Controversies on Language Effects on Bilingual Lexical-conceptual Linking Patterns in Chinese EFL Learners' Mental Lexicon*

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Abstract—Researches on lexical knowledge basically focus on the acquisition of the deep lexical knowledge. The lexical-conceptual organization of Chinese EFL learners' mental lexicon has been a most researched issue. This paper is to review the existing literature in this field and propose the controversies on the language effects on the lexical linking patterns of the learners, which are hopefully clues of further studies.

Index Terms—controversies, language effects, linking patterns, Chinese EFL learners

I. INTRODUCTION

Lexical knowledge is a meaningful indicator of reading skills, and plays an essential role in the second language acquisition. Researches on lexical knowledge basically focus on the acquisition of the deep lexical knowledge, and the researches in this field have been changed radically for the recent fifty years, whose focus has moved from the increase of vocabulary size to the organization features of mental lexical network, and from multidimensional decomposition of a word to the exploration of lexical representation and processing with research methods employed mainly in the other disciplines. Of all the research topics on mental lexicon, the relationship between the two languages has been a heated one. How L1 words are linked to L2 and how L2 words are linked to L1 are two most studied questions. Literature review showed that L2 words are linked to L1 in a different way from the opposite direction, which was termed as language effects.

II. L2-L1 LINKS AND L1-L2 LINKS

Whether or not the L2 learners had L2 conceptual representations determined the way in which L2 words linked to L1 words. And whether there was L1 translation equivalents activation during L2 reading determined the way in which L1 words linked to L2 words. So the linking patterns were studied along the two lines.

A. Establishment of L2 Conceptual Representation

Two major study paradigms were used for the L2 semantic representation status, they were cross-language priming studies and translation (recognition) studies. Findings in these aspects would be of extreme value for determining the L2-L1 links.

a. Priming patterns

Priming studies found language processing patterns could be dependent on and varied with the target language, which was termed as the asymmetry. Of course, if the processing pattern did not vary with the target language, it was termed as symmetry.

The earliest disagreement of bilingual mental lexical research was the inconsistent perspectives about the shared vs. separate lexicon of the two languages. Those who were in favor of separate mental lexicon claimed that the L2 lexicon was newly established which was different and separated from the L1 lexical representation. In particular, if there was strict separation and difference between environments in which the two languages were acquired and used, the L1 and L2 lexical representations were distinct from each other (Weinreich, 1953). There was some supporting evidence from early work for this assumption (Gekoski, 1980). It was found that French-English bilingual participants who were exposed to their second language in a different context from L1 rated translation equivalents (e.g. *église* and church) differently, while those who learned and used both L1 and L2 in identical contexts rated translation equivalents similarly in a semantic differential task. That is, the former supposed "*église*" and "church" having different meanings, while the latter reported "*église*" and "church" having similar meanings. These results showed the great impact that different learning contexts had on the establishment of conceptual knowledge, but were not sufficient to claim that the two lexical representations were totally distinct from each other.

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With new psychological experiment paradigms coming out, priming for instance, this question would be no longer a question. Till now, bilinguals having one shared concept was no more a question, but "in what way the newly coming language co-inhabit with the old one" in the single lexicon had been a question. Two major and basic concerns in bilingual lexical researches nowadays focused on two relations: the lexical or formal relation between the two languages and relations between the concept and the two languages respectively, i.e. the hierarchical relation of the lexicon, or organizations of the form layer (phonological and orthographic) and the meaning layer.

