded responses and were consequently excluded. The voice key apparatus malfunctioned in fifty five trials and thus was excluded. Reaction times were calculated only for correct responses and those longer than mean plus two and a half standard deviation for a given subject and the condition were not included in the analysis. Two reaction times were rejected on the basis of the cut off of that condition. The subject's mean reaction time of correct responses in each of the four conditions was obtained and used in the analysis of subjects. The item analysis was based on the means of correct responses to each item in each condition. The mean RTs and percentage of accuracy are shown in Table (2).

Table 2

The mean Response Latencies (in ms), the Accuracy of Response in the four conditions and semantic Relatedness Effects.

	High Proficiency (n=10)					Low Proficiency (n=10)				
	Related		Unrelated		Effect	Related		Unrelated		Effect
	RT	ACC	RT	ACC	RT	RT	ACC	RT	ACC	RT
Forward Translation	599.9	91%	631.4	90%	31.4	822.7	84%	923.2	86%	100.5
Backward Translation	670.7	87%	772.2	78%	101.4	1069.9	82%	1259.6	72%	189.6

A mixed ANOVA analysis was then performed on the mean response latencies per subject with proficiency as a between-subject factor and translation direction (forward and

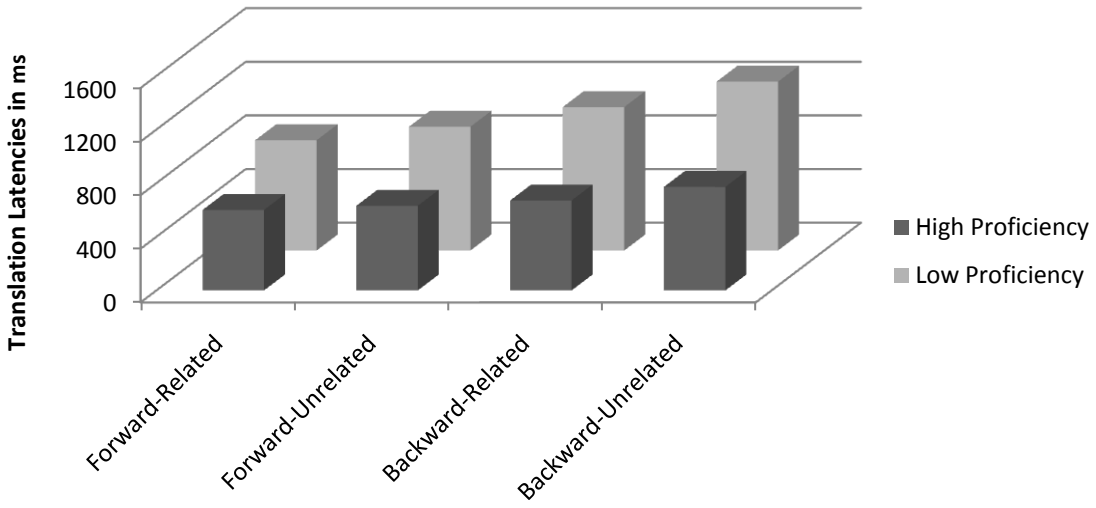
backward) and semantic relatedness (semantically related and semantically unrelated) as within-subject factors.

A statistically significant main effect of group was found in the analysis by subject, $F(1, 18) = 7.301$, $P > 0.05$ and in the analysis by items, $F(1.32) = 65.883$, $P < 0.05$. The more proficient group outperformed the less proficient group in all experimental conditions as shown in Figure (4). This finding makes it apparent the significance of subjects' proficiency level in performing bilingual translation task.

Moreover, there was a significant main effect of translation direction in the analysis by subjects $F(1, 18) = 14.819$, $P < 0.05$, and in the analysis by items $F(1, 32) = 11.419$, $P < 0.05$. Contrary to the prediction of RHM, forward translation was faster than backward translation. Translation latencies were approximately 198 ms longer when undertaking translation from L2 to L1 than when translating from L1 to L2.

Figure 4

Reaction Times in the Four Conditions According to Proficiency Level.

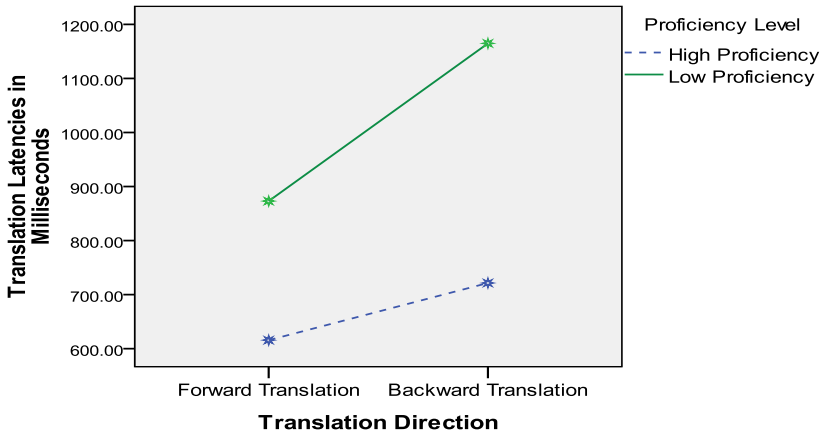


There was a main effect of relatedness in the analysis by subjects, $F(1, 18) = 12.911$, $P < 0.05$. In other words, semantically related context induced faster translation latencies than unrelated contexts (790 ms and 896 ms respectively) which is in accordance with La Heij et al. (1996) finding. However this difference failed to reach a significant level in the analysis by items, $F(1, 32) = 2.349$, $P > 0.05$.

