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The Development of Conceptual Representation for Words in a Second Language

Judith F. Kroll and Natasha Tokowicz

To become a fluent bilingual, an individual must acquire the means to access concepts for second language words independently of the first language. For adult second language learners, successful conceptual processing of the second language does not necessarily occur automatically as a consequence of increasing exposure. During early stages of acquisition, words in the second language, L2, may rely on their counterparts in the first language, L1, to mediate access to meaning. And even when the aspiring bilingual becomes able to directly retrieve the meaning of L2 words, he or she may not be able to use this knowledge to achieve fluent production in L2.

In this chapter we consider the cognitive processes that support the achievement of concept mediation in the adult second language learner. First we review past literature that suggests that L2 is initially dependent on lexical transfer from L1 to access the meanings of L2 words. We then examine the factors that influence the development of direct conceptual processing for the second language and the consequences of this process for the representation of the two languages in the mind of the fluent bilingual. Finally, we consider the implications of an extension of this framework which suggests that the problem the L2 learner faces is not simply a matter of creating representations for L2 that allow access to meaning, but also a matter of developing control mechanisms to effectively modulate the activity of L1. This addition provides a basis on which observed individual differences in L2 acquisition and performance may be understood.

1 Early Stages of Acquisition

Past research on lexical development in the adult L2 learner provides evidence for the claim that during early stages of acquisition, the presence of simultaneous lexical activity in L1 shapes the nature of the representations and processes that guide L2 performance. Because other recent book chapters review this material in detail, we restrict ourselves

here to the main results of this work. (See Chen, 1992; de Groot, 1992b, 1993, 1995; Kroll, 1993; Kroll & De Groot, 1997; and Kroll, Michael, & Sankaranarayanan, 1998, for related reviews of this literature.)

Potter, So, von Eckardt, and Feldman (1984) reported a study of picture naming and word translation that provided the logic for a series of experiments on the nature of the interlanguage connections for second language learners and fluent bilinguals. In the critical conditions of their study, bilinguals named pictures in L2 and translated words from L1 to L2. Potter et al. reasoned that because picture naming is believed to require concept mediation (i.e. the picture must be recognized and its concept retrieved before the process of lexicalization resulting in the name can be initiated), translation should resemble picture naming only if it too is conceptually mediated. However, if translation can be accomplished at a lexical level alone, via access to associated translation equivalents, then translation should be faster than picture naming. In two experiments, Potter et al. found that picture naming in L2 and translation into L2 were quite similar, providing support for the conceptual alternative for both highly fluent bilinguals and second language learners.

Subsequent studies using the same empirical logic, but with second language learners at earlier stages of development than those included in the Potter et al. (1984) experiment, reported evidence for a developmental shift from lexical to conceptual processing of L2 words with increasing proficiency. Chen and Leung (1989) and Kroll and Curley (1988) found that translation was indeed faster than picture naming in L2 for less proficient learners, whereas they replicated the Potter et al. concept mediation results for more proficient bilinguals. These studies interpreted the observed change with increasing expertise to indicate that early in acquisition, direct connections between translation equivalents across the two languages are salient until the ability to directly conceptually mediate L2 develops.

The observation of a shift from lexical to conceptual processing with increasing expertise fits the phenomenology of many second language learners. However, the research based on comparisons of picture naming and word translation provides only one source of evidence for this pattern of change and one that is potentially open to alternative interpretations, since the critical data in these studies involve a cross-task comparison of overall latencies. We will consider one of these alternatives, the proposal that what changes over development is the inhibitory control associated with L2, in more detail later in the chapter. However, a more compelling source of evidence for a developmental shift comes from studies which show that different variables influence processing at different points in acquisition.

Talamas, Kroll, and Dufour (1999) compared the performance of more and less fluent bilinguals on the translation recognition task. The participants were English-dominant bilinguals who differed in their level of proficiency in Spanish, as measured by a set of self-assessed fluency measures and by their overall accuracy in the experimental task. A word was presented briefly in one of the participant's two languages and it was followed by a word in the other language. The task was to decide whether the second word was the correct translation of the first. For example, the pair *man-hombre* would constitute a correct translation trial. De Groot (1992a) has shown that translation recognition is sensitive to many of the same variables as translation production. In the Talamas et al. study, the critical focus concerned those trials on which the two words were not translation equivalents (i.e. the *no* trials). On half of these trials, the two words were completely

unrelated to each other. On the remaining *no* trials, the two words were related by virtue of word form similarity (e.g., *man-hambre* where *hambre* means *hunger*) or meaning (e.g., *man-mujer* where *mujer* means *woman*). Talamas et al. found that the two types of related trials produced different results for the more and less fluent bilinguals. For less fluent bilinguals, there was significant interference for form-related pairs, but little effect for semantically-related pairs. For more fluent bilinguals, the pattern was reversed; form-related pairs produced inconsistent effects in performance but semantically-related pairs produced significant interference. The overall pattern of results provides support for the hypothesis that early in second language learning, lexical form relations between L2 and L1 provide the basis of interlanguage connection. Only with increasing L2 proficiency are second language learners able to access the meanings of L2 words directly.

2 A Model of Bilingual Representation

What are the consequences of an early stage of acquisition in which the meanings of L2 words are mediated through L1? One possibility is that it represents only a temporary scaffold for L2 that disappears entirely when the L2 learner is able to conceptually mediate L2 directly. Alternatively, L1 may continue to play a role even after the learner becomes a relatively fluent bilingual. Kroll and Stewart (1994) proposed a model of bilingual representation, the revised hierarchical model, which attempts to accommodate the potential consequences of this developmental process.

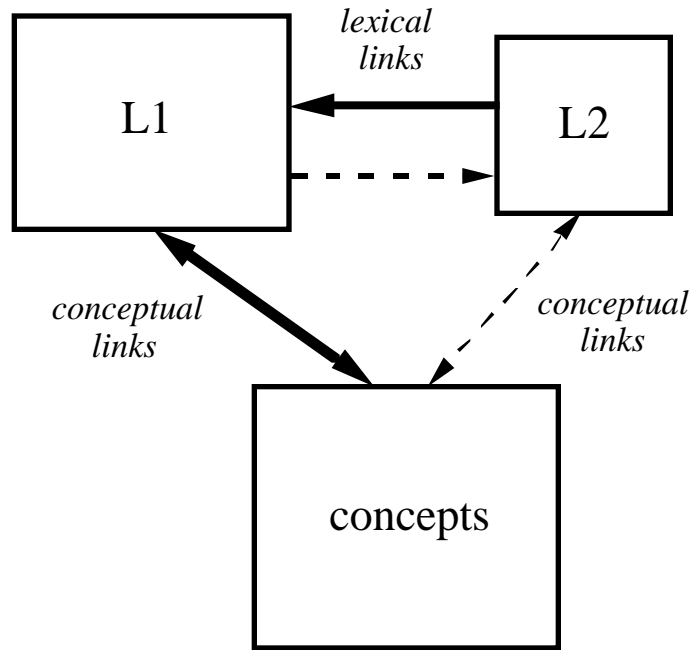


Figure 3.1. The Revised Hierarchical Model (adapted from Kroll & Stewart, 1994). Words in each language (L1 and L2) are interconnected via lexical-level links and conceptual links. The lexical-level links are stronger from L2 to L1 (solid line) than from L1 to L2 (dashed line) but the conceptual links are stronger for L1 (solid line) than for L2 (dashed line).