The experimental paradigm of priming had been one of the most commonly used techniques to explore the structure of the mental lexicon in monolingual, an area that continued to be one of the most widely studied in the domain of cognitive psychology. Because the priming paradigm proved to be an extremely informative experimental technique, it was not surprising that it had been expanded to examine bilingual memory representation by using cross-language stimuli. Cross-language priming was an ideal paradigm, very frequently used to explore bilingual representation. In a cross-language priming research, a target word was preceded with a prime word in another language. If these two words were translation equivalents or meaning related, RT of lexical decision of the target word would be shorter than those not. The shorter RT was, the more robust the priming effect was. In the case of translation equivalents, this behavior phenomenon was called translation priming effect; while in the case of meaning relatedness, it was cross-language semantic priming effect. The rationale of priming studies was that translation equivalents usually had different orthographic forms, but shared the same/similar meanings. The semantically related words within a language, such as doctor-nurse, shared similar properties: different orthographic forms but related to each other in meaning. That is, like English speakers who responded to "nurse" faster if it was preceded by "doctor" compared with "table-nurse", bilinguals responded to the target item significantly faster if it was preceded by its translation equivalent. Above all, priming occurred as a result of both the prime and target accessing the same or similar conceptual/semantic representations. For example, participants in a cross-language priming experiment could be presented with the prime word "cat" followed by the target word "狗", the Chinese translation of dog. Word stimuli could also be created so that the prime and the target words appeared in the opposite language direction, such as 猫-dog (猫being the Chinese translation of cat). This allowed one to measure priming effects in the L1-L2 or the L2-L1 direction. Translation (or repetition) priming could also be examined by presenting a prime word followed by its translation in the opposing language. Thus, word pairs can appear as either 猫-cat or cat-猫.

Nearly one dozen of these studies have used the semantic priming paradigm with cross-language stimuli (e.g., Chen & Ng, 1989; de Groot & Nas, 1991; Frenck & Pynte, 1987; Grainger et al., 1989). They believed significant semantic priming could be found across languages. These studies found that bilinguals produced cross-language semantic priming effects that resemble within-language semantic priming effects (e.g. doctor-nurse). Nearly one dozen found cross-language priming by using the translation-priming paradigm (e.g., Altarriba, 1992). Therefore, these two types of priming researches both concluded that the two languages were represented in shared lexicon instead of separated. Since priming occurred as a result of both the prime and target accessing the same or similar conceptual representations, this effect could be regarded as to argue against the distinct representation hypothesis because two totally distinct mental representations would not lead to semantic priming. More importantly, this effect seemingly confirmed the conceptual interconnection between the languages.

With the emergence of priming design, the existence of conceptual link between the two languages has no longer been a question. However, despite the agreement on the existence of cross-language priming and conceptual interconnection, there were controversies in overall priming patterns, which was mainly on the existence of L2-L1 priming effect. On the one hand, there was much psycholinguistic evidence showing priming in two directions, and smaller priming magnitude from L2 to L1 than from L1 to L2 (e.g., Kroll & Curley, 1988; Kroll & Stewart, 1994; Sholl et al, 1995). That is, RT of lexical decision or categorization of L1-L2 was shorter than L2-L1. This occurred because presentation of a word in the L1 would activate more conceptual information and, thus allow a greater amount of conceptual activation to spread to the L2. While L2 conceptual representation was not established or less well established, inadequate to spread the activation to L1. To put it simply, according to these studies, the cross-language priming pattern could be described as two asymmetries. First, L1 was more strongly associated with the concept than L2, therefore, showed stronger priming effect for concept access. Second, the asymmetry in priming direction. That is, priming effect was stronger from L1 to L2 than from L2 to L1. Let's take a study for example, Dufour & Kroll (1995) used categorization paradigm (the participants decided whether the target word could be categorized into the category name previously presented, e.g. vegetable-cabbage) to investigate the relations between lexical and conceptual connections in bilingual memory of fluent and less fluent English-French participants. They reported L2-L1 categorization was about 100ms faster than the opposite direction, with mean RT of French-English (L2-L1) 788 (msec) and mean RT of English-French (L1-L2) 881 (msec) in fluent participants. And their accuracy were 0.9 and 0.8 respectively. While in less fluent participants, L2-L1 categorization was about 80 ms faster than L1-L2, RTs being 958 ms and 1041 ms, and accuracy rates were 0.86 and 0.68 respectively. This study showed asymmetry in RT and accuracy in two directions in participants of varied proficiency. We could make a tentative hypothesis that representation asymmetry was universal in EFL learners.

