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A Review of L2 Lexical Representation Models

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ABSTRACT：*This paper introduces five typical theoretical models of second language vocabulary processing, illustrating with respect to how there may be differences between the size of the first language (L1) and the second language (L2) lexicon, differences or similarities between how meaning is retrieved, and differences in how rich the meanings of words in each language are. The paper also examines the validity and applicability of the models in terms of results of the experimental paradigm. Finally, the paper points out the common restrictions in the field of L2 representation research and provides advice based on the advantages and disadvantages of the theoretical models.*

KEYWORDS: L1 lexicon, L2 lexicon, models, vocabulary processing; memory system

INTRODUCTION

One of the long-standing questions asked in the bilingualism literature is whether bilinguals store their first language (L1) and second language (L2) lexicons in shared or separate memory system. In order to account for the mechanism of bilingual memory based on some of the findings pertaining to these questions, various models have been proposed. These models include the Revised Hierarchical Model (Kroll & Stewart, 1994), the Bilingual Interactive Activation Model (Dijkstra, 2005), the Sense Model (Finkbeiner, Forster, Nicol, & Nakamura, 2004), and the Episodic L2 Hypothesis (Jiang & Forster, 2001), to name a few. Specifically, these models illustrate the differences between the size of the first and the second language lexicon, differences or similarities between how meaning is retrieved, and differences in how rich the meanings of words in each language are. Although these models are interesting and offer insight into how two languages in bilinguals are represented and processed, the specific question of how L2 words are represented in memory has still been a controversial. The aim of this essay is to examine several bilingual models, to provide an overview of the memory system that stores L2 words.

The Revised Hierarchical Model

The Revised Hierarchical Model was proposed by Aparicio and Lavaur (Kroll & Tokowicz, 2001). This model had an attempt to describe how semantic processing of L2 learners developed from words to concepts as L2 level improved. In the early stage of L2 acquisition, learners relied on the translation of L2 words into L1 words to access L2 word meaning. At this stage, the beginners' direct connection between L2 lexical representation and conceptual representation was weak, so they were exclusively dependent on lexical connections between L1 and L2 to access the L2 word meaning. This means that at this stage, learners' performance was much more influenced by morphology than by semantics. When they were more exposed to the second language and their level of L2 improved, the direct connection between words and concepts would be developed and strengthened. In this case, they may directly use concepts as intermediaries to access L2 words, which means that their performance would be significantly affected by semantically related variables. However, the lexical correlation between L1 and L2 would remain an intermediary and not disappear despite the improvement of the language level. Since L1 always had the priority of access to meaning, for most learners, the correlation between L1 words and concepts would be much stronger than that between L2 words and concepts. Therefore, according to this model, the L1 lexicon and L2 Lexicon have shared the same conceptual system but the different lexical system.

To a large extent, this model could accurately reflect the bilingual lexical representation patterns of the second language learners, and we could infer that this model demonstrated the same conceptual system that were shared by L1 and L2 lexicon but the different lexicon system between them. However, this model could not explain the phenomenon of asymmetry of cross-language priming (Chen & Gao, 2009) that in masked lexical decision task the researchers only found the priming effect from L1 to L2 but no priming effect from L2 to L1 (De Groot & Nas, 1991; Sanchez-Casas, Davis, & Garcia-Albea, 1992; Grainger & Frenck-Mestre, 1998; Gollan, Forster, & Frost, 1997). With the deepening of the research, Finkbeiner et al. (2004) proposed another new model, namely the Sense Model, which can successfully explain the asymmetry of cross-language priming.

The Sense Model

Finkbeiner et al. (2004) used Japanese-English bilinguals as the participants, investigated and verified the phenomenon of asymmetry of cross-language priming. This model believes that a large number of words in a language were polysemous, that is, one word had more than one related meaning, and the meanings of polysemy were stored independently in semantic representation system. One L2 words may have

several meanings, but the number of word meanings that bilinguals really master was far less. Therefore, the meaning of L2 words that bilinguals knew was less than that of L1 words. For example, in Figure 1, one circle represents one semantic meaning that this word represent. The black circle means the shared meaning by L1 and L2, while the grey and white circle are the exclusive meaning that only L1 represents. For example, for the Japanese (L1) words *kuroi* and its translation equivalent in English "black". They both have the same meaning as the color of "black", but for L2 English *black*, there are several other meanings instead of this one. However, because of less knowledge of L2 words, bilinguals only obtain very few of them. While for the Japanese words *kuroi*, for it is their native language, they know much more semantic meanings of this word.

