Testing Conceptual Routes in Elementary/Highly Proficient Persian Speaking EFL Learners

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Abstract

According to a basic prediction made by the revised hierarchical model (RHM, Kroll & Stewart, 1994), there is no L2 conceptual connection at the beginning stages of language learning as L2 learners mostly rely on L1 conceptual connections to retrieve the meaning of the L2 words. With increasing proficiency, however, there would be a direct access from L2 to the conceptual system. Available literature challenges this hypothesis, as it shows the existence of the L2 conceptual connections from early stages of L2 acquisition (Duyck & Brysbaert, 2004). There is one study which supports this hypothesis; however, it is problematic in the sense that it used a long prime exposure duration (Basnight-Brown & Altarriba, 2007). In an attempt to reevaluate the prediction of this model, two groups of highly proficient and two groups of elementary Persian learners of English were tested on noncognate stimuli with lexical decision task in both forward and backward direction. The results obtained for elementary L2 learners were consistent with RHM. The data showed the presence of strong L1 conceptual connections and the absence of L2 conceptual connections at this level of proficiency. However, the pattern obtained for highly proficient L2 learners could not be interpretedin terms of the model.

Keywords: **Episodic task, language priming, RHM**

1. Introduction

The RHM is a dominant model in psycholinguistics (Kroll & Steward, 1994). This model acknowledges two levels of representation, conceptual and lexical. Based on the model, conceptual representations of both languages of a bilingual are stored in the same conceptual store; however, the two languages have their own separate stores at the lexical level. There are connections between the two languages of a bilingual at both lexical and conceptual level. The conceptual store is connected to the L1 and L2 lexical stores consisting of lexical representations via routes which are called conceptual connections. There also exist some links connecting the L1 and L2 lexical stores, which are called lexical links. Lexical processing may occur at the lexical level through lexical routes or at the conceptual level via conceptual connections.

There are two series of studies that provide evidence for this model. In one, Kroll and Curley (1988) tested beginner English-German L2 learners on picture naming and translation from L2 to L1 (backward translation). It was hypothesized that backward translationoccurred via lexical route while picture naming required

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conceptual access. As processing at the conceptual level needed more time, the reaction times (RTs) for the picture naming task was expected to be longer than RTsfor the translation task. The findings of the study clearly demonstrated shorter RTs for backward translation in comparison with picture naming task. Hence, Kroll and Curley (1988) came to the conclusion that for beginners, picture naming occurs at the conceptual level whereas backward processing occurs at the lexical level.

In another series of studies by Kroll and Stewart (1990), Dutch-English learners translated two lists of words in both directions. One of the lists included semantically categorized while the other contained randomly organized words. It was assumed that semantic manipulation of words would affect translation in the L1-L2 direction (forward translation), as the processing for doing the task would occur at the conceptual level. On the contray, semantic categorization of words did not expect to infizuence backward translation, as the processing for doing the task predicted to occur at the lexical level. The findings of the study confirmed these two assumptions by showing that semantically categorized word list affected forward but not backward translation. Hence, it was concluded that translation performance in forward direction takes place at the conceptual level whereas translation in the backward direction occurs at the lexical level via the lexical route.

There are a number of other studies supporting that forward translation takes longerand is more sensitive to semantic manipulations for both early and advanced L2 learners (de Groot, Dannenburg & Van Hell, 1994; Sanchez-Casas, Davis & Garcia-Albea, 1992; Sholl, Sankaranararyanan & Kroll, 1995).

One basic assumption made by RHM (Kroll & Stewart, 1994) is that at the beginning stages of L2 learning, learners do not have direct access to the conceptual store because of the lack of any conceptual connection between L2 lexical storage and the conceptual store so that they depend mainly on L1 conceptual connections to retrieve the meanings of L2 words. This is done through the lexical links that connect the two lexical systems together and are created as learners learn new L2 vocabulary items by connecting each L2 word with its L1 equivalence. There are a number of studies that support this prediction. These studies have used cross language priming as a tool to investigate word representation in bilingual memory (Basnight-Brown & Altarriba, 2007; Duyck, Duyck&Warlop, 2009; Finkbeiner, 2006; Gollan, Forster, & Frost, 1997; Jiang & Forster, 2001). In this paradigm, cross-language word pairs (semantically related or translation equivalents) are presented to participants sequentially and participants are required to give a timed response such as lexical decision or word naming. The analysis is based on response time to pairs of prime-target words that differ in their semantic relatedness. A faster reaction time to related pairs across languages (e.g., prime from the first language and target from the second language) is usually discussed in terms of facilitation caused by the implicit spreading of activation from the prime word to the target word in a bilingual mental lexicon.