There was a significant interaction found between proficiency and direction in the analysis by items, $F(1, 32) = 5.907$, $P < 0.05$, and a trend towards significance in the analysis by subjects, $F(1, 18) = 3.244$, $P > 0.05$. Apparently, differences in subjects' performance in the two directions of translation was relatively dependent on their proficiency level. As shown in Figure (5), the effect of translation direction is larger for the low proficiency group than the high proficiency group.

Figure 5

Interaction between Proficiency Level and Translation Direction.



Additionally, no significant interaction was found between direction and relatedness in the analysis by subject, $F(1, 18) = .972$, $p > 0.05$, and in the analysis by item, $F(1, 32) = 2.646$, $p > 0.05$. This was applied to the other interactions as the rest fail to reach significance.

A one way repeated-measure ANOVA for each proficiency level was performed to explore the interaction found between proficiency and direction. In the case of the high proficiency group, no statistically significant main effect was found in the analysis by subject for direction, $F(1, 9) = 2.514$, $p > 0.05$. In other words, for highly proficient bilinguals translation latencies for forward translation were almost as fast as those for backward translation. For the low proficiency group, statistically significant main effect was found for translation direction, $F(1, 9) = 13.700$, $p < 0.05$. This indicated that for less proficient learners, forward translation is faster than backward translation. This finding is not in line with the prediction of the Revised Hierarchical Model. Overall results suggested that as proficiency increases, the difference in performance between forward translation and backward translation decreases.

2.2.6.2 Error Analysis

ANOVA analysis showed that there was a main effect of direction, $F(1, 5) = 20.408$, $p < 0.05$. More errors were made in backward translation than forward translation. There was no main effect of semantic relatedness, $F(1, 5) = .585$, $p > 0.05$, though more errors were made in the unrelated condition than the related condition but this difference failed to reach significance. No statistically main effect of proficiency was obtained, $F(1, 18) = .031$, $p > 0.05$, though less proficiency group made more errors than the high proficiency group. All interactions failed to reach significance. This lack of significance in terms of errors suggests that the measure of speed is the most appropriate one for testing the hypotheses and to determine the impact of direction, proficiency and relatedness on translation.

Chapter Three

3.1 Discussion

The purpose of this study is to test the predictions of the Revised Hierarchical Model and the alternative model proposed by La Heij et al (1996). The current study investigated the questions given in the introduction to this chapter to either prove or disprove La Heij et al's (1996) model;

1. Is backward translation faster than forward translation?

The results showed that forward translation was faster than backward. Translation latencies in backward translation were approximately 198 ms longer than those in forward translation.

2. Does the magnitude of nonverbal semantic effect differ for backward and forward translation?

The findings did not support this hypothesis as there was no statistically significant difference in the degree to which semantic effect differed for backward and forward translation. However, it was observed that the magnitude of semantic effect was greater for backward translation than forward translation (145 ms and 65 ms respectively) but again it was not significant.

3. Does the magnitude of the nonverbal semantic context differ in the two directions of translation in conjunction with differences in proficiency level? affirmative

This was refuted as results suggested that the magnitude of nonverbal context did not differ in the two directions of translation with differences in proficiency level.

4. Does semantically related nonverbal context induce faster translation latencies?

It was apparent from the analysis that the semantically related list induced faster translation latencies than the semantically unrelated list, although this difference failed to reach significance in the analysis by item. In other words, regardless of proficiency level and translation direction, words were translated faster when they were accompanied by a semantically related picture.

5. Is the performance of the high proficiency group in the two translation directions different from the performance of less proficient bilinguals in the two translation directions?

The analysis showed that translation direction had different effects on the performance of high versus low proficiency group. A detailed inspection of the translation performance of the two groups revealed that first, highly proficient bilinguals outperformed less proficient bilinguals in all experimental conditions. Second, the performance of highly proficient bilinguals in forward translation was almost similar to their performance in backward translation (615.6 ms and 721.4 ms respectively), meaning their performance was not affected by the translation direction. On the other hand, the performance of the less proficient group in forward translation was considerably different from their performance in backward translation (873 ms and 1164 ms respectively). Fourth, difference in translation performance between the highly proficient and less proficient learners was larger in backward translation than forward translation (443 ms and 257 ms respectively).

A more thorough investigation and interpretation of each finding is given in the following sections.

3.1.1 Interpretation of these findings

3.1.1.1 First Hypothesis: Is backward translation faster than forward translation?

This hypothesis was refuted as results showed that forward translation was faster than translation. This finding is contrary to the general findings in the literature (Kroll and Stewart, 1994, Kroll, Micheal, Tokowicz, and Dufour, 2002; Sholl, Sankaranarayanan, and Kroll 1995; Dufour and Kroll,1995; Talamas, Kroll, and Dufour 1999) yet it is in accordance with other studies (e.g., La Heij et al 1996, La Heij et al 1990, De Groot & Poot, 1997; De Groot & Comijs, 1995; Salamoura & Williams, 1999; Duyck & De Houwer, 2008).