Francis and Gallard (2005) designed a more complicated experiment that also showed the universality of asymmetry of L2 learners. They asked 48 English-Spanish-French trilinguals to perform a translation task, who translated in six

directions at study and two directions at test. Translation response times and error rates at the study reflected the relative proficiency of the subjects in comprehension and production of their three languages. At test, repeated items were translated more quickly than new items, with the strongest priming effects occurring for identical repetitions. Repetition priming was also substantial when only the stimulus language or only the response language matched from study to test, which indicated that repeated comprehension and production processes contribute to priming in translation. RT patterns and repetition priming indicated that translation in all directions involved conceptual access. Additive asymmetric patterns in response time and repetition priming were consistent with the treatment of word comprehension and production processes of translation as independent.

Unlike the asymmetry claim about cross-language priming, a great number of studies claimed the absence of the priming effect from L2 to L1 in the learners (e.g. Altarriba, 1992; Finkbeiner et al., 2004; Gollan et al., 1997; Jiang, 1999). Finkbeiner et al. (2004) even hypothesized that translation priming was typically not supposed to emerge from L2 to L1 because L2 words only shared a small subset of the senses of their L1 translation equivalents. Silverberg and Samuel (2004) further demonstrated that the age of acquisition (AOA) of the L2 appeared to be an influential factor on cross-language semantic priming, with only early and proficient bilinguals producing reliable L2-L1 priming (L1 to L2 priming was not tested). Similarly, Kotz and Elston-Güttler (2004) indicated that proficiency in the L2 determined the type of semantic relations to which bilinguals were sensitive, with greater constraints for semantic category relations than for associations. Based on the evidence from these researches, L1 and L2 presumably differed not only quantitatively but also qualitatively in terms of the type of information that was accessed and the type of representation that was formed for the L2. There would be L2-L1 priming if the two languages are qualitatively the same, just like the mechanisms of within-language priming effect. Furthermore, L2-L1 priming seems to be an indicator of establishment status of L2 conceptual representation, which somewhat supports the “asymmetry view”.

However, Basnight-Brown and Altarriba's (2007) findings were unlike either of the above two versions. They reported translation priming in both directions at the same magnitudes of facilitation. Significant translation-priming effects of 37 and 48 msec were obtained for English targets and for Spanish targets, respectively. The differences between the two magnitudes of facilitation were not significant. More interestingly, Kiran & Lebel (2007) recruited Spanish-English more balanced (MB) and less balanced (LB) bilinguals for the priming research. They reported semantic priming was observed from English to Spanish (L2-L1) in both the LB and MB groups although the effect was greater for the LB group. Further, only the LB group showed priming from Spanish to English (L1-L2). Their results were contradictory to most others mentioned above.

Based on the existing literature, presence or absence of L2-L1 was still a mystery and need further study. The above studies exclusively used bilingual participants, with their two languages being both alphabetic, some of them being even in the same language family, undoubtedly, more studies are needed, which recruited bilinguals whose two languages are far apart, to provide more evidence for the general priming patterns. Meanwhile tasks of these researches were limited to lexical decision, categorization, and pronunciation production, which could be extended to other tasks. Only in this way, can we have a comprehensive view over the concept relationship between the two languages.

b. Translation patterns

During the past 3 decades, there had been many studies conducted on bilingual memory representation and the way in which two or more languages were stored in memory, however, compared with priming paradigm, translation and translation recognition were relatively scarce. As a researcher, we should be aware that this research paradigm or task had superiority to others. First, it could reveal the L2 conceptual representation status just like other paradigms. Second, it could also reveal the L2 lexical (orthography and phonology) representation. Last but not least, this paradigm could study the two layers of mental lexicon at the same time. In this way, it was very suitable for studying the relationship between the two languages.