The revised hierarchical model, shown in Figure 3.1, includes both the lexical and conceptual interlanguage alternatives that were initially described by Potter et al. (1984). According to the model, the early dependence on L1 to mediate access to meaning for L2 words creates an asymmetry in the form of interlanguage connections. At the lexical level, connections from L2 to L1 are hypothesized to be stronger than connections from L1 to L2. This asymmetry may arise in part from the differential reliance of L2 on L1, and also as a consequence of the differential nature of the mappings from a small lexicon, L2, to a large lexicon, L1. Because the L2 learner will know many L1 words for which he or she does not have an L2 translation equivalent, the lexical mappings from L1 to L2 will be inconsistent and unreliable. At the conceptual level, the model assumes strong connections for L1 words, but relatively weaker connections for L2 words. Thus, an L1 word will be more likely to engage conceptual processing than its L2 translation equivalent. (We will return later to consider the issue of whether the concepts themselves that are activated by L1 and L2 are, in fact, one and the same.)

The initial evidence for the revised hierarchical model came from translation experiments which showed that translation from L1 to L2 was slower, less accurate, and more likely to be influenced by semantic variables than translation from L2 to L1 (De Groot, Dannenburg, & Van Hell, 1994; Kroll & Stewart, 1994; Sanchez-Casas, Davis, & Garcia-Albea, 1992; Sholl, Sankaranarayanan, & Kroll, 1995). Kroll and Stewart also demonstrated that only a portion of the observed translation asymmetry could be accounted for by differences in the speed of production for the two languages because the magnitude of the language effect for simple word naming was much smaller than the one observed in translation. These results suggest that only translation in the forward direction, from L1 to L2, necessarily engages conceptual processing.¹ Furthermore, cross-language priming experiments have shown that L1 words are more likely to prime L2 words than the reverse (e.g., Altarriba, 1990; Gollan, Forster, & Frost, 1997; Keatley, Spinks, & de Gelder, 1994; Tzelgov & Eben-Ezra, 1992). The asymmetry in priming is also consistent with the claim that L1 is more likely than L2 to initiate conceptual processing.

The translation asymmetry observed by Kroll and Stewart (1994) suggests that the lexical-level connections established during early stages of acquisition may still continue to function under some circumstances once individuals become fluent bilinguals. The participants in that study were highly fluent Dutch-English university students. Although they were clearly dominant in Dutch and tested in a Dutch environment, their experience required frequent use of English for many aspects of their work. Their performance on the translation tasks suggests that despite their high level of L2 proficiency, they showed the predicted asymmetry. Thus, in the out-of-context nature of the single word translation task, these lexical-level connections appear to have been active. In the presence of contextual support of the sort available in normal language use, this effect might be expected to disappear. Indeed, La Heij, Kerling, and Van der Velden (1996) using a similar group of Dutch-English bilinguals, reported no evidence for a difference across the two directions of translation when the word to be translated was preceded by picture context.

¹ Some recent studies have failed to replicate the translation asymmetry and/or a differential effect of semantic processing in the L1 to L2 direction (e.g., De Groot & Poot, 1997; La Heij, Kerling, and Van der Velden, 1996). We suggest some possible reasons for these different findings later in the discussion.

3 The Development of Proficiency

The revised hierarchical model permits a number of interesting predictions to be made about changes in performance with increasing fluency in L2. If lexical-level connections are in place during early L2 learning for the purpose of mediating access to meaning, then aspects of lexical form might be predicted to be salient for learners at this stage. Once individuals become more proficient, their performance should be more likely to be influenced by conceptual factors. The overall pattern of results described earlier in the Talamas et al. (1999) study is consistent with this general prediction; less fluent bilinguals appeared to depend more on lexical form than on meaning and the reverse was generally true for more fluent bilinguals.

To examine the implications of this prediction for the word naming and translation tasks that Kroll and Stewart (1994) had used, Kroll, Dufour, Michael, and Tokowicz (1998) compared the performance of two groups of native English speakers who were learning French as a second language, with the performance of a group of highly fluent English-French bilinguals. In word naming, participants are simply asked to read aloud the word presented in the language in which it appears. In word translation, participants are asked to speak the translation of the word presented in their other language. For word naming, the predictions are fairly straightforward: word naming performance should be similar for all groups in English, because all participants were native English speakers, but word naming in French, which includes the process of recognizing the L2 word and producing it, should be slower and less accurate for the less proficient participants and should become faster and more accurate with increasing proficiency.

For translation, the revised hierarchical model suggests that the translation route from L2 to L1 may very well be in place early in L2 acquisition if the same lexical-level connections that mediate initial learning can be accessed when performing translation in this direction. Thus, the model predicts that translation from L2 to L1 should be in place early in second language learning. In contrast, the model predicts that translation from L1 to L2 should engage conceptual processing, a task that should be relatively inaccessible to the learner during early stages of acquisition. Thus, if L1 to L2 translation requires conceptual access, and if only more proficient bilinguals are able to conceptually mediate L2, then performance on the L1 to L2 task should improve dramatically with increasing fluency, relative to performance in the L2 to L1 direction. However, performance on translation from L2 to L1 should improve to some extent with increasing fluency because more proficient bilinguals will know more L2 words than the beginning second language learners, but the change should be smaller than the one observed for L1 to L2 translation.

How do less fluent bilinguals translate in the L1 to L2 direction? Initially, the second language learner may not be able to lexicalize concepts directly into L2 at all. Thus, when presented with an L1 word, conceptual processing will be activated in much the same way it would be to perform a task exclusively in L1, but the resulting conceptual activity will not result in the corresponding activation of an L2 word. Instead, a parallel process at the lexical level will, at least some of the time, produce an associated L2 translation equivalent. If the time course of these two processes coincides, then direct conceptual processing for L2 will begin to emerge (Kroll, 1993).

The results of the Kroll, Dufour et al. (1998) study are shown in Figure 3.2. The first graph shows mean naming latencies for the three groups of participants when naming words in English (L1) and in French (L2). The second graph shows the mean

translation latencies for the same three groups for translation from English to French (L1 to L2) and from French to English (L2 to L1). The accuracy for each condition is given in parentheses.

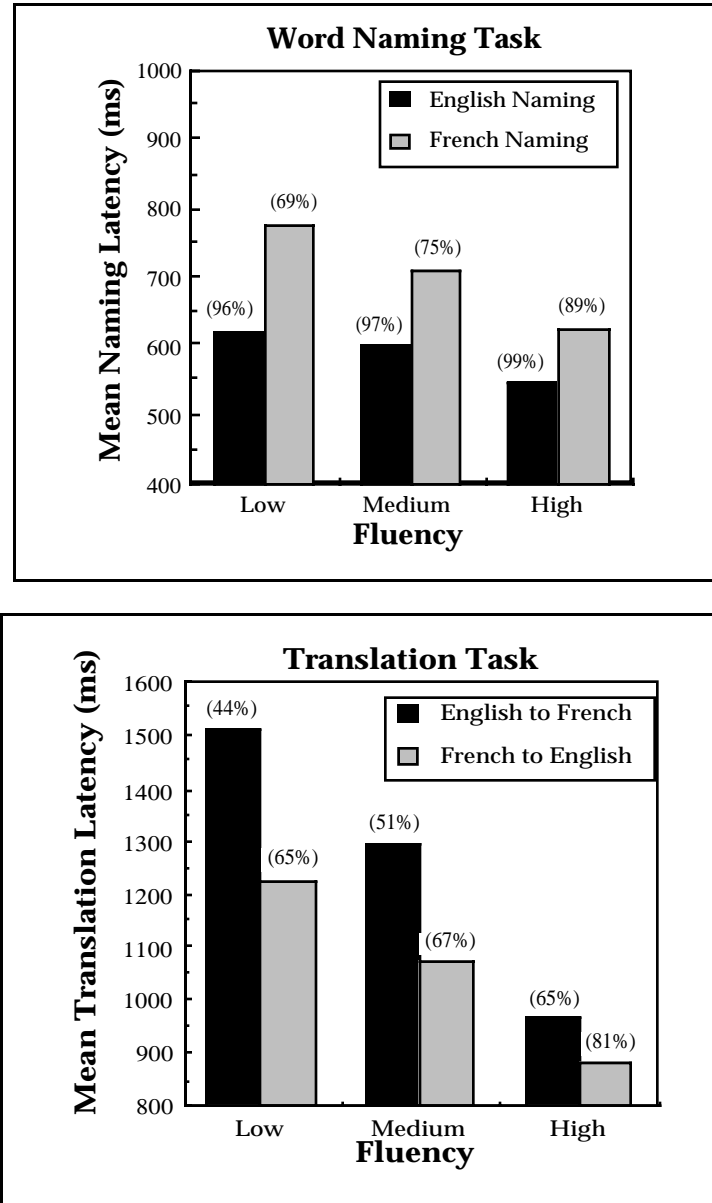


Figure 3.2. Mean latencies (in msec.) and percent accuracy to name words in both languages (top graph) and to translate words in both directions (bottom graph) for three groups of native English speakers differing in their level of fluency in French (from Kroll, Dufour et al., 1998).