However, this paradigm is questioned by those who believe that when the bilingual nature of the task is apparent, information about the prime may reach consciousness so that any observed priming effects can be a result of nonautomatic or strategic processing rather than refecting automatic processing mechanism per se. This means that bilinguals strategically connect one language with the other by detecting the relationship between the prime and the target stimulus (Kirsner et al. 1984). A way to hide the bilingual nature of the task is using masked priming paradigm developed in the studies of visual word recognition (Evett & Humphreys, Forster & Davis, 1984). In this paradigm, a very briefy presented prime preceded by a

forward mask (like a number of signs) is immediately followed by a given target stimulus so that the prime cannot be identified. Due to the adopted masking procedure, the prime is, for most subjects, virtually invisible and it cannot be identified.

Adopting the masked priming paradigm with the lexical decision task, a number of studies have found that translation priming is asymmetrical in nature; presenting L1 translation primes systematically facilitates the processing of L2 target words not the other way (Basnight-Brown & Altarriba, 2007; Gollan et al., Jiang, 1999, Jiang & Forster, 2001; Kim & Davis, 2003; Voga & Grainger, Williams, 1994). According to RHM (Kroll & Stewart, 1994), the reason that forward priming is more effective than backward priming in lexical decision task is that presenting the L1 prime activates the shared semantic features of the prime and the target through the strong L1 conceptual connections. In fact, some conceptual nodes of the target that is the L2 translation equivalent of the prime are preactivated leading to shorter RTs. However, in backward primingthe target is not preactivated and no facilitation effect is resulted, as the conceptual connection between the L2 prime and the conceptual store is weak or absent.

As mentioned earlier, while there are strong L1 conceptual connections at the beginning of the L2 learning but no L2 conceptual connections, this situation might change with increasing L2 proficiency (Kroll, 1993). RHM (Kroll & Stewart, 1994) hypothesize that as L2 learners becomes more proficient in the L2, conceptual connections would be established between the L2 words and the conceptual memory and these connections gradually become stronger. Therefore, highly proficient L2 learnershave a direct access from the L2 to the conceptual system. A recent study with noncognate stimuli (translation equivalents with different spellings and sound patterns in the two languages e.g., the Persian word /abi/ and its English translation blue) using highly fluent Spanish-English learners has reported evidence for this issue (Basnight-Brown & Altarriba, 2007). In this study, similar forward and backward masked translation priming was obtained. To interpret the results in terms of the RHM (Kroll & Stewart, 1994), one might argue that for highly fuent L2 learners, L1-L2 and L2-L1 links are of the same strength; therefore, forward and backward priming are of the same amount. One problematic point about this study is that the prime exposure duration of 100 ms was used in order to give more time to process words in the L2. Here, the problem is that although some previous studies have shown that prime exposure durations shorter than 150ms do not lead to the development of strategic effects based on expectancy generation, primes can be partially visible under such conditions (Hutchison, Neely & Johnson, 2001; Neely, 1991; Perea & Rosa, 2002). As many previous effects have been obtained with the prime durations shorter that 60ms (de Groot & Nas, 1991; Gollan et al, 1997; Grainger & Frenck-Mestre, 1998; Jiang, 1999; Jiang & Forster, 2001; Williams, 1994), the question which arises here is whether or not the same symmetrical pattern can be obtained for highly fuent L2 learners in masked translation priming using nonvisible masked primes with shorter prime duration. Evidence for RHM (Kroll & Stewart, 1994) can be found in case the same symmetrical pattern is found for highly fuent L2 learners in masked priming paradigm with prime duration shorter than 100 ms. Testing this assumption is one of the purposes of this study.

RHM (Kroll & Stewart, 1994) argues that limited conceptual mediation is involved in L2 word recognition and translation at the beginning stages of language acquisition, as L2 learners mostly depend on connecting L1 lexical representations with their conceptual representation to retrieve the meanings of

L2 words. In fact, only for very high levels of proficiency, the model assumes equivalent conceptual mediation in L2 and L1. One may challenge this assumption, as some studies have shown the existence of L2 conceptual connections from even early stages of L2 proficiency (Duyck & Brysbaert, 2004). The data from unbalanced bilinguals provided by this study is not consistent with the developmental hypothesis of RHM (Kroll & Stewart, 1994). Even for low level L2 learners, conceptual mediation played an important role in backward translation. Testing this issue was another aims of the present study.