A fairly early translation study available on the intranet databases of the University was Potter et al's (1984). Potter et al. (1984) referred to the two different ways of access to L2 respectively as word association and concept mediation, by comparing the performance of more-fluent and less-fluent bilinguals on picture naming and translation in their second language (L2). Because picture naming is thought to require concept mediation, the demonstration that translation resembled picture naming would suggest that translation also engaged conceptual processing. For low-proficiency learners, L2 picture naming was faster than English-French (L1-L2) translation, which was suggestive that cross-language translation accessed the shared concept, instead of direct lexical link. They argued that concept mediation was the basic form of interlanguage connection in bilingual memory because all participants, regardless of their level of L2 fluency, appeared able to mediate conceptually.

However, Potter et al's (1984) research mentioned above was somewhat problematic. They recruited Chinese-English speakers as proficient L2 learners and found RT of L2 picture naming was the same as that of English-Chinese (L2-L1) translation, which suggested cross-language translation was meaning mediated, just as meaning access in L2 picture naming tasks. First, proficient learners were very likely to have well-established L2 conceptual representation, but it could not exclude the possibility of lexical link in a sense, as lexical link can be as fast as the meaning access. Additionally, same RTs did not necessarily mean that they accessed L2 via the same route, as different access routes can cost the same time. Then, while English-French learners were recruited as less proficiency group, which were not comparable with the proficiency group. Languages of the same linguistic system tended to share meaning and even

form representations. So it was risky to conclude conceptual representation was for every type of participants. Additionally, recall task was added to test less proficiency group, which was not comparable with the proficiency group task.

There was another classic translation experiment with bilinguals, which was much better designed. Kroll and Stewart (1994) had highly proficient Dutch-English bilinguals translate in both directions. In one condition, the words to be translated were blocked by semantic category, and in the other, they were randomly mixed. Kroll and Stewart (1994) reported that L1-L2 translation was slower in the context of the semantically categorized lists than in the mixed conditions, but L2-L1 translation was unaffected by the semantic manipulation, which meant translation of this direction accessed no meaning. Additionally, even for these highly proficient bilinguals, there was a translation asymmetry, with longer latencies in the L1 to L2 direction than in the L2 to L1 direction. The translation experiment led to the proposal of the hypothesis of RHM, which claimed translation in the forward direction—L1-L2—should be conceptually mediated, but translation in the backward direction—L2-L1—should be lexically mediated. Talamas et al. (1999)'s research, which used English-Spanish fluent and less-fluent participants to perform translation-recognition task, reported the similar findings, i.e., backward translation (858ms) was 79 ms faster than forward translation (937ms).

Based on evidence from both priming and translation studies, it can be concluded that backward priming (L2 facilitates recognition of L1 equivalent) is a good indicator of L2 conceptual representation establishment. But the presence or absence of L2-L1 is still a question, which need further study with different experiment design and wider variety of bilingual participants. If L2-L1 translation priming does exist, representation symmetry or asymmetry is also a question, which reveals the conceptual relationship between the two languages.

B. L1 Influence

Besides priming, and translation studies, another clue was L1 influence studies, which could provide consolidated evidence for the linking pattern from L1 to L2 of the bilinguals. Unlike the previous two lines of research, L1 influence researches can answer questions of both levels, orthography and semantics, and reveal L2 word processing patterns, which in turn deepen the understanding of L2 representation. L1 influence studies were to find out the role of L1 translation equivalent in L2 reading. If L1 translation equivalent was activated during L2 reading, it meant the two languages were linked at the lexical level to an extent and the L2 concept had to be accessed via L1 word. On the contrary, if L1 translation equivalent was not activated, it would be suggestive that L1 formal representation was bypassed, the concept was accessed directly and the two languages were linked at the conceptual level.