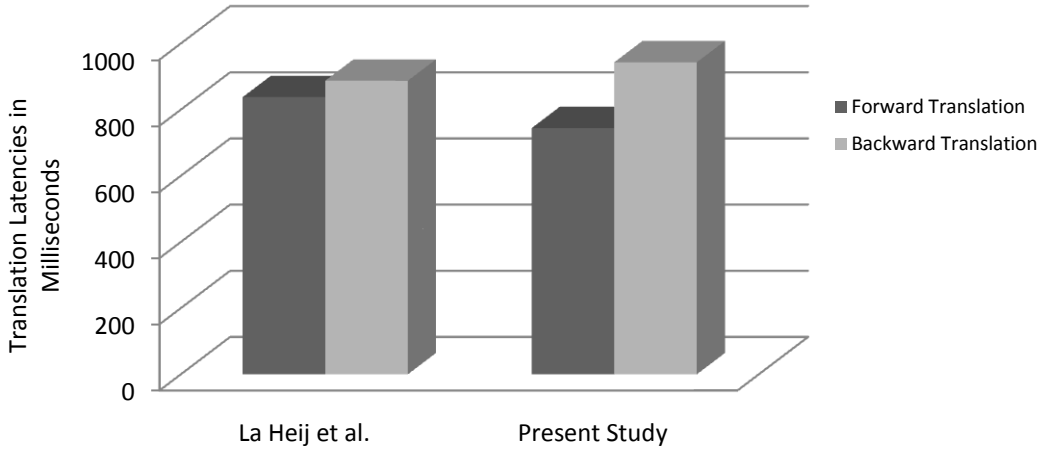
The finding did not support the prediction of the Revised Hierarchical Model as it predicted that backward translation is faster than forward translation. The model based this prediction on the assumption that there is an asymmetry in the lexical links between L1 and L2 words i.e. the link that maps L2 to L1 is stronger than the links that maps L1 to L2.

The study is in line with La Heij et al's (1996) research. La Heij et al. found that forward translation is faster than backward translation, but this finding failed to reach significance in their analysis by subjects and was only significant in the analysis by item. In this study forward translation was faster than backward translation and was statistically significance in terms of the analysis by subjects and in the analysis by items. Figure (6) shows the difference in translation latencies in the two directions of translations between the current study and that of La Heij et al's (1996) experiment four.

In short, this finding brings support to La Heij et al's findings and subsequent studies that forward translation is faster than backward translation whereas it contradicts the prediction of the Revised Hierarchical Model that participants translate words from L1 to L2 faster than from L2 to L1.

Figure 6

The Difference in Translation Latencies between the Present Study and La Heij et al (1996) experiment four.

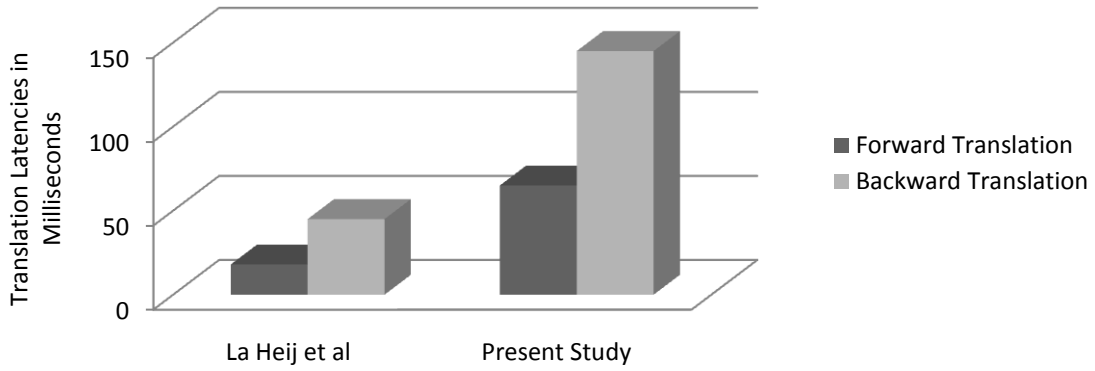


3.1.1.2 Second Hypothesis: Does the magnitude of nonverbal semantic effect have different effects for backward and forward translation?

The finding that the magnitude of nonverbal semantic effect did not differ in the degree to which it affect backward and forward translation was not in accordance with the prediction of the Revised Hierarchical Model. The model predicted that forward translation will be greatly affected by semantic manipulation of contexts than backward translation. This finding is in line with La Heij et al. (1996) who found that the magnitude of the semantic effect in backward translation is greater than in forward translation (45 ms and 18 ms respectively) but this difference failed to reach a significant level in the analysis by subjects and items. However, in the present study the size of the semantic context effect was larger in backward translation than with forward translation (145 ms and 65 respectively) as shown in Figure (7) yet the difference was not significant. Overall, the results of La Heij et al and the present study suggest that there is no significant difference in the degree to which semantic context affect backward and forward translation.

Figure 7

The Differences in the Size of Semantic Effect between the Present Study and La Heij et al (1996).