On the whole, very little information from the existing literature tells us how and through what process the nature of L1 and L2 conceptual connections change with increasing proficiency. Testing this assumption was the main purpose of this study. In an attempt to test the predictions made by RHM (Kroll & Stewart, 1994) regarding the existence and strength of conceptual connections at different proficiency levels, two groups of high and elementary L2 learners were tested in masked priming experiments in both forward and backward directions. The pattern of priming obtained for both groups were compared in the end. The results of the study helped to evaluate the predictions made by this model of bilingual mental lexicon, according to which the strength of lexical and conceptual connections depends on the proficiency level of L2 learners.

2. Method

In experiment 1 and 2, two groups of highly proficiency and elementary Persian learners of English were tested on noncognate pairs in forward direction (Persian- English) with lexical decision task. In this experiment, the primes (noncognates) were in L1 (Persian) and the targets were in L2 (English). In experiment 3 and 2 other groups of high and elementary L2 learners were tested in backward direction (English-Persian) with the same task and stimuli. In these two experiments, the primes (noncognates) were in English and the targets were in Persian.

2.1. Experiment 1

2.1.1. Lexical Decision Task with Elementary Learners (L2-L1 Priming)

2.1.2. Participants

Twelve Persian learners of English were selected from among a pool of 30. All the participants were undergraduate students of TEFL at Islamic Azad University, Najaf Abad. They had been in a Persian speaking environment from birth; however, they had received formal instruction in English at high school, university, and language institutes. Moreover, they had no exposure to English in natural settings.

The grammar part of the Oxford placement test (OPT, Allan, 2004), which included 100 grammatical multiple choice questions, was administered to homogenize the learners based on their general knowledge of English , and those whose range of scores was between 52-59 were identified as elementary participants based on the test manual and were selected. The reliability index of the test estimated through Chronbach's alpha was .78.

2.1.3. Stimuli and Design

The stimuli used in this experiment included 30 Persian words and 30 Persian nonwords. Each of these items was displayed on the PC screen as target words and it was upon participants to decide whether or not the Persian characters presented on the screen made a word. Each of word targets was preceded once by its translation equivalent (translation prime) and the other time by an English control item (control prime).

In order to make sure that the primes activated the relevant targets at the conceptual level, an attempt was made to assure that the two members of each pair were unique translation of each other. Following Finkbeiner (2006), six Persian- English L2 learners from the same pool of experiments 1 and 2 were asked to translate a list of 60 words from English into Persian (L2-L1); and another group of six was asked to

translate the same words in the opposite direction (L1-L2). Only the translation pairs which were translated identically in each direction by all the participants were chosen as the critical stimuli.

The control primes chosen were matched closely and item by item to the translation-equivalent primes on length, frequency, and concreteness as far as possible. A translation and its control prime were similar to each other regarding factors like length, frequency and concreteness yet different from each other in the sense that the translation prime was semantically related to the target, whereas the control prime was not. This way, one could attribute the priming obtained at the end only to the activation at the conceptual level. The MRC psycholinguistic database (Cullings, 1988) was utilized for this purpose.

The Persian nonword targets used for this experiment were generated by changing one or two letters of words matched in length to the targets on that list. All the nonwords were preceded by unrelated primes. Two presentation lists were constructed so that if a target was paired by its translation equivalent on one list, it would be paired with its control prime on the other list and vice versa. Hence, the material was counterbalanced across the priming factor. No target or prime word was repeated within the lists.

2.1.4. Data Collection Procedure

Adopting Forster and Davis's (1984) Procedure, the stimuli were presented in the center of a PC screen. Each trial consisted of the following sequence: First, the participants were presented with a row of 10 hash marks for 500 ms. This forward mask made the participants aware of where the target appeared on the screen. Moreover, it masked the subsequently presented prime. Second, the prime word immediately appeared for 50 ms. Then a blank interval was presented for 150 ms. The blank interval consisted of a row of hash marks but was presented in a different font and font size from the forward mask such that the two different masks used for each item were quite distinct and different from each other. Finally, the target followed immediately after the backward mask. The target remained on the screen until the participants made a response. The reason for including a blank space and a backward mask in the L2-L1 direction was increasing the amount of prime processing time. Normally when the prime is in L2, its processing is slower than when it is in L1; therefore, there would be no chance for the L2 prime to have any effect on the L1 target (see Jiang 1999, Experiment 4). After each trial was completed, the participants received a feedback regarding speed and accuracy of their performance.