In terms of L1 activation during L2 reading, there were two different viewpoints. One view was selectivity, which held that languages of bilinguals were selectively activated, i.e. only the target language, e.g., L2, was activated and accessed during L2 reading. While the other view was non-selectivity. Generally, whenever features of a non-target language were found to impact target language activation, such as by producing facilitatory or inhibitory effects in word processing, this was taken to support an integrated account of bilingual language processing and organization, and non-selective activation. The degree of activation of non-target lexicon might vary with the language dominance as well as other factors (e.g. modality of presentation, phonological or orthographical similarity between the target and the non-target language, etc.). In the visual modality, both non-target language phonology and non-target language orthography had been found to impact target language processing. For phonology, masked phonological priming revealed interlingual homophone priming effects from both the native language to the non-native language, and from the non-native language to native language (e.g. Van Wijnendaele & Brysbaert, 2002). The magnitude of interlingual priming was comparable to that of priming within a single language. For orthography, interference effects were found to be influenced by cross-linguistic word frequency and interlingual orthographic density (the number of words with similar orthography that differed by a single grapheme). In a lexical decision task, Bijeljac-Babic, Biardeau, and Grainger (1997) found that orthographically-related high frequency primes in the non-target language inhibited processing in the target language and the effect was greater for bilinguals who were highly proficient in the nonnative language. Similarly, Van Heuven, Dijkstra, and Grainger (1998) found that words with more orthographic neighbors in the native language slowed responses to target words in the non-native language. In addition to language recognition, orthographic input from the non-target language was also found to impact bilingual language production. Hermans, Bongaerts, De Bot, and Schreuder (1998) used a picture-word interference task and found that bilinguals could not suppress native-language lexical information when naming pictures in a non-native language. In the auditory modality, spoken word recognition was also found to be influenced by phonological and orthographic overlap, as demonstrated by priming effects (e.g. Slowiczek et al., 1992). However, parallel activation occurred more reliably with high-proficiency non-target languages than with low-proficiency non-target languages (Silverberg & Samuel, 2004). Findings of parallel first-language activation during second language processing had been consistent.

Based on the review on the large body of empirical studies, the researcher intended to believe that languages of bilinguals, target or non-target, were activated non-selectively and parallelly. Non-target language would be activated inevitably during target language recognition. The target language was accessed because of inhibition of the non-target language. A closer look at Bijeljac-Babic, Biardeau and Grainger's (1997) study would provide a clear picture. In their study, French-English subjects were recruited to make lexical decisions to L1 or L2 target preceded by masked orthographic prime words from the same or a different language. The target language was English (L1-L2) in the first experiment, while in the second it was French (L2-L1). The target words in both experiments were low-frequency

words or nonwords that were orthographically legal and pronounceable. The primes were high-frequency words (presented for 57 ms) that either in the same language as the target or in the other language. In both experiments it was found that when prime and language were from the same language, RTs to target word were inhibited for orthographically related primes relative to orthographically dissimilar primes. For example, when the target language was English, the prime-target combination “real -HEAL” led to slower RTs than the combination “roof - HEAL”. This finding highly suggested that any facilitation effects that might arise due to form priming (overlap in letters) were annihilated by inhibition effects due to lexical competition. More relevant, however, was that when prime and target were words from different languages (“beau - BEAM”), inhibition effects were found as well. This indicated that lexical knowledge from the other language affected target recognition, which provided evidence supporting lexical linking and language non-selective access to the bilingual lexicon.

For another example, studies that used cross-language neighbors, words that were orthographically similar in the two languages but otherwise unrelated (e.g., the English word “gate” had neighbors in English, such as “game”, but also neighbors in Spanish, such as “gato”.) had shown that word recognition in both the L1 and the L2 was influenced by the neighborhood properties of words in both languages (e.g., Grainger et al, 1992; Van Heuven et al., 1998.) In other words, even when performing a task in one language alone, there was evidence that neighbors in the other language are active (Sunderman and Kroll, 2006). If it were possible to simply switch off one language (e.g.L1), there would be no effect of these lexical properties. English and Spanish were two much closer languages than English and Chinese, which shared no similar orthographic features at all. Therefore, whether non-selectivity was still the case for Chinese-English bilinguals during L2 reading was still a question.