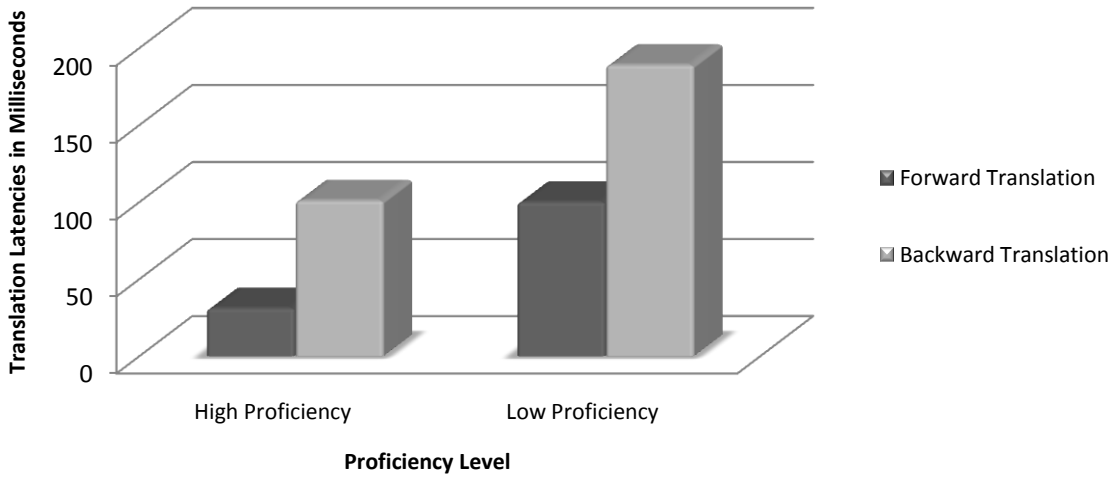
Also, the present study concurs with Salamoura and William's (1999), who tested fluent Greek–English bilinguals on a translation task from L2 to L1. They presented subjects with a semantically related list of words and another randomised list and found that a semantically categorised list induced a semantic effect in backward translation 130 ms. In short, both directions of translation, forward and backward, are conceptually mediated and backward translation is more sensitive to semantic manipulation than forward translation.

3.1.1.3 Third Hypothesis: Does the magnitude of the nonverbal semantic context effect differ in the two directions of translation with differences in proficiency level?

The magnitude of the nonverbal semantic context did not differ in the two directions of translations with the differences in proficiency level though the larger semantic effect was observed in backward translation than in forward translation for both groups as shown in Figure (8).

Figure 8

The Size of Semantic Effect for Less and High Proficient Bilinguals.



This finding did not support the prediction of the Revised Hierarchical Model. The Model assumes that as proficiency increases, links that map L2 to concept develop. Thus for highly proficient bilinguals, translation from L2 to L1 should be affected by semantic manipulation of contexts more than less proficient bilinguals. In the current study, we found that in backward translation not only were highly proficient bilinguals sensitive to the semantic manipulation of contexts but so were less proficient bilinguals and no difference in the degree to which semantic context affect the performance of the two groups. The implication of this is that direct links map L2 lexical representations to concepts exist for both lower and highly proficient groups. This finding is in accordance with Potter et al (1984) who tested the performance of fluent and less proficient bilinguals in a bilingual translation and picture naming task. They concluded that backward translation is mainly achieved at the conceptual level not only for highly proficient bilinguals but also for less proficient bilinguals. However, it was argued that the results for less proficient bilinguals might be biased on the basis that the students were going to France in their summer vacation thus they might be motivated to learn French and have been taking extra courses. Thus they might reach a level where they

behave in a way that is similar to highly proficient bilinguals (Chen & Leung, 1989; Kroll & Sunderman, 2005). Moreover, it was argued that subjects of Potter et al. differed not only in first and second language but also the age of initial acquisition of L2 thus these factors might have contributed independently or jointly to the obtained results (Chen & Leung, 1989). In the present study, the differences between less proficient and highly proficient subjects in their IELT tests scores reached significant level. The IELTS test that they undertook was recent with a maximum difference between distance from taking the test being 9 months and the minimum 2 months. Also, subjects in the two groups were similar not only in their native language and second language (Arabic and English respectively) but also had begun acquisition of the L2 at a similar age and been taught in the standard formal education system and then tested by the researcher at a similar age. Thus the difference in their performance in the translation tasks could be only interpreted as representative of their different proficiency level.

Moreover, the study was in accordance with that of Altarriba and Mathis (1997) who compared the performance of less and more proficient bilinguals on a Stroop colour-word task. They found that both less and more proficient bilinguals experienced interference effects thus they concluded that conceptual links mapping L2 words to their concepts are present at the early stages of L2acquisition.

In short, the fact that the size of semantic context effect was not different for the highly proficient and less proficient in the two translation directions suggests that; a) there are direct links that map L2 to concepts for less and more proficient bilinguals, contrary to the assumptions of the Revised Hierarchical Model; and that b) there are direct links that map L1 to concepts for less and more proficient learners, which are in line with the predictions of the Revised Hierarchical Model.

3.1.1.4 Fourth Hypothesis: Does semantically related nonverbal context induce faster translation latencies

The semantically related list induced faster translation latencies than the unrelated list. A facilitation effect was noticed that is significant in the analysis by subject but not significant in the analysis by items. To explain this we will first explore and try to determine why the difference was not significant in the analysis by item, and then we will discuss the fact that we found a facilitation effect and not interference effect.