In this task, the participants were asked to decide as quickly as possible whether or not the Persian characters presented on the screen made a word. Instructions, both oral and written, were given in Persian. Therefore, the participants were unaware of the bilingual nature of the task. Ten practice items were given before the test items, and the participants were asked to do the task as quickly and accurately as possible.

2.1.5. Apparatus

The DMDX (Forster & Forster, 2003) was used for the presentation of the stimuli.

2.2. Experiments 2

2.2.1. Lexical Decision Task with Highly ProficientL2 Learners (L2- L1 Priming)

2.2.2.Participants

A different sample the same pool of learners used in the frst experiment was selected and homogenized in the same way.

2.2.3. Stimuli and Design

The stimuli used for the tasks in this experiment were the same as Experiments 1.

2.2.4.Data Collection Procedure

The procedure was identical to Experiment 1.

2.2.5. Apparatus

The DMDX (Forster & Forster, 2003) was used for the presentation of items.

2.3. Experiments 3

2.3.1. Lexical Decision Task with Elementary L2Learners (L1-L2 Priming)

2.3.2.Participants

A second group of twelve elementary Persian learners of English were selected in the same way as in Experiment 1.

2.3.4. Stimuli and Design

The same Persian -English translation pairs of previous experiments were used in this experiment too. Thirty Persian words matched with Persian targets on length and frequency were also selected to serve as the control primes. The frequency of the Persian control primes was taken from Bijankhan corpus (Amiri & AleAhmad, n.d.). The Persian control primes that were paired with abstract targets referred to abstract concepts, whereas the ones that were paired with concrete targets referred to concrete objects. Thirty nonword targets were generated by the ARC nonword database (Rastle, Harrington, & Coltheart, 2002). All the nonwords were preceded by unrelated primes. Ten additional translation pairs were selected to be used as practice items.

The procedure used in Experiments 1 and 2 was used to create the lists for both tasks. The only difference was that the direction of priming reversed from English to Persian to Persian to English.

2.3.5. Data Collection Procedure

Each trial consisted of the following sequence: First, a forward mask of 10 hash marks appeared for 500 ms. This forward mask was immediately followed by the prime presented for 50 ms. Finally, the target word immediately followed the prime and remained on the screen until the participants made a response. The font used for target words was 18pt, Times New Roman.

The participants were asked to indicate whether or not the appeared target word was a word by pressing a Yes or No button. After each trial was completed, the participants received feedback regarding speed and accuracy.

2.3.6. Apparatus

The DMDX (Forster & Forster, 2003) was used for the presentation of items.

2.4. Experiments 4

2.4.1. Lexical Decision Task with Highly ProficientL2 Learners (L1-L2 Priming)

2.4.2. Participants

A second group of 12 highly proficient Persian learners of English were selected in the same way as in Experiment 2.

2.4.3. Stimuli and Design

The stimuli used for this experiment was the same as Experiment 3.

2.4.4. Data Collection Procedure

The procedure was identical to Experiment 3.

2.4.5. Apparatus

The DMDX (Forster & Forster, 2003) was used for the presentation of items.

3. Results

3.1. L1-L2 and L2-L1 Priming with Lexical Decision Task

3.1.1. The Elementary L2 Learners

Following previous studies (Gollan et al. 1997; Keatley, Spinks, & de Gelder, 1994), the scores over 1400 ms and incorrect responses were excluded from the analysis. This included 11.38% of the data for the experiment done in L1-L2 and 25.97percent of the data for the experiment done in L2-L1direction. All the results are reported at the significant level of .05. The descriptive statistics of lexical decision times for noncognates in L1-L2 direction and L2-L1 direction are provided in Table 1.

The mean response times were 44.36 ms faster for the noncognate translation items in the forward and 25.22 ms faster for the cognate translation items in the backward direction. The results of two paired samples t-tests show that noncog- nate translation and noncognate control items were processed the same in L2-L1 direction; however, noncognate translations were reacted significantly faster than the noncognate control items in L1-L2 direction $t(156) = -1.934$, $p = .055$.