L1 was not only activated but also mediated L2 reading, according to some studies, for example, Talamas et al.’s (1999) was a classic design. They used the translation-recognition task to explore the performance of English-Spanish learners who had different proficiency in Spanish. In this task, participants were presented with two words, one in each language. Their task was to decide whether the second word was the translation equivalent of the first. The critical focus in the Talamas et al.(1999)’s study concerned those trials in which the two words were not translation equivalents, i.e., the “no” trials. For example, the pair *man-hombre* would constitute a correct translation trial. On the critical “no” trials, the second word of the pair was either related in the form of the translation equivalent (e.g., *man-hambre* “hunger”) or meaning (e.g., *man-mujer* “woman”). Talamas et al. (1999) reported that the L2 form relatives of the translation equivalent caused more interference for the low-proficiency bilinguals relative to the unrelated controls, whereas L2 meaning related words caused more interference for the more proficient bilinguals compared with the unrelated controls. The overall pattern of results provided support for the hypothesis that early in L2 learning, it is the lexical form relations to the translation equivalent between L2 and L1 that provide the basis of interlanguage connection. Only with increasing L2 proficiency were L2 learners able to access the meanings of L2 words directly.

Another example was Thierry *et al.*’s (2007) study. In their study, Chinese-English bilinguals were required to decide whether English word pairs were related in meaning or not; they were unaware of the fact that half of the words concealed a character repetition when translated into Chinese. Whereas the hidden factor failed to affect behavioral performance, it significantly modulated brain potentials in the expected direction, which was that English words were automatically and unconsciously translated into Chinese. Critically, the same modulation was found in Chinese monolinguals reading the same words in Chinese, i.e., when Chinese character repetition was evident. These findings demonstrated that native-language activation was an unconscious correlate of second-language comprehension.

Guasch et al.(2008) varied participants’ proficiency and word pair relations, and investigated translation performance of beginning, intermediate and proficient Spanish-Catalan bilinguals and examined how form and semantic manipulations affected the performance of these groups in a translation-recognition task using three types of word relations (very close and close semantically related word pairs and form-related pairs). The results revealed that form manipulation affected the performance of the three participant groups, whereas the influence of semantic relations depends on the participants’ level of proficiency. That is, L1 form mediation, or lexical link, existed in all levels of L2 learners, whereas proficient learners were to a larger extent influenced by conceptual representation.

However, studies of null activation of L1 translation equivalents were almost as many as those of non-selectivity. A great deal of evidence supported the claim that bilinguals were able to process the L2 conceptually, without L1 activation (e.g., La Heij et al., 1996; Zeelenberg & Pecher, 2003). These studies had something in common which was that they exclusively used proficient L2 participants. However, it was not clear at what point learners became able to access the concepts to which L2 words refer. Some studies suggested that the ability to do so was available quite early in learning (e.g., Altarriba & Mathis, 1992; De Groot & Poot, 1997; Potter, So, Von Eckardt, & Feldman, 1984), whereas other studies suggested that it developed in stages (e.g., Dufour & Kroll, 1995; Talamas et al, 1999). Dufour & Kroll (1995) had expected low-proficiency L2 learners to show more reliance on lexical-level connections between languages, requiring translation of second-language words. However, their findings revealed that low-proficiency learners were also able to access limited conceptual information from the second language under certain condition. Therefore, it seemed safe to hypothesize that, besides the commonality of orthographic features, selectivity/non-selectivity was also dependent on the learning stage and participant proficiency.