How did this model account for the asymmetry of cross-language priming? When the participants performed the lexical decision task, in order to activate the target words, they must activate all of its meanings. However, the peoples' degree of familiarity to the L2 words' meanings was so different that when words in different languages as the target words, there were a great differences among participants' performance. Take Figure 1 for example, for the words *kuroi* (L1) and *black* (L2), the bilinguals could master 8 meanings of *kuroi*, but very few meaning for the word *black*, maybe only one meaning, that is, the shared meaning, "the color of black". When *kuroi* is taken as the prime word, all of its 8 meanings are activated, including "the color of black". Therefore, when *black* being the target word, the ratio of the number of meanings activated by the

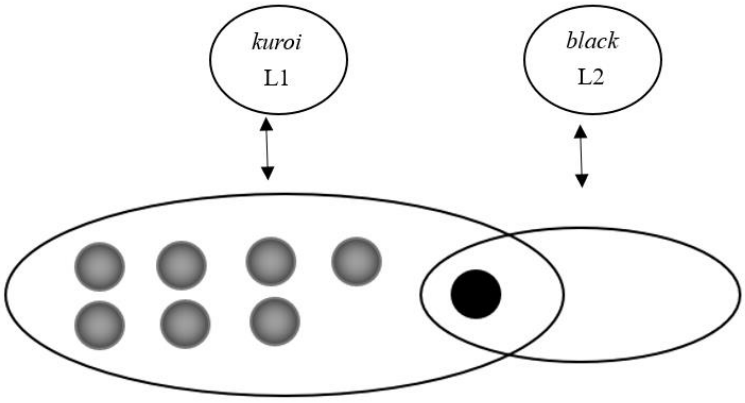

Figure 1 The diagram of the Sense Model

prime word to that of meanings needed to fully activate the target word is 1:1 so as to promote recognition of the targe words, thus priming effect is apparent. Whereas, when the situation has reversed, in which *black* is taken as the prime word and *kuroi* the target word, only one meaning is preactivated, while the number of meanings that could activate the word *kuroi* is 8. The ratio here is 1:8. That is to say, When L2 words primes L1 words, only few of meanings of L1 are activated, thus the L2-L1 priming effect of

being absent.

In short, this model has successfully explained the phenomenon of asymmetry of cross-language priming. It agrees that L1 and its L2 translation equivalents have their independent words forms and the shared semantic concepts, which was also advocated by the Revised Hierarchical Model. However, there are some limitations about this model. For example, when both the target word and prime word are monosemic, the question whether the L2 will activate the L1 as the ratio is also 1:1 is still unknown. In addition, this model was proposed from the level of semantics. In other words, this model assumed that the recognition of words was mainly influenced by words' meaning. However, some researchers are against this view and admit that the recognition of words is far more complicated, thus emerging several new models, among which BIA model holds that bilingual word recognition is the recognition of its orthographic representations.

BIA Model

BIA model assumes that visual input of a word would activate both this word and its logographically similar words, which called lexical candidates; this model also defends that bilingual mental lexicon was integrated across languages (Dijkstra & van Heuven, 2002). In other words, the words of both languages were stored together. Therefore, a visual recognition of a word was concerned with the activation of both languages. When in bilingual word recognition, there were four levels of word process, including feature, letter, word and language level. The whole recognition process goes like this:

> When a string of letters is presented, this visual input affects particular features at each letter position, which subsequently excite letters that contain these features and at the same time inhibit letters for which the features are absent. The activated letters next excite words in both languages in which the activated letters occurs at the position in question, while other words are inhibited. At the word level, all words inhibit each other, irrespective of the languages to which they belong. (Dijkstra & van Heuven, 2002).

When word nodes from both languages were activated, they would activate the corresponding language node while inhibiting the other language node. To be noticed, the activation of the languages nodes reflects the amount of activity in each lexicon. Therefore, the whole process is the activation of the related and inhibition of the unrelated.

In this model, orthographic similarity effects were regarded as the only condition in

bilingual word recognition. Therefore, this model assumes that only when both languages had the words with the similar spelling could both languages be activated. However, there are some bilinguals with their L1 and L2 being different script, indicating that it is impossible to find the overlapping orthographic features from both languages. Do they store in an integrated lexicon? This model did not have an explicit explanation. Therefore, with the aim of modifying the BIA model, a new model, namely BIA + model was provided. This revised model considered that the recognition of words was not only by cross-linguistic orthographic similarity effects, but also by cross-linguistic phonological and semantic overlap (Dijkstra & van Heuven, 2002).

BIA+ Model

Just like the BIA model, the BIA+ model proposes that the bilingual lexicon was integrated across the languages and was accessed in a language non-selective way (Dijkstra & Van Heuven, 2002: 182). However, the BIA+ model extends these assumptions from orthographic representations to phonological and semantic representations.

As shown in Figure 2, in order to recognize a word, the visual input activates sub-lexical orthography in the first place. Soon afterwards, related phonological and semantic representation are activated. The representations are integrated at these three level. The input is offered from the identification system to task system which possessed its own decision criteria and a responses is triggered as soon as its criteria are achieved. This model presumes that L2 words are stored with L1 words together in an integrated lexicon. Especially, when it comes to activation of orthographic nodes, it is predicted that lexical orthographic candidates from both languages can be activated in the case of the similarity between input string and lexical candidates. It is more explicit than other models with respect to the time-course of the bilingual word identification process, the interactions between different types of representations (orthographic, phonological, semantic). It is plausible to explain inhibitory neighbor priming effects in processing L2 neighbors and cross-language inhibitory neighbor priming effects. Nevertheless, it does face trouble in explaining why the within-language inhibitory neighbor priming effect is absent when different script bilinguals recognize neighbor words. If lexical representations of two languages are integrated at the lexical level as the BIA+ model proposes, lexical properties are shared. Thus, symmetric translation priming is expected to occur. However, this is not the case for many a studies (e.g., Finkbeiner, et al., 2004; Jiang & Forster, 2001). Therefore, this model fail to justify the asymmetry of cross-

language priming.

