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FEATURE ARTICLE

Bilingual Memory: A Re-Revised Version of the Hierarchical Model of Bilingual Memory

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Bilingual Memory: A Re-Revised Version of the Hierarchical Model of Bilingual Memory

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How do bilinguals store their language information? Is the bilingual lexicon represented in one or two memory systems? For example, consider the relationship between LOVE and AMOR. For English speakers, LOVE is a general concept that applies to almost anything (e.g., I LOVE MY COMPUTER). For Spanish speakers, on the other hand, LOVE is a much more reserved concept applying only to one's wife or girlfriend (e.g., AMO a mi esposa: I LOVE my wife). How are bilinguals able to integrate/separate their lexical semantic representations?

Although far from a concrete answer, the present view of bilingual memory emphasizes differential storage and processing (for a complete review, see Heredia & McLaughlin, 1992; Heredia, 1995). That is, bilingual memory is conceived as represented in separate but interconnected lexicons (see top portion of Figure 1; see also, Kroll & Stewart, 1994 for further details). These two structures represent the bilingual's first (L1) and second language (L2) lexicons. This model's most critical assumption is that the lexical links differ in strength, and words in each language are linked to a general concept and to each other. The L2 lexicon is connected to the L1 lexicon by strong (i.e. automatic or associative) links and the L1 is connected to the L2 lexicon by weak links that are sensitive to semantic processing (i.e., knowledge based). Presumably, these links reflect the manner in which the L2 was learned. For instance, in learning their second language, L2 learners usually associate the new word to their L1. In learning the lexical item for HOUSE, for example, L2 learners must make a direct association to CASA thus creating a direct and strong association to the meaning of their L1 (Kroll & Stewart, 1994). This assumption holds that the meaning of the L2 item becomes subordinated to the meaning of the L1 language.

Because bilinguals seldom translate from their L1 to their L2, they develop a weak link from their L1 to their L2. Indeed, there is no reason for the L2 language learner to develop direct connections from the L1 to the L2 lexicon because their developing L2 lexicon has no information regarding concepts or meaning of the new language. In a way, L2 learners are forced to provide meaning to the word they are about to learn by associating it to the information they already know (Ervin & Osgood, 1954). As a result, their L1 to L2 lexical link does not develop as well as the active L2 to L1 lexical links.

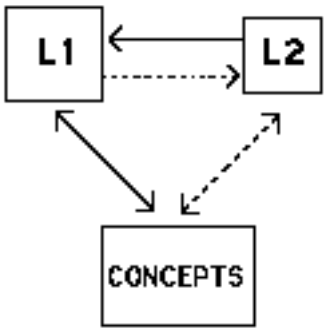

Figure 1. Hierarchical Bilingual Model (from Kroll & Stewart, 1994)

In addition to the connections between the two lexicons, bilingual memory is thought to be composed of a conceptual store (bottom part of Figure 1). The conceptual store is said to contain abstract representations about the world (e.g., Potter, So, Von Eckhardt & Feldman, 1984). The conceptual store is connected to both the L1 and L2 lexicons. However, the connections between the L1 lexicon and the conceptual store are strong and direct; whereas, the connections between the L2 lexicon and the conceptual store are weak. Thus, the subject's L1 is more likely to access the conceptual store directly (conceptually mediate) than the subject's L2. In other words, when exposed to an L1 concept, the bilingual is more likely to access the conceptual store because of his/her L1. Because the lexical link from the bilingual's L2 to L1 lexicons are stronger and faster, the bilingual would most likely utilize these links to access the conceptual store. In this way, the link from the conceptual system to the bilingual's L2 lexicon remains weaker. A logical prediction is that on a translation task, bilinguals would be faster to translate from L2 to L1 (e.g., see HOUSE give CASA), than L1 to L2 (e.g., see CASA give HOUSE) because L2 to L1 are directly associated, and empirical data supports this prediction (e.g., Kroll & Stewart, 1994; Dufour & Kroll, 1995). L2 to L1 translations seem to be faster than L1 to L2 translations. In addition to translation tasks, experimental tasks that involve semantic priming behave in the same manner as the translation tasks. In short, L2 to L1 translations seem to be sensitive to lexical processes (i.e., factors that have a direct effect of lexical access only) whereas L1 to L2 translations are also sensitive to conceptual/semantic processes and some require more mental effort and/or more time.