- *No main effect of semantic relatedness in the analysis by items*

The question here is why there was no main effect for relatedness in the analysis by items? A factor that might contribute to the failure to achieve a significant main effect of semantic relatedness in the analysis by items was that the stimuli included loan words and thematically related pictures. Inspection of the stimuli found that there were four words that were loan words (LEMON, TOMATO, LAMP and MIRROR). Loan words are words that integrated from a foreign language. We suspect that loan words would behave in a similar way to cognates. Different studies reported that the conceptual representations of cognates are similar thus the translation of cognates is faster than the translation of noncognates. This finding is obtained not only for highly proficient bilinguals but also for less proficient bilinguals (De Groot, 1992, De Groot et al., 1994; Kroll and Stewart, 1994, Lotto and De Groot, 1998). If loan words behave similarly, then having loan words among the stimuli list, especially in unrelated conditions would affect the translation latencies in both conditions. Assuming the general pattern which we observed that longer translation latencies were obtained in the unrelated condition, the words in the unrelated condition suppose to induce longer translation latencies. The existence of loan words in the unrelated condition would affect the general pattern (i.e. longer RTs) because we would find loan words induce faster translation latencies in the unrelated condition where it supposed to induce longer translation latencies

in that condition. Inspection of the translation latencies of these words supported these assumptions. First, the word 'LEMON' and its L1 translation equivalent /laimoːn/ were used in the related conditions only. For the highly proficient bilinguals, the translation latencies for the word 'lemon' in the forward translation was 399 ms and in backward translation was 400 ms. For the less proficient bilinguals the translation latencies for the same word in forward translation was 469 ms and in backward translation it was 439 ms. Apparently, the word induced similar translation latencies in all experimental conditions for less and highly proficient bilinguals. Second, the word 'TOMATO' and its L1 translation equivalents /tomatˤ/ were included in the unrelated condition. The word 'tomato' was phonologically similar to its translation equivalent in colloquial Arabic /tomatˤ/. The highly proficient bilinguals translated this word in forward translation in 414 ms, whereas in backward translation 448 ms. The less proficient group translated the word 'TOMATO' in forward translation in 903 ms whereas in backward translation the time taken was in 969 ms. The fact that for each proficiency level, the difference in translation latencies between forward and backward translation for the same word was approximately similar suggested that they shared the same conceptual representation. Third, the word 'MIRROR' was presented to subjects in the unrelated condition and phonological similar to its translation equivalent /mer?a/. The first syllable was approximately similar to the two words. The highly proficient bilinguals translated this word in forward translation in 634 ms, whereas in backward translation 662 ms. The less proficient bilinguals translated this word in forward translation in 963 ms whereas in backward translation 726 ms. As we can see the word obtained approximately similar translation latencies in all experimental conditions. Also, the word 'MIRROR' was accompanied by a picture of a 'Kite' which only a few participants know the meaning of this word in English. Moreover, Kite is very rarely used or seen in Saudi Culture. Even linguistically, it only has a name in Standard Arabic and not in Colloquial Arabic. So perhaps;

the fact that the picture of ' Kite' has no equivalent translation in colloquial Arabic as it is the dialect used by subjects in this study, a few of whom know L2 word for this picture, it is possible that this condition (lack of lexical activation in L1 and L2) facilitated the translation of the word 'mirror'. Thus translation latencies were faster in what was supposed to be slower conditions. Finally, the word 'LAMP' and /lamba/ were used in the unrelated condition. So we expected to find similar translation latencies for this word in forward translation and backward translation for both less proficient and more proficient bilinguals. However, the word 'lamp' is also related to the word 'lamb'. Arabic speakers find difficulties in differentiating between the phoneme [p] and [b]. Thus the two words for most of the Arabic speakers, especially less proficient bilinguals might be the same. So we would expect the word 'LAMP' to induce faster translation latencies in forward translation as it will act as a semantic facilitator, whereas it would induce longer translation latencies in backward translation and especially for less proficient bilinguals. Results showed that for highly proficient learners, the average translation latencies of the word 'lamp' in forward translation was 485 ms and in backward translation 558 ms. For less proficient bilinguals, the average translation latencies for the word in forward translation was 580 ms and in backward translation 2281 ms. Apparently, the word produced larger translation latencies in backward translation for the less proficient group than for highly proficient bilinguals because less proficient subjects may get confused between the two words 'lamb' and 'lamp'.

Moreover, we have noticed that the word 'CHICKEN' was used in the unrelated condition and didn't follow the general pattern and we found that it was accompanied by a thematically related picture, which is a picture of a fridge. We speculate that the thematically related picture might facilitate the retrieval of the translation equivalent though to our knowledge, there was no study that tested the effect of thematically related pictures on word translation.

- *The semantic relatedness paradox*

In the current study, semantic facilitation effect was observed, which is in accordance with several studies in which a context picture presented 250 ms before the target word induced a semantic facilitation effect (Bloem & La Heij, 2003). This contradicts other studies in which a semantically related context induced interference effect (Kroll & Stewart, 1994; Kroll & Curley, 1988; La Heij, De Bruyn, Elens, Hartsuiker, Helaha, & Van Schelven, 1990; Salamoura & Williams, 1999). The discrepancy in the literature regarding the type of effect induced by semantic relatedness is termed by Neumann 1986 (as cited in Bloem and La Heij 2003) as the semantic relatedness paradox. To account for the discrepancy in literature, Bloem and La Heij (2003) claimed that context words will induce an interference effect, whereas context pictures induce a semantic facilitation effect because the semantic facilitation effect is localised at the conceptual level, whereas the semantic interference is localised at the lexical level. They argued that context pictures are much slower than words are when activating their lexical representation. Thus, context pictures would facilitate conceptual activation of the target word before their lexical representation would interfere with the lexical representation of the target word.

In 2004, Bloem, Boogaard, and La Heij added another factor that would play an important role in the type of effect obtained. They suggested that manipulation of the SOA value would reversed the polarity of the semantic contexts in language production tasks. They tested whether semantically related context words presented at SOA –400 ms would induce a semantic facilitation effect just like that of images used for contextualisation . They found that context words induced a facilitation effect when presented at SOA -400 ms because they pre-activate the conceptual representation of the target word and "its lexical representation is completely decayed by the time the target is presented", thus it will not interfere with the lexical activation of the target word, (Bloem, Boogaard, & La Heij, 2004, p. 318). They also

extended Bloem and La Heij's (2003) findings by showing that not only do context pictures induce a semantic facilitation effect at SOA -400 ms but also at +200 ms.