3.1.2 The Highly ProfcientL2 Learners (L1-L2 and L2-L1 Direction)

The response times longer than 1400 ms and the incorrect responses which included 5.27% of the data for the experiment done in L1-L2 and 4.72 percent of the data for the experiment done in L2-L1direction was excluded from the analysis (Gollan et al.

Table 1. *Descriptive Statistics of Lexical Decision Times (ms)*

L2-L1	Mean	N	Std. Deviation	Std. Error Mean
control noncog	858.2	157	209.7562	16.74
translation noncog	813.8	157	183.8283	14.67
L2-L1	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
control noncog	765.6	166	224.5753	17.43
translation noncog	740.3	166	198.944	15.44

Table 2.*Descriptive Statistics of Lexical Decision Times (ms)*

L2-L1	Mean	N	Std. Deviation	Std. Error Mean
control noncog	724.6	170	157.5991	12.087
translation noncog	720.9	170	69.45466	12.996
L2-L1	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
control noncog	686.4	168	199.4179	15.385
translation noncog	671.8	168	184.8876	14.264

1997; Keatley, et al.1994). Table 2 presents the descriptive statistics of noncognates reaction times in L1-L2 and L2-L1 direction.

The mean response times were 3.69 ms faster for the noncognate translation items in the forward and 14.67 ms faster for the cognate control items in the backward direction. The analysis of the data by two paired samples t-tests show that the noncognate translation and the noncognate control items were processed the same in both directions.

4. Discussion and Conclusion

According to the developmental hypothesis of RHM (Kroll & Stewart, 1994), initial reliance on L1 for retrieving the meaning of L2 words creates strong L1 conceptual connections; however, with increasing profciency, there would be direct access from L2 to the conceptual system. On one hand, this hypothesis has been challenged by studies which have shown the existence of L2 conceptual connections from early stages of L2 acquisition. On the other hand, there is a study which has supported this hypothesis by showing that L1 and L2 conceptual routs are of the same strength at higher stages of language development. However, the procedure adopted by this study was problematic, as they used the prime exposure duration of 100 ms, which may be partially visible to participants. The main purpose of the experiments done in this study was to test the developmental hypothesis of RHM (Kroll & Stewart, 1994) by examining the pattern of priming obtained for groups of elementaryand highly proficient L2 learners. Adopting the masked translation priming with lexical decision task to test this prediction suggested the following hypotheses, which were tested against two groups of highly profcient and two groups of elementary L2 learners on noncognate stimuli with lexical decision task in both forward and backward direction:

For the elementary L2 learners:

• Significant L1-L2 priming is expected in lexical decision task (as RHM predicts the existence of strong L1-L2 conceptual connections at elementary levels of proficiency).
For the highlyprofcient L2 learners:
• Significant and somehow similar forward and backward priming is expected in lexical decision task (as the model predicts the existence of similar L1-L2 and L2-L1conceptual connections).

The results obtained for the elementary learners showed significant L1-L2 priming but no priming in backward direction in lexical decision task. To interpret the observed pattern in terms of RHM, one might argue that presenting L1 prime activates the conceptual node shared by the prime and the target through strong L1 conceptual connections. Preactivating some semantic features of the target would lead to effective priming. However, weak or even absence of L2 conceptual connections led to the lack of priming in backward direction. Hence, this pattern is consistent with the prediction of RHM and proves the presence of strong L1 conceptual connections at lower levels of proficiency. However, L2 conceptual connections are nonexistent or weak if they exist at all.

The same pattern was obtained in an experiment by Schoonbaert, Duyck, Brysbaert, and Hartsuiker (2009) with low level participants. There are also a number of studies which reported the same asymmetrical pattern with unbalanced bilinguals (Basnight-Brown & Altarriba, 2007; Gollan et al., 1997; Jiang, 1999, Jiang & Forster, 2001; Kim & Davis, 2003; Voga & Grainger, 2007; Williams, 1994).

The results found for highly proficient L2learners showed no significant priming in either backward or forward direction in lexical decision task. This pattern cannot be interpreted in terms of the RHM. According to RHM, there must be a direct access from L2 to the conceptual system at higher levels of proficiency. Hence, significant and somehow similar magnitude of priming is expected for the highly proficient L2 learners in both directions. Therefore, the observed pattern is not consistent with the predictions of RHM. Further, reported results are incontrast with a recent study, which showed similar forward and backward translation priming for a group of highly fuent Spanish-English learners (Basnight-Brown and Altarriba, 2007). The results reported by these authors support RHM as it shows that L1 and L2 conceptual connections are of the same strength in highly profcient L2 learners.