Although the bilingual model depicted in Figure 1 explains most of the bilingual memory findings in both interlanguage translations and semantic priming (see Kroll 1993, for a complete review), new evidence challenges some of the major assumptions of the hierarchical model. In a recent experiment, Dufour and Kroll (1995) asked fluent and non-fluent English-French bilinguals to view category names (e.g., vegetable) and decide whether a target name (e.g., peas) was a member of that category. As expected, target language presentation (French or English) did not make a difference for more-fluent bilinguals. For less fluent bilinguals, language target presentation affected categorization. It took longer to categorize English to French words (1050 ms) than French to English words (950 ms). These general results were found regardless of the stimulus onset asynchrony (SOA) manipulations (300 vs. 650 ms). In short, their results showed that less fluent bilinguals relied more on their lexical links (L2 to L1) whereas more fluent bilinguals showed evidence that they could access the conceptual store via their L2 lexicon directly. In general, their results suggested that the model in Figure 1 was true for non-fluent bilinguals, but only partially true for more advanced bilinguals.

Most studies in bilingual memory have not systematically controlled for word frequency, word concreteness and the subject's L2 proficiency (but, see De Groot, 1992; De Groot, Dannenburg & Van Hell, 1994). In a recent study, however, Heredia (1995) utilized high proficient Spanish-English bilinguals only, high frequency words (word frequencies higher than 40 occurrences per 1,000,000) and manipulated word concreteness (e.g., concrete vs. abstract). Subjects participated in a translation task (e.g., see CASA produce HOUSE) and a translation-recognition task (e.g., is the word pair, HOUSE-CASA, a translation? YES/NO). Figures 2A and 2B summarize Heredia's (1995) results.

The results are straight forward. As can be seen from Figures 2A and 2B, L1 to L2 and L2 to L1 translations did not differ in the concrete conditions. Both translation conditions benefited from the concreteness effect. However, in the abstract conditions, L2 to L1 translations were slower than L1 to L2 translations in both the translation and the translation-recognition task.

Clearly, these results do not agree with the hierarchical model. First, the concrete word conditions did not show the predicted language asymmetry where L2 to L1 translations were expected to be faster than L1 to L2 translations. These results suggest that both L1 to L2 and L2 to L1 conditions are sensitive to semantic or conceptual factors. Second, the abstract condition showed that contrary to the predictions of the hierarchical model, L2 to L1 translations took longer than L1 to L2 translations, thus suggesting that L2 to L1 translations are less sensitive to lexical processes and perhaps more sensitive to conceptual factors.

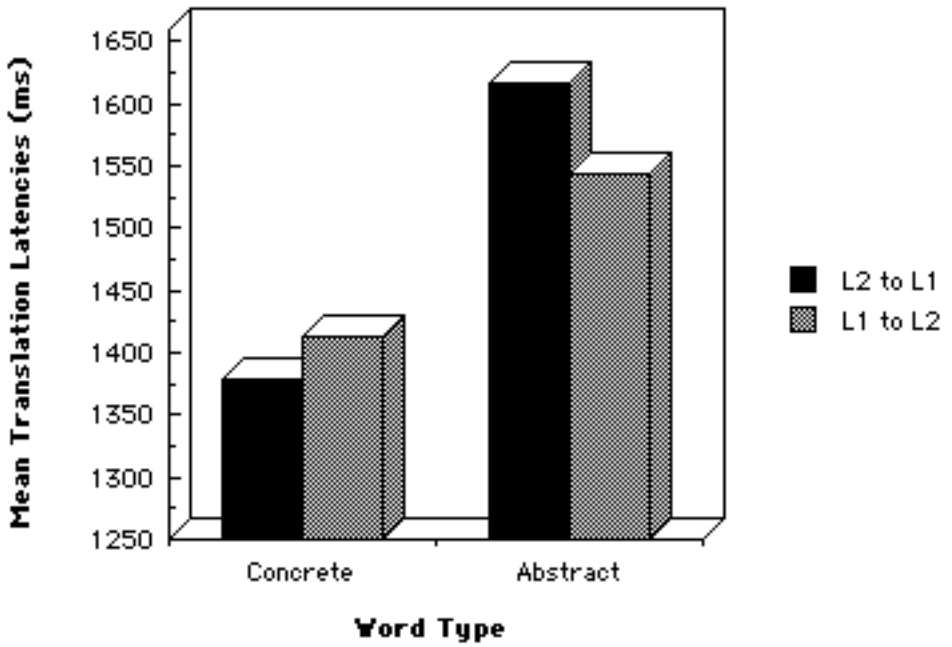

Figure 2A . Mean translation-recognition latencies (ms) as a function of word type and language.