Different from all of models demonstrated before, a new model, L2 Episodic Hypothesis, proposed by Jiang and Forster (2001) deems that L1 and L2 words are stored separately in two different memory system, and their model shed new light on the L2 word presentation.

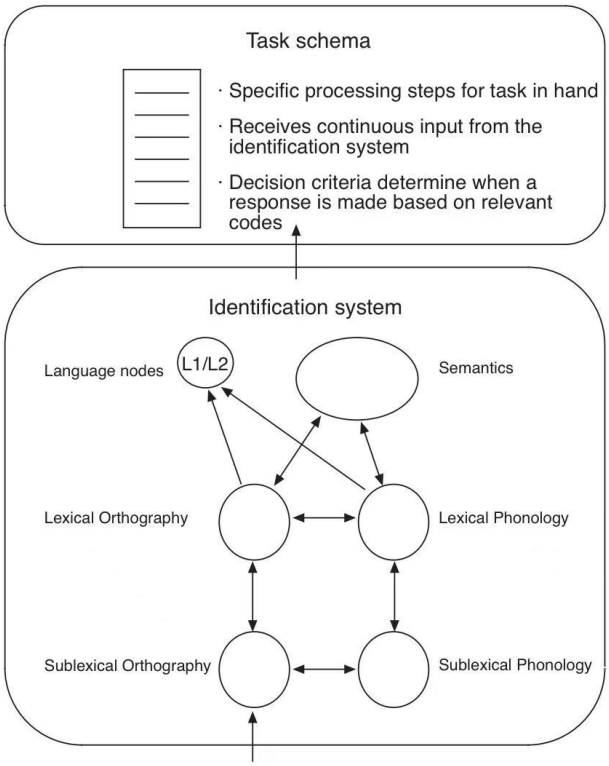

Figure 2 The BIA+ model for bilingual word recognition (Dijkstra & Van Heuven, 2002: 182)

L2 Episodic Hypothesis

This hypothesis is based on the asymmetric translation priming. Many studies (De Groot & Nas, 1991; Sanchez-Casas, Davis, & Garcia-Albea, 1992; Grainger & Frenck-Mestre, 1998; Gollan, Forster, & Frost, 1997) found the effect of L1-L2 priming on the lexical decision task of cross-language translation priming, but found no L2-L1 priming effect. While some scholars (Jiang & Forster, 2001; Witzel & Forster, 2012) found a different result, that is, the priming effect of L2-L1 when the experimental task was changed into the episodic recognition task. This task requires two stages, namely the learning stage and the testing stage. In the learning stage, subjects are presented with a series of native language words and asked to remember them as much as possible. The purpose is to produce temporary episodic memory for these native language words. In

the test stage, the participants completed the masked translation priming experiment, with the priming words as second language and the target words as native language. The subjects were asked to judge whether the target words were the words that had appeared in the first stage (the appeared words were called "learned" words; Words that do not occur are called "unlearned" words. Two studies (Jiang & Forster, 2001; Witzel & Forster, 2012) found that second language has a significant priming effect on "learned" native words. The L2 Episodic Hypothesis interpreted this result as due to second language vocabulary stored in episodic memory, while the second language in the lexical decision task cannot activate the native language, but in the episodic recognition task (a kind of episodic memory is needed to complete tasks), as native language words were "temporarily" stored in the episodic memory system, so the priming effect is produced.

L2 Episodic Hypothesis assumes that L1words are stored in lexical memory, while L2 words are stored in episodic memory. The episodic memory refers to a "non-lexical memory system" as opposed to "lexical memory". If the lexical memory system is a modular system of tightly connected words that automatically activate each other, the episodic memory system is less modular. Moreover, more extra stimulus energy is needed to activate L2 words (Witzel, 2010).

CONCLUSION

This article have introduced and examined a number of models related to how L2 words are stored - the Revised Hierarchical Model, the Sense Model, the BIA Model, the BIA+ Model, and the L2 Episodic Hypothesis. So far, the research on second language representation has not reached a unified conclusion. Although there are many experimental paradigms and research results supporting that L1 and L2 words are stored together in an non-selective way, such as BIA model and BIA+ model. However, many studies also found the evidence of separate lexicon that L1 and L2 have, such as L2 Episodic Hypothesis. Some models believe that L1 and L2 share the same conceptual system but different lexical system. As the second language representation process is a very complex cognitive processing procedure, there are multi-dimensional connections between the form, sound and meaning of L2 words, and this process integrates linguistic and non-linguistic situational information, we still do not know all the factors affecting this process. Therefore, future research should pay attention to: 1) design the more scientific and flexible experimental paradigm by combining the advantages of different experimental paradigms; 2) apply the multi-dimensional and multimodal approach and combine behavioral measurements with the latest cognitive science and technology to explain the cognitive and mental mechanism of second language lexicon processing.

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