The general pattern of results for the word naming task appears to support the predictions. The time to name words in L2 was longer than in L1, and the difference in the naming latency and accuracy for the two languages diminished as individuals became more proficient in L2. However, there was also a surprising result in these data: the time to name words in English, the L1 of all of these participants, was faster the more fluent the group was in L2. Because L1 was the native language for all of the groups, and because words in the two languages were presented in separate blocks of trials preceded by practice in that language, the result was unexpected. It is possible, of course, that these differences reflect self-selection factors such that only individuals with high verbal ability go on to become fluent bilinguals. However, it is also possible that the longer L1 naming latencies for the less fluent groups reflect a cost to L1 processing during early stages of L2 acquisition. If L2 learners must suppress L1 in order to speak L2 words, then even under conditions in which the two languages are presented in separate blocks, as they were in this study, it is possible that the larger bilingual context of the experiment produced a differential processing load for less fluent individuals (see Grosjean, 1997, 1998, and this volume for a related account of the effects of language mode).

The results for translation also support the general predictions of the revised hierarchical model. Overall, there was a translation asymmetry, with longer RTs and lower accuracy for L1 to L2 translation than for L2 to L1 translation. Furthermore, there was a gradual reduction in the magnitude of the translation asymmetry with increasing fluency, such that L1 to L2 changed more over time than L2 to L1. Moreover, a comparison of the development of word naming performance in L2 with production in L2 in the translation task, suggests that the ability to produce L2 words alone can only account for a small portion of the observed change in translation. Overall, the pattern of results supports the hypothesis that forward translation, in the L1 to L2 direction, involves component processes that are difficult for the second language learner to engage.

From the perspective of the revised hierarchical model, the results of the Kroll, Dufour et al. (1998) study appear to converge on the conclusion that individuals at early stages of second language learning have difficulty in conceptually mediating L2. However, concept mediation itself is not a simple process and it would seem important to determine whether the difficulty that second language learners experience is attributable to difficulty in accessing concepts for L2 words or in using activated conceptual information to direct lexicalization to L2.

4 Conceptual Access for L2

Dufour and Kroll (1995) examined the first alternative in a study in which more and less fluent bilinguals performed a semantic categorization task. A category prompt (e.g. fruit) was presented in either English or French, followed by a category exemplar (e.g. pear), in either English or French. The participant had to decide whether the exemplar belonged to the designated category. If less fluent individuals are unable to access conceptual information for L2 words, then categorization performance will necessarily have to rely on mediation via L1. That is, deciding whether an L2 word is a member of a superordinate semantic category will require that the translation equivalent in L1 be retrieved and used to access conceptual memory, resulting in longer response latencies to perform the task. Contrary to this hypothesis, Dufour and Kroll reported that less fluent bilinguals appeared to be capable of retrieving conceptual information directly for L2 words.

Although these results suggest some limits to the degree of access that less fluent individuals have to semantic information, they clearly rule out the translation alternative.

However, rejecting the translation hypothesis in a comprehension task, such as categorization, does not necessarily rule out lexical mediation in a production task, such as translation. Unfortunately, the participants in the Dufour and Kroll study were not also asked to translate words from one language to the other so it is impossible to tell, on the basis of the categorization results alone, whether the same less fluent bilinguals who appeared to be able to access concepts for L2 words, would have shown a pattern of translation performance that was also consistent with concept mediation.

Additional evidence for the claim that even less fluent bilinguals may be able to access some aspects of meaning for L2, comes from a post hoc analysis reported by Talamas et al. (1999). Talamas et al. found that less fluent bilinguals did not produce interference effects in translation recognition when nontranslation pairs were semantically related. This result stood in contrast to the findings for more fluent bilinguals who were slower to reject semantically related nontranslation pairs, and supports the claim that early in L2 acquisition, conceptual mediation is not possible and that individuals must rely on a lexical strategy for recognizing L2 words. However, when the data from semantically related pairs (e.g., *man-mujer* [woman]) were reanalyzed to examine the effects of semantic similarity, the results showed that the less fluent bilinguals were indeed sensitive to semantic relations, but only when the word pairs had been rated as highly semantically similar. Like the results of the Dufour and Kroll (1995) study, the more fluent bilinguals in the Talamas et al. study appeared to be sensitive to a wider range of semantic relations than the less fluent bilinguals.

Other recent studies provide converging evidence for this conclusion. Altarriba and Mathis (1997) reported semantic effects for native English speakers who were trained on a limited set of Spanish words. In that study, English monolinguals with no prior exposure to Spanish were trained on a set of Spanish-English translations and later tested on a either a translation recognition task [with orthographically related foils (Experiment 1a) and semantically related foils (Experiment 1b)] or a Stroop color-word task. The goal of this study was to measure the ability of early second language learners to conceptually mediate L2 as compared to a group of fluent bilinguals.

The results of the Altarriba and Mathis (1997) study suggest that even novice bilinguals are able to conceptually mediate L2 since a similar pattern of results was found for the novice and expert bilinguals. In translation recognition, both orthographic and semantic interference were found for related foils, and in the Stroop color-word task, participants in both groups showed Stroop effects within and between languages.

However, the results of this study do not address the question of whether novice bilinguals trained on a very limited number of translation pairs are at all comparable to beginning second language learners. This is especially true given that a very small number of items were used repeatedly throughout the experiment, and that priming may have affected the results since the test phase came soon after the acquisition phase of the experiment. Furthermore, even if one assumes comparability of the two groups, it is not clear that translation recognition taps the more difficult and perhaps more critical aspect of concept mediation, lexicalization from concepts to L2 words. Indeed, De Groot and Comijs (1995) reported that translation recognition of noncognates in the L1 to L2 direction was not as sensitive to the manipulation of semantic variables as translation production from L1 to L2.

Similarly, French-Mestre and Prince (1997) found that even individuals who are not completely fluent in L2 can function in L2 at a level that is sufficiently autonomous to enable semantic access. They investigated the level of second language autonomy of French-English bilinguals at two levels of proficiency. One group of L2 speakers was comprised of relatively proficient graduate students who were studying to become instructors of English. The other group included less proficient students who had studied English for five years and were training to be primary school teachers. French-Mestre and Prince also tested a group of native English speakers as a comparison group. In one experiment, they used an English primed lexical decision task with several types of lexical relations--antonyms (e.g., hot-cold), synonyms (e.g., small-little), and collocations (e.g., comb-hair). They found that highly proficient bilinguals showed priming similar to the native speakers, demonstrating that the proficient bilinguals were able to access conceptual information in the second language.

In a second experiment, French-Mestre and Prince (1997) tested a similar set of participants on a primed lexical decision task, to examine priming of the dominant and subordinate meanings of homographs (e.g. ruler). They again found that the highly proficient bilinguals performed like the English monolinguals, showing priming for both dominant and subordinate meanings of the homographs. In contrast, the group of intermediate bilinguals showed priming for the dominant but not the subordinate meanings of the homographs.