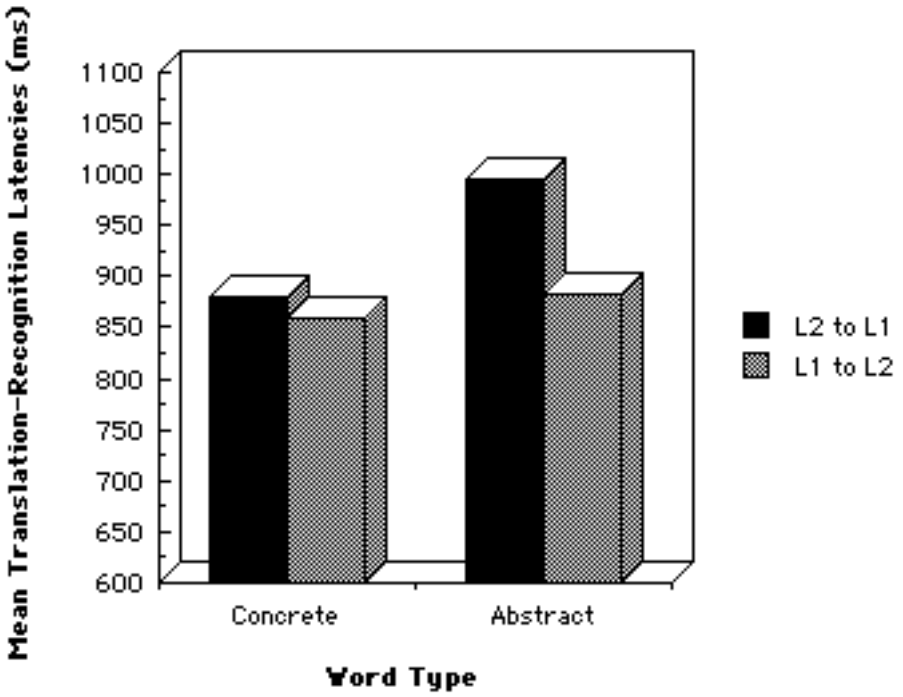

Figure 2B. Mean translation-recognition latencies (ms) as a function of word type and language.

How can we reconcile these results with the hierarchical model? It is important to point out that the subjects in Heredia's (1995) experiments were classified as highly proficient in both their Spanish and English languages. Moreover, the fact that these subjects received most of their formal education in their L2 (i.e., English) and their L2 was the more active language in their everyday activities suggests that their L2 became their dominant language, thus behaving as if it were their first language (see also, Altarriba, 1992). Regarding the hierarchical model, it could be that this model is a language proficiency model and it is unable to take language dominance as a major factor in describing bilingual memory structure. That is, it may very well be the case that this model can only explain bilingual memory for early bilinguals and not for highly advanced bilinguals.

Do we need two hierarchical models to explain different stages of bilingual memory representations? Figure 3 attempts to modify Kroll's hierarchical model to account for some of the results in Altarriba (1992) and Heredia (1995). Unlike Figure 1, the **Second Revision (R-2) Hierarchical Model** is not concerned with the order in which the languages were learned, but instead with which language is the **More Dominant Language (MDL)** and which the **Less Dominant Language (LDL)**. Since the model does not distinguish between L1 and L2, it allows for the possibility that the bilinguals' L2 can become the more dominant language. Notice that this R-2 version avoids the problem of having one memory structure for non-fluent bilinguals and another memory structure for fully-fluent/more fluent bilinguals as in the case of Altarriba (1992) and Heredia (1995).

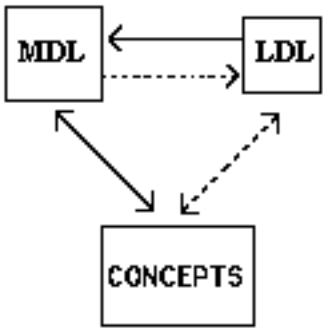

Figure 3. R-2 Hierarchical Bilingual Model

Furthermore, it is important to note that this R-2 version is not suggesting that the LDL lexicon becomes smaller or that it shrinks for the bilingual with his/her L2 becoming more dominant than his/her L1. What I am suggesting here is that the information is perhaps there in the L1 store, but is not readily accessible or is not as easy to access due to underuse. Because the L2 is used more frequently, on the other hand, stronger direct links to concepts are established. It is important to point out that the

present version (R-2) of the hierarchical model makes the same assumptions as Figure 1 regarding the links between the MDL and LDL lexicons and the lexical links to the conceptual store.

Finally, this R-2 version can account for the results in Figure 2A and 2B for abstract word translations and Altarriba's (1992) results because language dominance is taken into account. However, R-2 does not explain the finding that concrete high frequency bilingual translations (i.e., L1 to L2 and L2 to L1) are structurally the same. As pointed out by Kroll (1993) and De Groot (1992), high frequency concrete words could be a special case and more research is needed to determine if this effect holds for concrete low frequency words as well.

To conclude, I have provided a short summary of the present research and theoretical framework in bilingual memory representations. In addition, I have suggested a revision of Kroll's hierarchical model to account for a larger range of data. Namely, the R-2 model accounts for both high and low proficiency bilinguals, and – importantly – both for bilinguals whose L1 is more dominant and for those bilinguals whose L2 has become the more dominant language.

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