Taking this altogether, we can conclude that the context picture in the current study induced a semantic facilitation effect because: a) context pictures slowly activate their lexical representation and thus facilitate conceptual retrieval of the target word; b) pictures were was presented 240 ms before the target word and thus facilitate the conceptual representation of the target word without interfering in the lexical representation of the target word.

3.1.1.5 Fifth Hypothesis: The performance of the high proficiency group in the two translation directions would be different from the performance of less proficient bilinguals.

The performance of the high proficiency group in the two translation directions was different from the performance of less proficient learners as shown Figure (4). Due to their proficiency level, highly proficient bilinguals translated words from L1 to L2 faster than less proficient learners and a similar pattern was found in translation performance from L2 to L1. For both groups, semantic context affected both forward and backward translation and induced longer translation latencies in backward than in forward translation. However, the difference in translation latencies between the less proficient speakers and the highly proficient in backward translation was larger than the difference observed in forward translation (443ms and 258ms respectively). The size of the semantic effect for less and more proficient learners in backward translation did not differ statistically (189 ms and 101 ms). Moreover, the size of semantic effect for less and more proficient learners in forward translation did not differ statistically (100 ms and 31 ms respectively). This suggested that both less proficient learners and more proficient learners were sensitive to semantic manipulation in backward and forward translation. This finding does not support the prediction of the Revised Hierarchical

Model as it predicts that fluent bilinguals conceptually mediate L2 words more than less proficient bilinguals.

This finding is in accordance with Choi (2005); he found that the performance of highly proficient bilinguals is faster than that of the less proficient group and the difference in performance was larger in backward translation than in forward translation (277 ms and 121 ms respectively).

To sum up, the performance of highly proficient learners is different from the performance of less proficient bilinguals. Highly proficient learners outperformed the less proficient bilinguals in all four experimental conditions, suggesting that as proficiency increases, subjects performance in word translation improves. In addition to which, considerable improvement will be also be noticed in backward translation when compared to forward translation.

3.1.2 La Heij et al's (1996) Alternative model

The main findings of La Heij et al. (1996) lead them to hypothesise the following: First, the problem in backward translation is not at the lexical level as the Revised Hierarchical Model predicted but at the conceptual level. Bilinguals have no problem in retrieving their L1 words as this is a skill well practiced while speaking L1. Thus the problem exists in the concept and the activation of the concept mapping for the L2 word. They claimed that since the problem in backward translation is concept activation, then subjects will make more semantic errors. For example, the correct translation of the word 'ORANGE' is /bortoqal/ and a semantically related error would be 'APPLE' / tofaɦ/. Conversely, they claim that the problem in forward translation is not the conceptual activation of the L1 as this skill is well practiced when reading in L1. They claim that the problem with forward translation is at the lexical level, in

other words the retrieval of L2 (translation equivalents). Thus, they expect that subjects would made phonological errors or would fail to respond during forward translation.

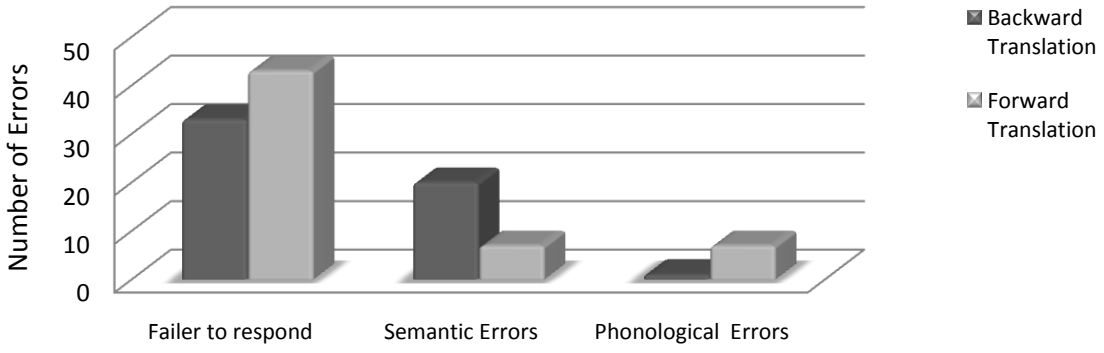
Moreover, they claimed that according to their hypothesis; semantically related pictures would facilitate translation latencies in backward translation and the magnitude of the effect would be larger for this direction than in forward translation.

Furthermore, several studies have reported that backward translation is faster than forward translation, whereas in other studies forward translation was found to be faster than backward translation. La Heij et al. argued that the reason behind such inconsistency in results is due to the difference in familiarity of words. Familiar words result in faster translation latencies in forward translation, whereas relatively unfamiliar words would results in slower translation latencies to the extent that there might be more difficulties here than in the retrieving of the L2 concept.

The findings of this study supported their claims. As shown in Figure (9), we found that participants make more semantic errors in backward translation than forward translation. Second, subjects' failed to respond in forward translation more frequently than in backward translation. Thirdly, subjects made phonological errors in forward translation more commonly than in backward translation.

Figure 9

Error Analysis for Less and Highly Proficient Bilinguals.