The results of the French-Mestre and Prince (1997) study suggest that even bilinguals who are not highly proficiency are able to use conceptual information to a certain degree within the second language and even under the rapid presentation conditions that were used in this study to encourage automatic processing. However, as noted by the authors, since the lexical decision task requires only comprehension but not production it is not clear that these same bilinguals would be able to lexicalize concepts into second language words. Less proficient bilinguals may be able to use L2 words to direct access to conceptual memory but the process of using activated concepts to access L2 words may require the additional ability to resolve cross-language competition from alternatives in L1 with similar meanings. Thus, these results may be limited to tasks which do not require lexicalization into the second language.

Taken together, the findings from bilingual performance on tasks which do not require production suggest that less fluent bilinguals are able to access semantic information, at least under some restricted circumstances. However, the corresponding results of studies in which production tasks have been used suggest that L2 production is slow and error prone at early stages of L2 proficiency. Most critically, these studies suggest that it is not pronunciation in L2 per se that is the cause of the problem in production, but rather the process of lexicalizing concepts into L2 words.

The most compelling evidence against the claim that the ability to conceptually mediate is unique to more proficient bilinguals was reported by De Groot and Poot (1997). In their study, the performance of three groups of bilinguals at different levels of proficiency (low, average and high) was compared on a translation production task. They manipulated the imageability/concreteness of the words to be translated and the direction of translation task. Words classified as high in imagery or concrete were considered to have accessible perceptual referents (e.g., girl, tiger), whereas words classified as low in imagery or abstract did not (e.g., peace, delay). The magnitude of the concreteness ef-

fect was used to measure the degree of concept mediation.² De Groot and Poot found that word imageability affected the performance of the three groups of bilinguals to a similar extent and therefore concluded that concept mediation is present even at very early stages of L2 acquisition. They further found that the two directions of translation were influenced by imageability to a similar extent, which is inconsistent with the predictions of the revised hierarchical model (Kroll & Stewart, 1994). We will return to consider the interpretation of cross-language concreteness effects in a later section.

5 Operationalizing Concept Mediation

The results of the De Groot and Poot (1997) study conflict with much of the evidence on production, which suggests that the ability to conceptually mediate the second language only develops with increasing L2 fluency. A possible explanation for this discrepancy is that in past research concept mediation has been operationalized in a number of different ways. These differences can lead to apparently conflicting results because alternative measures of concept mediation may reflect different processing components. In past studies, concept mediation has been operationalized to include performance differences on picture-naming and translation production tasks (e.g., Potter et al., 1984), cross-language semantic priming (e.g., Keatley, Spinks, & de Gelder, 1994), cross-language semantic categorization (e.g., Dufour & Kroll, 1995), category interference during translation production (e.g., Kroll & Stewart, 1994), transfer from picture naming to translation production (e.g., Sholl, Sankaranarayanan, & Kroll, 1995), semantic interference in translation recognition and in cross-language Stroop tasks (e.g., Altarriba & Mathis, 1997; La Heij et al., 1990), and concreteness effects in translation production and recognition (e.g., De Groot, 1992a).

De Groot and her colleagues (e.g., De Groot, 1992a; De Groot et al., 1994; Van Hell & De Groot, 1998) have used concreteness and/or word imageability as an indicator of concept mediation in many different studies and the general pattern of results is consistent with the one reported by De Groot and Poot (1997). Overall, bilingual performance on a variety of tasks is sensitive to word concreteness. To the extent that concreteness reflects semantic access, these results suggest that performance in the second language is conceptually mediated. For example, De Groot (1992a) showed that word imageability affected the performance of highly fluent Dutch-English bilinguals on normal translation production, cued translation production, in which the first letter of the word to be produced is presented as a cue, and translation recognition from L1 to L2, in which the participant must decide whether the second word is the correct translation of the first word. In all three tasks participants responded more quickly to concrete words than abstract words. In addition, De Groot et al. (1994) showed that both directions of translation were influenced by word imageability, although the L1 to L2 direction was affected to a greater extent than the L2 to L1 direction. Van Hell and De Groot (1998) further demonstrated that bilinguals were faster to generate word associations to concrete than abstract nouns, and that within and between-language associations to concrete words were more often translation equivalents than were associations to abstract words.

² Word imageability and concreteness are often confounded, and therefore are very highly correlated (e.g., Paivio, Yuille, & Madigan, 1968; Schwanenflugel et al., 1988, Experiment 2).

All of the above results have been explained in terms of a model of bilingual memory representation in which concepts are represented as distributed features (for reviews of this work see De Groot, 1995, Kroll & De Groot, 1997, and Van Hell, 1998). According to the distributed feature model (see Figure 3.3), concrete words are more likely than abstract words to share meaning across languages and cultures. Concrete words in different languages are proposed to access a shared set of semantic features because the perceptual objects to which they refer are typically similar. In contrast, abstract words in different languages are assumed to have only partial meaning overlap because differences in the linguistic and cultural contexts in which they are used will determine their meaning. Thus, when a bilingual translates an abstract word, only some of the semantic features activated for that language will overlap completely with the semantic features of the translation equivalent in the other language. The model assumes that high levels of featural overlap will be associated with rapid conceptual access and fast response latencies.

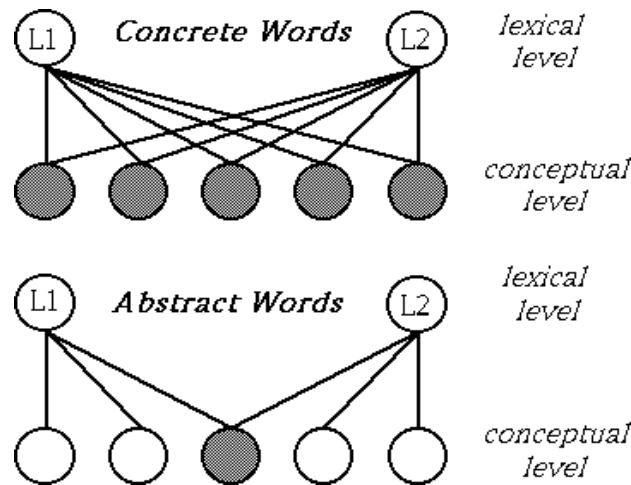


Figure 3.3. The distributed feature model of bilingual memory representation (adapted from De Groot, 1992b).

6 Word Concreteness as an Index of Conceptual Processing

The findings of bilingual studies examining concreteness or imageability effects parallel the results of studies focusing on the effects of concreteness within a single language. Concrete words have been shown to hold a processing advantage over abstract words in a number of language and memory tasks such as lexical decision, recognition, and recall (e.g. Schwanenflugel, Harnishfeger & Stowe, 1988). Originally, such concreteness effects were thought to reflect the difference in the availability of an imaginal code for the referents of the two types of words (e.g. Paivio, 1971, 1986). More recent research on the topic suggests that the two types of words differ in the ease with which they evoke a context in which they might appear (the context-availability hypothesis, e.g. Schwanenflugel & Shoben, 1983). According to this hypothesis, context is more readily available for concrete than for abstract words, and therefore concrete words are comprehended more easily and rapidly than abstract words. Research on this topic has shown that contextual information aids in the comprehension of abstract words more than

concrete words, thereby reducing or eliminating the concreteness effect (e.g. Schwanenflugel & Shoben, 1983). Similarly, context availability and not imageability has been shown to account for unique translation variance in the translation production task (de Groot, 1992a).