The total pattern observed in this study does not confirm the RHM. On one hand, significant priming was obtained for the elementary learners in forward direction, which is in accordance with RHM. On the other hand, no significant effect in any direction is observed for the highly proficient L2 learners, which disapproves the model. Hence, on the whole, the data provided by the present study cannot be interpreted in terms of this model.

Instead of imposing limitation on the model, one might challenge the existence of the noncognate priming as a proof for the presence of the conceptual connections. As mentioned before, according to the RHM, the asymmetrical pattern observed in some previous studies was attributed to strong L1 conceptual connections; however, not all the studies adopting lexical decision task with noncognate stimuli led to appearance of the same pattern. Some others failed to find any priming at all. Davis, Sànchez-Casas, and García-Albea (1991), observed no priming effect for noncognates by Spanish-English participants in a lexical decision task under the masked paradigm. García-Albea, Sànchez-Casas and Valero (1996), confirmed the consistent lack of facilitation with noncognate translations found by Davis et al. (1991) with Spanish-English bilinguals. In both studies, facilitatory effects were observed only for cognate translations. Lack of significant noncognate priming has also been reported by some other studies (García-Albea,

Sànchez-Casas, Bradley, & Forster, 1985; García-Albea, Sànchez-Casas, & Igoa, Grainger & Frenck-Mestre, 1998). This shows that the results obtained for noncognate stimuli are not consistent. The present study also confirms this. Therefore, further studies testing L2 learners with such stimuli at different levels of proficiency and in other contexts might provide a better picture of this phenomenon.

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References

Allan, D. (2004). Oxford Placement Test. Retrieved August 20, 2010, from www. waterstones.com.

Amiri, H., AleAhmad, A. (n.d.). Bijankhan Corpus. Retrieved Sep 20, 2010, from http://ece.ut.ac.ir/dbrg/bijankhan.

Basnight-Brown, D.M., & Altarriba, J. (2007). Differences in semantic and trans lation primingacross languages: The role of language direction and language dominance. *Memory and Cognition*, 35, 953-965.

Cullings. J. (1988) .MRC psycholinguistic database. Retrieved Sep 25, 2010, from http://www.psy.uwa.edu.au/mrcdatabase/uwa_mrc.htm.

Davis, C. W., Sànchez-Casas, R. M., García-Albea, J. E. (1991). Bilingual lexical representation as revealed using masked priming procedure, Unpublished manuscript. St. Louis University. Madrid, Spain.

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

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

Duyck, W. (2005). Translation and associative priming with cross- lingual pseudo homophones: Evidence for nonselective phonological activation in bilinguals. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, 31, 1340-1359.

Duyck, W., & Brysbaert, M. (2004). Forward and backward number translation requiresconceptual mediation in both balanced and unbalanced bilinguals. *Journal of Experimental Psychology*: Human Perception and Performance, 30, 889-906.

Duyck, W., & Warlop, N. (2009). Translation priming between the native language and a second language: New evidence from Dutch-French bilinguals. *Experimental Psychology*, 56,173-179.

Evett, L. J., & Humphreys, G. W. (1981).The use of abstract graphemic information in lexical access. *Quarterly Journal of Experimental Psychology*, 33, 325-350.

Finkbeiner, M. (2006). Task-Dependent L2-L1 Translation Priming: An Investigation of the Separate Memory Systems Account. In Cohen, J., McAlister, K., Rolstad, & MacSwan, J. (Eds.), ISB4: Proceedings of the 4th International Symposium on Bilingualism (pp. 741-750). Somerville, MA: Cascadilla Press. Forster, K. I., & Davis, C. (1984). Repetition priming and frequency attenuation in

lexical access. *Journal of Experimental Psychology*: Learning, Memory, & Cognition, 10, 680-698.

Forster, K. I., & Forster, J. C. (2003). DMDX: A Window display program with millisecondaccuracy. *Behavioral Research Methods, Instruments, & Computers*, 116-124.

Gollan, T., Forster, K. I., & Frost, R. (1997). Translation priming with different scripts: Masked priming with cognates and noncognates in Hebrew–English bilinguals. *Journal of Experimental Psychology*: Learning, Memory, and Cognition, 23, 1122–1139.

Grainger, J., & Frenck- Mestre, C. (1998). Masked priming by translation equivalents inproficient bilinguals. *Language & Cognitive Processes*, 13, 601-623.