To test words familiarity, subjects were asked at the end of the test to rate words according to a four point scale (less frequent, frequent, very frequent or extremely frequent). As can be seen in Table (2), only two words among the top five extremely frequent words behaved in accordance with La Heij et al prediction. The words 'CHICKEN' and 'POTATO' were translated faster in forward translation than backward translation. However, this cannot be considered as a fair judgement of La Heij et al.'s suggestion. A further study is needed to test this prediction where we could compare the translation latencies for frequent words and in frequent words.

Table 3

Translation Latencies in (ms) for the two direction of translation for the top Five Frequent Words.

	Translation Direction	
Items	Forward Translation	Backward Translation
CHICKEN	633	658
BED	838	471
APPLE	673	499
MIRROR	799	694
POTATO	641	1110

In general, the present study revealed several important findings that hold implications for models of the bilingual lexicon. The results did not support the prediction of the Revised Hierarchical Model and provided partial support for the predictions of La Heij et al's Model. The asymmetry in translation performance was not due to the nature of the connections between the L1 and L2 lexicons and the concepts as the RHM claimed but due to differences in concepts and word form retrieval. Backward and forward translation differs in terms of concept retrieval and lexical retrieval. As La Heij et al. suggested, retrieving concepts for L1 word was easier than retrieving concepts for L2 words, whereas retrieving the lexical form was easier for L1 word than L2 word. An important factor that may contribute to the

asymmetry is word type. Different study reported that the difference in translation performance could be attributed to word type and frequency. In the current study, we found that not only cognates and concreteness status of words would play an important role but also loan words. La Heij et al suspected that familiar words would induce faster translation latencies than in forward translation than backward translation. Yet this assumption needs further investigation.

3.2 Conclusion

The main purpose of the present study is to test the predictions of the Revised Hierarchical Model (RHM) proposed by Kroll and Stewart (1994) and a subsequent model proposed by La Heij et al. (1996). The RHM claims that; a) backward translation is faster than forward translation b) forward translation is conceptually mediated whereas forward translation is less conceptually mediated c) as proficiency increases, conceptual links map L2 lexicon to concept develops. La Heij et al (1996) claim that backward and forward translation is conceptually mediated regardless learners' proficiency level and the time it takes to translate from L1 to L2 (forward translation) and from L2 to L1 (backward translation) is almost identical. To test the predictions of the two models, we tested the performance of less and more proficient bilinguals on a bilingual translation task and observed the effect of nonverbal semantic contexts on the translation performance. The logic of the study is that if backward translation is conceptually mediated, then we would expect to find nonverbal context effect on the performance of the two groups of participants. If, however, backward translation is lexically mediated then it should not be affected by the existence of nonverbal context. Results showed that forward translation is faster than backward translation. The size of semantic effect did not differ for the two translation direction. In other words, forward translation and backward translation were similarly affected by the semantic manipulation of contexts.

Moreover, the translation performance of less and more proficient bilinguals were different and similarly affected by the semantic manipulation of contexts which suggest that less proficient bilinguals conceptually mediate L2 as the more proficient bilinguals. We considered the implication of these findings as evidence in support of the model proposed by La Heij et al. (1996).

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3.4 Appendixes:

3.4.1 Semantic Category and Rank Order of the Stimulus words.

Semantic Relatedness	Category	English Words	Arabic Translation	Rank order
Related	Food	LEMON	ليمون	4364
Related	Food	GRAPES	عنب	4134
Related	Food	APPLE	تفاح	4601
Related	Food	TOMATOES	طماطم	6787
Related	Food	ORAGNE	برتقال	4807
Related	Food	GARLIC	ثوم	25000
Related	Animals	DUCK	بطه	50000
Related	Animals	LION	اسد	3148
Related	Animals	SPIDER	عنكبوت	5231
Related	Animals	CHICHKEN	دجاجه	2665
Related	Animals	SNAKE	حيه	7155
Related	Animals	RABBIT	أرنب	39000
Related	Furniture	BED	سرير	1951
Related	Furniture	MIRROR	مرآه	2481
Related	Furniture	TABLE	طاولة	1857
Related	Furniture	CHAIR	كرسي	1749
Related	Furniture	SOFA	كنب	60000
Related	Furniture	PILLOW	وساده	28000
Unrelated	Food	ONIONS	بصل	4300
Unrelated	Food	CARROT	جزر	5871
Unrelated	Food	OLIVES	زيتون	2471
Unrelated	Food	CORN	ذره	5431
Unrelated	Food	POTATOES	بطاطس	6638
Unrelated	Food	BANANA	موز	22000
Unrelated	Animals	DEER	غزال	22000
Unrelated	Animals	CAT	قطة	21000
Unrelated	Animals	DOG	كلب	1267
Unrelated	Animals	HORSE	حصان	3307
Unrelated	Animals	FISH	سمك	1619
Unrelated	Animals	COW	بقره	3339
Unrelated	Furniture	CURTAIN	ستارة	30000
Unrelated	Furniture	SHELF	رف	32000
Unrelated	Furniture	BLANKET	بطانية	2709
Unrelated	Furniture	DESK	مكتب	565
Unrelated	Furniture	LAMP	لمبه	89000
Unrelated	Furniture	CLOCK	ساعة	185

3.4.2 Sample of the Pictures used in the Experimental Conditions.

Target Word	APPLE	SPIDER	LEMON	BED
Semantically Related Condition				
Semantically Unrelated Condition				

(Pictures were taken from different web sources)

3.4.3 Participants Questionnaire

L2 Language History Questionnaire (Version 2.0)

Contact Information:

Name: _____ Email: _____

Telephone: _____ Today's Date: _____

Please answer the following questions to the best of your knowledge.