One consideration in comparing concreteness effects as a measure of concept mediation to other indices of conceptual processing, is that there is some evidence that suggests that concreteness effects may reflect lexical as well as semantic level processes. Sch nplflug (1997) reported that for German-English bilinguals, abstract words were more likely than concrete words to have multiple translation equivalents. This finding suggests lexical as well as conceptual mappings between the two languages may be dependent on the type of word being represented.

To assess the effects of the number of translation equivalents, the data from a recent translation production study were reanalyzed (Tokowicz, 1997). In a word translation task, relatively fluent English-Spanish bilinguals translated abstract and concrete words in both directions of translation. The results replicated the pattern reported previously by De Groot (1992a; De Groot et al., 1994); translation was faster for concrete than for abstract words, and the magnitude of the concreteness effect was larger for translation from L1 to L2 than for translation from L2 to L1. Using an off-line norming measure, the number of translations for each of the concrete and abstract words was then generated by an independent sample of participants drawn from the same relatively fluent group of bilinguals. Words were categorized as having only a single translation equivalent or more than one translation equivalent in either direction of translation. The norming measure revealed differences between abstract and concrete words in English and Spanish that were like those reported by Sch nplflug (1997) for German and English. On average, the abstract words were more likely than the concrete words to have more than a single translation equivalent.

When the translation data were reanalyzed to take the number of translations into account, Tokowicz (1997) found the usual advantage for concrete words only when words had multiple translation equivalents. The results are shown in Figure 3.4. The first graph shows translation from L1 to L2 and the second graph shows translation from L2 to L1. When the concrete and abstract words had only a single translation equivalent across languages, no difference was found in the time to translate the two types of words. These data show that there is indeed a concreteness effect in translation production. However, its form is qualified by the number of translations. The translation of concrete words appear to be uninfluenced by the number of translation equivalents, whereas the translation of abstract words is slower when additional translations are available.

7 Confounding the Contribution of Lexical and Conceptual Factors

An important implication of the observation that word concreteness and number of translation equivalents are confounded is that some portion of the concreteness effect observed in past research may be due to the lexical consequences of multiple translations rather than to the properties of conceptual processing. For example, suppose that an abstract word is to be translated from L2 to L1, and the L2 word form maps onto multiple translation equivalents in L1 (see Figure 3.5). This situation will lead to competition among the lexical entries that are candidates for production, and translation time will be slowed accordingly. Since abstract words are more likely than concrete words to have multiple translation equivalents across languages, the translation time of

abstract words will be slowed relative to concrete words, on average. Without additional research and/or a reanalysis of existing data, it is impossible to determine whether concreteness effects are localized at the lexical level, the semantic level, or both.

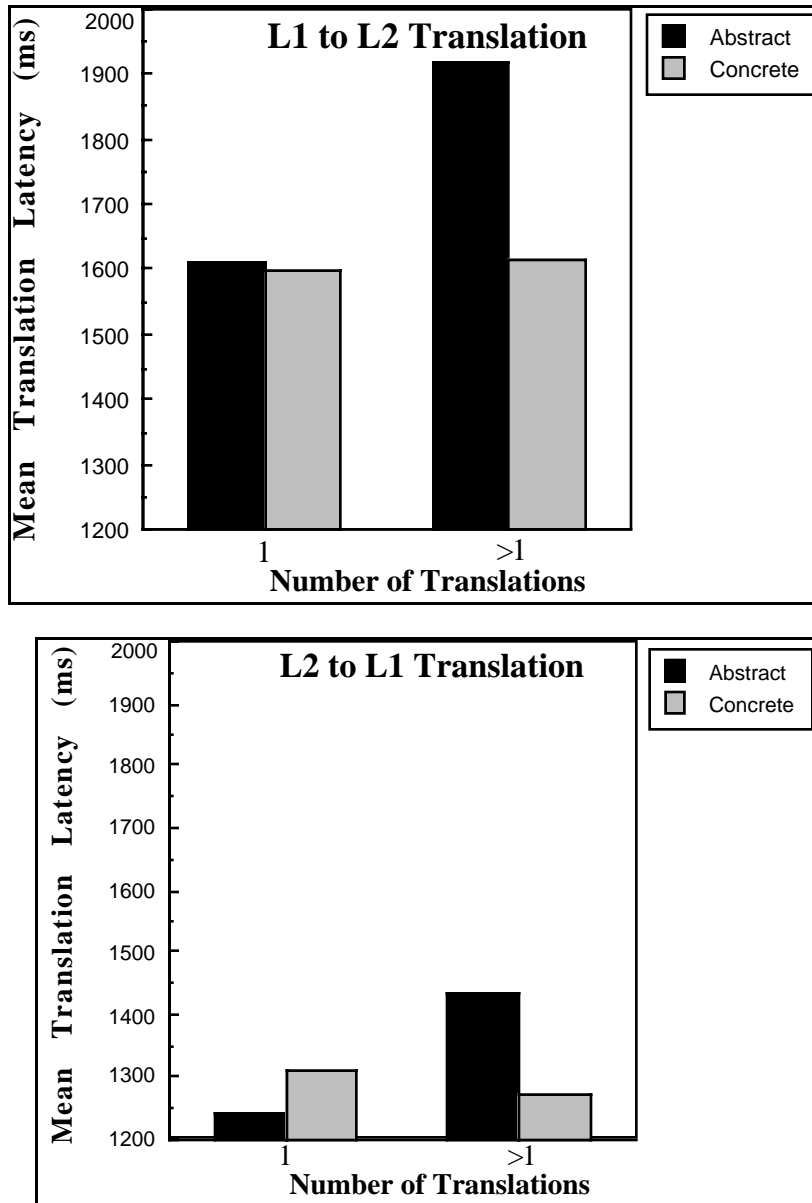


Figure 3.4. Mean latencies (in msec.) to translate words in the forward direction (top graph) and backward direction (bottom graph) as a function of word concreteness and number of translation equivalents (adapted from Tokowicz, 1997).

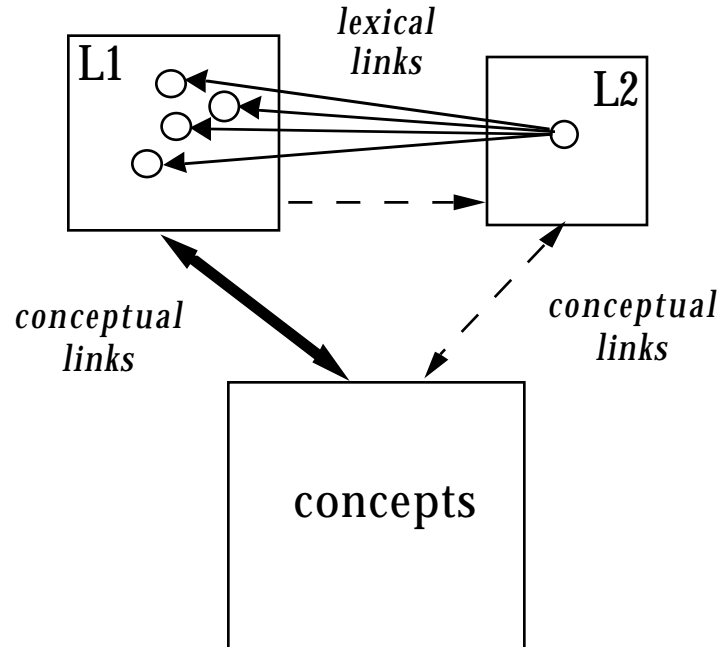


Figure 3,5. The Revised Hierarchical Model adapted to show the consequences of the availability of alternate translation equivalents at the lexical level.

A further implication in considering the potential effects of multiple translation equivalents is that cognates, words that share close word form and meaning across languages, are more likely to have a single translation equivalent than noncognates. In past research, there has been some debate about locus of cognate effects in cross-language processing (e.g., De Groot & Nas, 1991; De Groot, 1993; Gollan et al., 1997). The analysis we have presented suggests that genuine cognate effects can only be identified when cognates are compared to noncognates matched on the number of translation equivalents.