Garcia-Albea, J. E., Sanchez-Casas, R., & Valero, T. (1996). *Form and meaning contribution to word recognition in Catalan–Spanish bilinguals.* Paperpresented at the meeting of the Ninth Conference of the European Society for Cognitive Psychology, University of Würzburg, Germany.

Garcia-Albea, J.E., Sanchez-Casas, R.M., Bradley, D.C., & Forster, K.I. (1985, November) Cross-language priming effects in bilingual word recognition. Paper presented at the meeting of the Fifth Australian Language Conference, Melbourne, Australia.

García-Albea, J. E., Sànchez-Casas, R. M., &Igoa, J. M. (1998). The contribution of word form and meaning to language processing in Spanish: Some evidence from monolingual and bilingual studies. In D. Hillert (Ed.), *Sentence processing: A cross-linguistic perspective* (pp. 183-209). New York: Academic Press.

Hutchison, K. A., Neely, J. H., & Johnson, J. D. (2001). With great expectations, can two ”wrong” prime a “right”? *Journal of Experimental Psychology*: *Learning Memory and Cognition*, 27, 1451-1463.

Jiang, N. (1999). Testing processing explanations for the asymmetry in masked cross-Language priming. *Bilingualism: Language & Cognition*, 2, 59-75.

Jiang, N. & Forster, K. I. (2001). Cross-language priming asymmetries in lexical decision and episodic recognition. *Journal of Memory and Language*, 44, 32-51.

Keatley, C. W., Spinks, J. A., & de Gelder, B. (1994). Asymmetrical cross-language priming effects. *Memory and Cognition*, 22, 70–84.

Kim, J., & Davis, C. (2003).Task effects in masked cross-script translation and phonologicalpriming. *Journal of Memory and Language*, 49, 484-499.

Kirsner, K., Smith, M. C., Lockhart, R. S., King, M. L., & Jain, M.(1984). The bilingual lexicon: Language specific units in an integrated network. *Journal of Verbal Learning and Verbal Behavior*, 23, 519-539.

Kroll, J. F. (1993). Accessing conceptual representations for words in a second language. In: Schreuder, R., B. Weltens (Eds), *The bilingual lexicon.* (pp. 53–82). Amsterdam: John Benjamins Publishing Co.

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

Kroll, J. F., & Curley, J. (1988). Lexical memory in novice bilinguals: The role of concepts in retrieving second language words. In M. Gruneberg, P. Morris, & R.Sykes (Eds.), *Practical aspects of memory* (pp. 389–395). London: Wiley.

Kroll, J. F., & Stewart, E. (1990). Concept mediation in bilingual translation. *Paper presented at the meeting of the Psychonomic Society*, (pp. 1-7). New Orleans, LA.

Neely, J. (1991). Semantic priming effects in visual word recognition: A selective review of current findings and theories. In D. Besner and G.W. Humphreys (Eds.), *Basic processes in reading: Visual word recognition.* (pp.264-336). Hillsdale, NJ: Erlbaum.

Perea, M., & Rosa, E. (2002). Does the proportion of associative related pairs modulate the associative priming effect at very brief stimulus-onset asynchronies? *Acta Psychology*,110, 103-124.

Rastle, K., Harrington, J., & Coltheart, M. (2002).ARC Non-word Database. Retrieved Sep 20, 2010, fromhttp: //www.maccs. mq.edu.au/nwdb/ Sanchez-Casas, R. M., Davis, C. W., & Garcia-Albea, J. E. (1992). Bilingual lexical processing: Exploring the cognate/noncognate distinction. *European Journal of Cognitive Psychology Special Issue: Multilingual community*, 4, 293-310.

Schoonbaert, S., Duyck, W., Brysbaert, M., & Hartsuiker, R.J. (2009).Semantic and Translation priming from a first language to

a second and back; Making sense of the fndings. *Memory & Cognition*, 37, 569-586.

Sholl, A., Sankaranarayanan, A., & Kroll, J. F. (1995). Transfer between picture naming andtranslation: A test of asymmetries in bilingual memory. P*sychological Science*, 6, 45–49.

Voga, M., & Grainger, J. (2007). Cognate status and cross-script translation priming. *Memory & Cognition*, 35, 938-952.

Williams, J. N. (1994). The relationship between word meanings in the first and second language: Evidence for a common, but restricted, semantic code. *European Journal of Cognitive Psychology*, 6, 195–220.