III. SUMMARY ON THE CONTROVERSIES

A. *Diverse Understandings to the Way in Which L2 Words Are Linked to L1*

It seems that there is much consensus on L1 lexical and conceptual organization. L1 is organized in a way on the basis of semantic relatedness, which forms a conceptual network, and formal similarity at the lexical level in an individual. L2 models and studies referred to and borrowed monolingual models and findings from the relative researches, hopefully to have the similar findings, but unfortunately, fail to yield as much agreement as L1 research. Factually, it seems there are more discrepancies than agreements in terms of the extent of L2 linked with L1. The first discrepancy is the establishment of L2 concept. Nan Jiang's 3-stage model (2000) claimed there is hardly L2 specific conceptual representation, and learners' L2 words are embedded into L1 concept, no matter how proficient the learner is, so L2 conceptual representation is inadequate to prime L1. Kroll (1994) argues L2 shares L1 concept, but doesn't indicate specifically in what way they share the the concept. De Groot (1992), however, proposes that L2 shares the concept with L1 according to featural overlap, that is, the more common semantic elements those L2 words share with L1, the more likelihood L2 share the concept with L1 to a larger degree. While Duyck & Brysbaert (2008) stated that at the very beginning of learning (e.g., learning for 1 hour), there was conceptual representation. Diverse understandings toward establishment of L2 conceptual representation, therefore, naturally derive different researches and the opposite findings in the presence or absence of non-cognate translation priming, and L2-L1 priming.

The second discrepancy is the asymmetry/symmetry views between L2-L1 and L1-L2. The asymmetry view was that L2 is lexically linked more strongly to L1 than the opposite direction, and L1 is more strongly linked to the concept than the L2 (e.g., Kroll & Stewart, 1994; Dufour & Kroll, 1995; Francis and Gallard, 2005). While the symmetry view was that both lexical and conceptual levels of L2 were represented and processed symmetrically, which was predicted by de Groot et al.'s (1992, 1997) distributed concept featural model (DCFM), and their relative empirical studies, as well as other studies in line with this viewpoint. Basnight-Brown and Altarriba (2007), for example, reported translation priming in both directions at the same magnitudes of facilitation. Significant translation-priming effects of 37 and 48 msec were obtained for English targets and for Spanish targets, respectively. The differences between the two magnitudes of facilitation were not significant. More interestingly, Kiran & Lebel (2007) recruited Spanish-English more balanced (MB) and less balanced (LB) bilinguals for the priming research. They reported semantic priming was observed from English to Spanish (L2-L1) in both the LB and MB groups although the effect was greater for the LB group. Further, only the LB group showed priming from Spanish to English (L1-L2).

B. *Diverse Understandings to the Way in Which L1 Words Are Linked to L2*

Diverse understandings towards the extent of L1 words linked to L2 mainly come from the different findings of presence or absence of L1 activation during L2 reading. One view was that L1 is so strongly linked with L2 and exerts so powerful influence on L2 reading that L1 will be activated unconsciously and automatically during L2 reading, despite how high proficiency the participant has achieved, which reflects strong lexical link from L1 to L2.

There have been numerous studies that reported L1 influence on L2 with a variety of experiment design. Masked phonological priming revealed interlingual homophone priming effects from the native language to the non-native language. The magnitude of interlingual priming was comparable to that of priming within a single language. Hermans et al. (1998) used a picture-word interference task and found that bilinguals could not suppress native-language lexical information when naming pictures in a non-native language. Parallel first-language activation during second language processing had also been observed in Sunderman and Kroll (2006), Thierry *et al.*'s (2007) and Guasch et al. (2008) etc., which all claimed that L1 activation was inevitable and an unconscious correlate of L2 comprehension, even in the absence of L1 (Thierry et al. (2007) presented the word stimuli in L2-L2 paradigm).

However, studies of null activation of L1 translation equivalents were almost as many as the others. A great deal of evidence supported the claim that bilinguals were able to process the L2 conceptually, without L1 activation. These researchers assumed that learners can access L2 with no L1 reliance very early in learning. Null activation of L1 equivalents represents absence of L1-L2 lexical link.

These controversies may be settled if further researches make an attempt to have all irrelevant factors well controlled (participants, stimuli, lexical variables) so as to examine the linking patterns between L1 and L2.

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