This analysis also has interesting implications for within-language research on the representation of word meaning since words with multiple meanings in one language are likely to have multiple translation equivalents across languages. Therefore, it is possible that the cross-language confounding of concreteness with number of translations is really a reflection of the relative difference in the ambiguity of concrete and abstract words. Words in both languages may access a shared conceptual system, but when a given target word is ambiguous, the properties of its meaning representation will give rise to interpretations that are more contextually dependent both within and across languages.

Some of the apparent discrepancies in past research on the question of the way in which the bilingual's ability to conceptually mediate L2 develops are likely to be due to the wide variety of ways in which concept mediation has been operationalized. If the presence of concept mediation is measured by a variable that has effects at multiple processing loci, or by a task that does not require lexicalization and selection, then results for second language learners and fluent bilinguals may be qualitatively similar. What does seem clear, is that differences among individuals at different stages of L2 pro-

iciency are more likely to emerge when second language words must be selected for production following conceptual activation.

How do second language learners eventually begin to conceptually process L2, even when lexical default strategies may be available? In the case of translation from L2 to L1, the activation of the translation equivalent in L1 may produce parallel activation of the concept. Because even translation in the L2 to L1 direction is a relatively slow cognitive process, taking on average more than a second, it is likely that indirect conceptual activation following retrieval of the L1 lexical entry will often be available. Over time, the patterns of conceptual activation will be correlated with L2 and the ability to conceptually mediate L2 directly will begin to develop. On this account, the conceptual information that is available initially for L2 will be the same as that available for L1. Only with increased opportunities to use the L2 word in different contexts will a distinct conceptual representation develop.

In the next section we consider the consequences of acquiring the ability to access shared conceptual information for L2. In particular, we consider the potential competition that is generated when concepts can be lexicalized as words in either of the bilingual's two languages.

8 Cross-language Competition

Why is lexicalization a particularly difficult skill for second language learners to master? One possibility is that when concepts are activated on the basis of a word, a picture, or an idea, there is a strong bias to activate the words in L1 that correspond to those concepts. To some extent, lexicalization represents a basic problem for the adult second language learner. An important feature of L2 vocabulary acquisition for adult learners is that new words must be linked to old concepts. If the skill of lexicalizing concepts to L1 words is highly practiced, as it surely is for adult L2 learners, then the problem of acquiring new L2 vocabulary is not simply a matter of adding new information to memory and linking it appropriately, but also a matter of negotiating the increased ambiguity and competition that the inclusion of the new L2 information represents. The problem is likely to be most acute for second language learners whose experience is limited to the classroom. Unlike the situation for learners who are immersed in the new L2, the classroom context will afford few opportunities to acquire either unique environmental cues for L2 or unique concepts or nuances of meaning that are distinctly associated with L2. If second language learners fail to learn how to resolve competition from L1 to L2, they may very well never become proficient in L2.

Dijkstra, Van Jaarsveld and Ten Brinke (1998) reported a set of lexical decision results for highly fluent Dutch-English bilinguals that may be viewed as a simulation of the situation for L2 learners. The critical materials in the Dijkstra et al. study were interlingual homographs, words that look alike but do not share the same meaning across languages (e.g. the word *room* means *cream* in Dutch). When fluent Dutch-English bilinguals were asked to make lexical decisions in English, their L2, the presence of interlingual homographs had no apparent effect on performance. However, when the activation of L1 was increased in a second experiment by including some real Dutch words among the nonword distractors, then the interlingual homographs produced interference relative to matched controls. Dijkstra et al. took this pattern of results as support for the Bilingual Interactive Activation (BIA) model, a model which assumes nonselective access to words in the bilingual's two languages. According to the BIA model, the presentation of a word in one language also activates related lexical forms in

the other language. Most relevant to the present point is that L2 learners at early stages of acquisition may in fact be in a state that resembles the conditions that the more fluent bilinguals were forced to deal with when L1 was explicitly present. If L1 is always highly active for the second language learner or less fluent bilingual, then it will produce a variety of processing consequences that will appear as facilitation, when activated information in L1 helps to retrieve the corresponding information in L2, or as interference, when the information in L1 does not resemble the desired output in L2.

Additional support for the notion that words in the bilingual's two lexicons are always active comes from recent studies that have examined cross-language influences in both comprehension and production tasks. For example, Van Heuven, Dijkstra, and Grainger (1998) reported cross-language neighborhood effects in lexical decision for Dutch-English bilinguals. The time to make a lexical decision in one language was affected by the presence of words in both languages that possessed similar orthography to the target word. If these effects of shared lexical form are present even for the highly fluent Dutch-English bilinguals tested in the Van Heuven et al. study, then we might expect them to be particularly strong from L1 to L2 for individuals at earlier stages of L2 acquisition.

In the production domain, a number of recent studies have also shown that both languages appear to influence performance, even under conditions in which the bilingual is expected to speak only in one language (see also Poulisse, 1997, for a recent review of research on bilingual production). Hermans, Bongaerts, De Bot, and Schreuder (1998) examined picture naming by fluent Dutch-English bilinguals in an interference task in which auditory distractors were presented at variable delays following the presentation of a picture to be named. Picture naming was always performed in L2 (English) and in different experiments the auditory distractors were presented in either L2 (English) or L1 (Dutch). The results showed that L1 appeared to be active when naming in L2, and in some circumstances, even under rather subtle conditions in which the phonology of the L2 word was somewhat similar to the L1 name of the pictured object. Although it may not seem surprising to show effects of L1 distractors on L2 performance, particularly for bilinguals who have clear dominance in L1, Costa, Miozzo, and Caramazza (in press) reported a pattern of cross-language interference similar to the one described by Hermans et al. (1998) when pictures were named in L1 and visual distractors were presented in L2.

Taken together, the experiments on cross-language activation suggest that both languages are always available to some degree. When concepts are activated, by virtue of seeing a pictured object, or generating an abstract thought, the process of lexicalization appears to activate alternatives in both of the bilingual's languages. The critical issue then is to identify the locus of cross language activation and the mechanisms at the bilingual's disposal that enable modulation of the activation of the nontarget language to achieve successful comprehension and production in the intended language.

9 Modulation and Control of Activation in the Two Languages

Two recent proposals have addressed the manner in which the activity of the two languages might be manifest in different task environments. One is an analysis by Grosjean (1997a, 1998a, and also see the chapter in this volume) of the language mode in which a bilingual is using one or both of his or her two languages. The other is a model

described by Green (1998) to accommodate the regulation that must be necessary for one language rather than the other to be selected under the appropriate circumstances (see also Green, 1986). We review each of these proposals briefly and then consider the implications they hold for understanding L2 acquisition.

Language Mode

Grosjean (1997a, 1998a) proposed that bilinguals adopt a different position along a continuum of language activity within each of his or her two languages as a function of a host of variables, including the local language environment, the demands of particular processing tasks, the level of the bilingual's proficiency in each language, and the knowledge that speakers possess about the bilingualism of the individuals with whom they expect to speak. Grosjean argues that the interpretation of much of the empirical literature on bilingual performance will require an understanding of the language mode induced by the particular experimental parameters in addition to the nature of the representations and/or processing which the bilingual appears to possess or follow. To illustrate, he claims that when an individual knows that he or she has been invited to participate in an experiment by virtue of his or her bilingualism, this knowledge alone, may encourage the participant to adopt a bilingual language mode, whether or not the experiment requires explicitly that both languages be used. It is a bit difficult at this point in time to determine how well the language mode concept will be able to provide an alternative interpretation of the major experimental findings.