PART A

1. Age (in years):

2. Sex (circle one): Male / Female

3. Education (degree obtained or school level attended):

4(a). Country of origin:

4(b). Country of Residence:

5. If 4(a) and 4(b) are the same, how long have you lived in a foreign country where your second language is spoken? If 4(a) and 4(b) are different, how long have you been in the country of your current residence? (in years)

6. What is your native language? (If you grew up with more than one language, please specify)

7. Do you speak a second language?

YES my second language is _____.
NO (If you answered NO, you need not to continue this form)

8. If you answered YES to question 7, please specify the age at which you started to learn your second language in the following situations (write age next to any situation that applies).

At home: _____
In school: _____
After arriving in the second language speaking country _____

9. How did you learn your second language up to this point? (check all that apply)

(Mainly Mostly Occasionally) through formal classroom instruction.

(Mainly Mostly Occasionally) through interacting with people.

A mixture of both, but (More classroom More interaction Equally both).

Other (**specify:** _____).

10. List all foreign languages you know in order of most proficient to least proficient. Rate your ability on the following aspects in each language. Please rate according to the following scale (write down the number in the table):

Very poor Poor Fair Functional Good Very good Native-like
1 _____ 2_____3_____4_____5_____6_____7_____

Language	Reading proficiency	Writing proficiency	Speaking fluency	Listening ability

11. Provide the age at which you were first exposed to each foreign language in terms of speaking, reading, and writing, and the number of years you have spent on learning each language.

Language	Age first exposed to the language			Number of years learning
	Speaking	Reading	Writing	

12. Do you have a foreign accent in the languages you speak? If so, please rate the strength of your accent according to the following scale (write down the number in the table):

No Accent Very Weak Weak Intermediate Strong Very Strong
1 _____ 2_____ 3_____ 4_____ 5_____ 6_____

Language	Accent (circle one)	Strength
	Y N	
	Y N	
	Y N	

PART B

13. Estimate, in terms of percentages, how often you use your native language and other languages per day (in all daily activities combined, circle one that applied):

Native language: <25% 25% 50% 75% 100%

Second language: <25% 25% 50% 75% 100%

Other languages: <25% 25% 50% 75% 100%

(specify the languages: _____)

14. Estimate, in terms of hours per day, how often you are engaged in the following activities with your native and second languages.

Activities	**First Language**	**Second Language**	**Other Languages (specify _____)**
Listen to Radio/ Watching TV:	_____(hrs)	_____(hrs)	_____(hrs)
Reading for fun:	_____(hrs)	_____(hrs)	_____(hrs)
Reading for work:	_____(hrs)	_____(hrs)	_____(hrs)
Reading on the Internet:	_____(hrs)	_____(hrs)	_____(hrs)
Writing emails to friends:	_____(hrs)	_____(hrs)	_____(hrs)
Writing articles/papers:	_____(hrs)	_____(hrs)	_____(hrs)

15. Estimate, in terms of hours per day, how often you speak (or used to speak) your native and second languages with the following people.

	Language	**Hours**
Father:	_____	_____ (hrs)
Mother:	_____	_____ (hrs)
Grandfather(s):	_____	_____ (hrs)
Grandmother(s):	_____	_____ (hrs)
Brother(s)/Sister(s):	_____	_____ (hrs)
Other family members:	_____	_____ (hrs)

16. Estimate, in terms of hours per day, how often you now speak your native and second languages with the following people.

	Language	**Hours**
Spouse/partner:	_____	_____(hrs)
Friends:	_____	_____(hrs)
Classmates:	_____	_____(hrs)
Co-workers:	_____	_____(hrs)

17. Write down the name of the language in which you received instruction in school, for each schooling level:

Primary/Elementary School: _____

Secondary/Middle School: _____
High School: _____
College/University: _____

18. In which languages do you usually:

Count, add, multiply, and do simple arithmetic? _____

Express anger or affection? _____

19. When you are speaking, do you ever mix words or sentences from the two or more languages you know? (If no, skip to question 21).

20. List the languages that you mix and rate the frequency of mixing in normal conversation with the following people according to the following scale (write down the number in the table):

Rarely Occasionally Sometimes Frequently Very Frequently
1 _____ 2_____3_____ 4_____ 5_____

Relationship	Languages mixed	Frequency of mixing
Spouse/family members		
Friends		
Co-workers		
Classmates		

21. In which language (among your best two languages) do you feel you usually do better? Write the name of the language under each condition.

	At home	At work
Reading	_____	_____
Writing	_____	_____
Speaking	_____	_____
Understanding	_____	_____

22. Among the languages you know, which language is the one that you would prefer to use in these situations?

At home _____

At work _____

At a party _____

In general _____

23. If you have lived or travelled in other countries for more than three months, please indicate the name(s) of the country or countries, your length of stay, and the language(s) you learned or tried to learn.

24. If you have taken a standardized test of proficiency for languages other than your native language (e.g., TOEFL or Test of English as a Foreign Language), please indicate the scores you received for each.

Language	**Writing**	**Speaking**	**Reading**	**Listening**	**Name of the Test**
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

25. If there is anything else that you feel is interesting or important about your language background or language use, please comment below.

PART C

(Do you have additional questions that you feel are not included above? If yes, please write down your questions and answers on separate sheets.)

(Adapted from *www.personal.psu.edu)*