From the perspective of the second language learner, however, the notion of language mode provides an interesting context in which to explore the changes that accompany increased L2 proficiency. We can ask what sort of developmental processes must occur to enable the learner to achieve at least some control over the relative influence of the factors that determine language mode. In particular, we might expect to observe processing costs when less fluent individuals attempt to assume a monolingual mode in L2 or bilingual language mode, if those states requires active inhibition of one language relative to the other, or selective attention to cues in the language environment. Furthermore, we can ask whether the nature of the cues that are associated with particular points on the language mode continuum change with increasing expertise in L2.

The Inhibitory Control Model

Grosjean's (1997a, 1998a) analysis of language mode suggests that both of the bilingual's languages are active to some degree. Likewise, the empirical results on word recognition and language production support the notion that the activity of each language is not determined by task demands alone; both languages appear to be active even when the task requires attention to one language alone. Green (1998) recently proposed a framework for characterizing the problem that the bilingual faces when selectively attending to only one of his or her two languages. How does a bilingual prevent him or herself from blurting out utterances in the wrong language? The focus of the inhibitory control model is not on the nature of lexical and/or semantic representations per se, but rather on the regulatory processes that permit a bilingual to perform a given task in one language rather than the other.

Evidence for the role of an inhibitory control mechanism comes from experiments on language switching (e.g. Meuter & Allport, 1999; Von Studnitz & Green, 1997). When bilinguals are required to switch from one language to the other in production tasks, greater costs, in the form of increased response latencies, are observed when

switching into the more dominant L1 than into the weaker L2 (Meuter & Allport, 1999). Because L1 is likely to be active during the processing of L2, it will be necessary to inhibit L1 to achieve L2 performance goals. If the subsequent trial requires that L1 itself be processed, there will then be costs that correspond to the degree of inhibition required on the prior trial. In contrast, when L2 follows L1, the relative inhibitory costs will be smaller because L2, as a consequence of its relatively lower level of activity, will not have to be inhibited to the same degree, or at all, during L1 processing.

Green (1998) proposed a related explanation for the translation asymmetry described by Kroll and Stewart (1994). He argued that the asymmetry results as a consequence of differential inhibitory processes that are required to perform the two translation tasks. Forward translation, from L1 to L2, is hypothesized to require significant suppression of L1 because the more active L1 lemmas will compete for output with L2. Backward translation, from L2 to L1, will not require comparable suppression of L2 because L2 is hypothesized to be less active, and therefore will not generate as much competition for output.

Like Grosjean's (1997a, 1998a) claims about language mode, Green's (1998) proposal for inhibitory control assigns at least some responsibility to mechanisms other than the mental representations themselves in explaining why performance differs from one bilingual task to the next. By this account, what should develop with increasing fluency is not simply enriched mental representations of L2, but also the skill to allocate memory and attentional resources appropriately to best achieve the desired language goals.

10 The Implications of Control for Acquisition

How do second language learners solve these control problems to become fluent bilinguals? The results of experiments which focus on the performance of highly fluent bilinguals suggest that fluency alone does not decrease the degree of cross-language activation. Indeed, increased knowledge of L2 may result in an increase in the level of cross-language competition. Rather, high levels of fluency may be associated with skillful negotiation and resolution of competition. The activation associated with multiple mappings from words to concepts may be resolved if L1 can be inhibited.

What is unclear is how to characterize the cues that the L2 learner may use to accomplish inhibition of L1. Particularly when L2 is learned in a classroom context, the cues associated with L1 in the larger environment may be difficult to ignore. In immersion settings, the environment itself may provide cues that are uniquely associated with L2 and thereby reduce the relative advantage of L1. These cues may be overt and perceptual, for example, in the manner in which objects and events are culturally specified. But they may also be more subtle and conceptual, in the sense that nuances of meaning differ in different cultural contexts. For the classroom learner, despite the best efforts of language instructors, these cues may not be sufficiently salient to facilitate the acquisition of control. The L2 classroom learner is thus faced with the task of increasing the mappings of words to meaning, a goal which in some sense runs counter to the entire grain of the language processing system in that new words are simply attached to old concepts. In this case, the ability of the learner to generate internal strategies for processing the new L2 may be especially critical.

In recent work in our laboratory, we have taken two approaches to begin to examine the way in which learners acquire the ability to control the processing of L2. In one set of studies, we attempted to simulate the process of early vocabulary acquisition by varying

the salience of the available cues. In another set of studies, we focused on individual cognitive differences that may constrain the resources that individuals are able to allocate to solve this problem.

11 Cues to Second Language Vocabulary

In a recent study (Kroll, Michael, & Sankaranarayanan, 1998) we taught American college students a small set of Dutch words, either by learning to associate the Dutch words with their respective English translations or to pictures of the objects to which they referred. In one experiment, we attempted to make the meaning of the new words salient, by presenting them in semantically categorized lists (e.g., all of the fruits, furniture, animals, etc.). Compared to a condition in which the materials were presented randomly, there was little evidence for a benefit by virtue of having a semantic category cue.

In a second experiment, we again taught American students a limited set of Dutch words by having them associate the new words to their English translations or to pictures of the objects to which they referred. However, in this experiment, the pictures were presented as one would normally view them on only half of the trials; on the remaining trials the pictures were presented in a noncanonical orientation (see Figure 3.6). We hypothesized that the unusual orientation might have the effect of slowing down the retrieval of the first language name associated with the picture and therefore facilitate learning of the new Dutch word. And that was the result we obtained. When participants were asked at test to attempt to translate English words into Dutch in the absence of pictorial cues, they were faster if the word had been learned by association to a noncanonically oriented object. This finding suggests that even surface-level cues in the environment may function to uniquely cue the second language and permit access to the dominant language to be inhibited briefly.

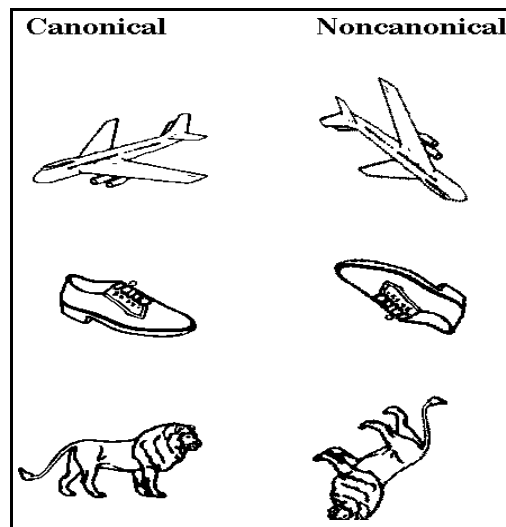


Figure 3.6. Canonical and noncanonical views of objects used in a vocabulary acquisition task (adapted from Kroll, Michael, & Sankaranarayanan, 1998).

12 Individual Differences and Control

Two types of individual differences in cognitive processing described in the monolingual literature seem potentially related to the hypothesis that the modulation of the first language during second language processing might be related to the attainment of proficiency. One is evidence on suppression (e.g., Gernsbacher & Faust, 1991), showing that good and poor comprehenders appear to differ in their ability to suppress irrelevant information. The other is research on memory span (e.g., Engle, Cantor, & Carullo, 1992; Just & Carpenter, 1992) which suggests that memory storage and/or computational capacity constraints influence language processing. In a preliminary study we showed that differences in the span of working memory were related to performance on bilingual tasks such as translation (Dufour, Kroll, & Sholl, submitted). However, the magnitude of this influence was far greater for individuals restricted to classroom acquisition of the second language than to individuals who had experienced language immersion. These results suggest that in the absence of unique cues associated with L2, the learner is left to his or her own resources to engage the second language and to suppress the first language when appropriate. Individuals with high capacity may be able to develop strategies to, in effect, immerse themselves in the absence of external cues. However, in the presence of external cues, these individual differences in cognitive resources may be less critical because the environment may serve to effectively cue the appropriate language mode.

In a subsequent study (Kroll, Michael, Elsinger, Tokowicz, & Miller, 1997) we examined the role of individual differences in bilingual performance to assess the contribution of internal cognitive processes during the very earliest stages of L2 vocabulary acquisition. We compared the performance of a group of nonfluent second language learners with a group of skilled bilinguals. The nonfluent participants were native English speaking students in a summer intensive language program at Penn State in which they were learning either Spanish or French. The fluent participants were native English speaking graduate student assistants in the Spanish and French departments.

All of the participants completed a battery of tasks, including measures of memory span in L1 and measures of bilingual performance in word naming and translation. The L2 materials were drawn from the texts used in the classes in which the nonfluent participants were enrolled to increase the likelihood that they would be able to recognize and translate the words presented in each task. If the critical problem for the second language learner is to accomplish sufficient activation of L2 to permit concept mediation, then we expected that tasks which include conceptual processing as a mandatory component would be particularly difficult for the nonfluent group and most likely to reflect differences in processing capacity measured by the memory span task. The memory span task, adapted from a version used by Waters and Caplan (1996), required participants to judge whether sentences were plausible or not and, at the same time, to remember the final word of each sentence until they were cued to recall.

There were four important results for present purposes. First, for the L2 learners, translation performance was related to memory span, but only for forward translation, the L1 to L2 direction, hypothesized to be conceptually mediated by the revised hierarchical model, and the direction of translation hypothesized by Green's (1998) inhibitory control model to require greater suppression of lemmas in the target language. Second, those L2 learners with higher memory span were actually slower to translate from L1 to L2 than

learners with lower memory span. These data are shown in Figure 3.7. This counterintuitive pattern replicated the results reported in the study described above (Dufour et al., submitted). However, an analysis of the slower translation performance by the higher span learners revealed that it was attributable entirely to performance on cognates. Across all conditions there was a benefit for translating cognates relative to noncognates, replicating previous translation studies (e.g., De Groot et al., 1994; Kroll & Stewart, 1994). However, the cognate effect was consistently larger for the lower span group. For both directions of translation, the lower span group derived more benefit from word form cues than the higher span group. These results provide support for the hypothesis that second language learners with higher memory span may allocate their mental resources to generate strategies that increase conceptual processing, even when it produces a cost to processing when translation could be accomplished on a more superficial basis.

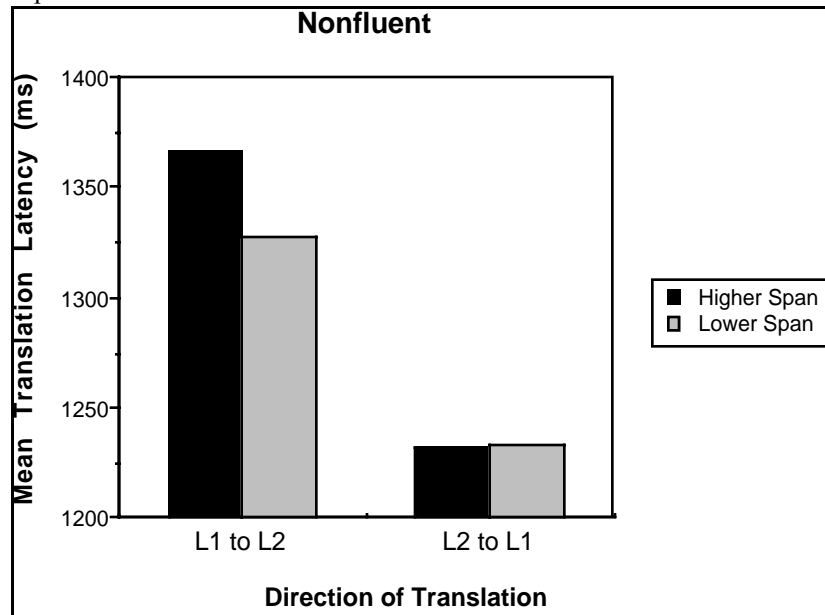


Figure 3.7. Mean translation latencies (in msec.) for nonfluent participants as a function of memory span and direction of translation (Kroll, Dufour, Michael, & Tokowicz, 1998).

A third result of interest was that the fluent bilinguals had higher memory span than the second language learners, even when age differences between the groups were taken into account. The result is surprising because the memory span task was performed in English, the native language of all participants in this study. When we broke down the two fluency groups by span, the nonfluent group was divided almost equally among low and high span individuals, whereas a higher proportion of the fluent group had high span. It is unclear from this result alone whether this difference reflects self selection (i.e., that only those who are most able go on to become bilingual), or whether it is a cognitive consequence of bilingualism.

Finally, in this study, as in a number of other studies we have conducted, performance on the simple word naming task in L1 was found to be slower for nonfluent participants than for fluent bilinguals although both groups were native English speakers.

This result, shown in Figure 3.8, is similar to the pattern obtained by Kroll et al. (1998) and shown in Figure 2; performance on the L1 word naming task was related to proficiency level in L2.

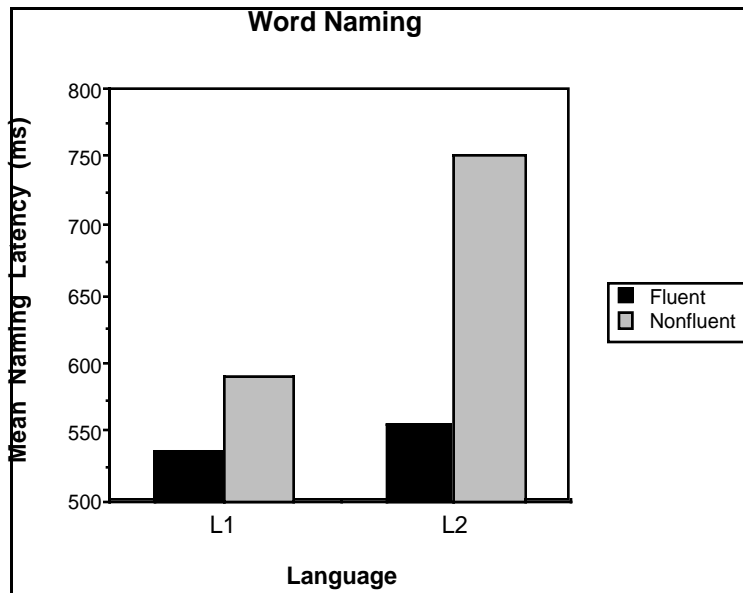


Figure 3.8. Mean word naming latencies (in msec.) as a function of fluency and language (Kroll, Dufour, Michael, & Tokowicz, 1998).

The data in Figure 3.8 show, as expected, that the fluent bilinguals were much faster to name words in L2 than the nonfluent participants. However, it is not immediately clear whether the differences observed for L1 are again a reflection of a self-selection bias such that only individuals with high verbal ability go on to become fluent bilinguals, or whether the longer L1 naming latencies for the nonfluent group reflect a cost to L1 processing during early stages of L2 acquisition. If L2 learners must suppress L1 in order to speak L2 words, then even under conditions in which the two languages are presented in separate blocks, as they were in this study, it is possible that the larger bilingual context of the experiment produces a differential processing load for less fluent individuals (see Grosjean, 1997a, 1998a, and this volume, for a related account of the effects of language mode).

To examine these alternative explanations, the data for word naming in L1 were analyzed by memory span. If the cost to L1 naming is due to the presence of individuals among the nonfluent group who have poor verbal ability and therefore are unlikely to develop L2 proficiency, then we expected that we might observe a difference among the nonfluent participants as a function of memory span. That is, nonfluent participants with low span might be expected to show a larger cost in L1 processing than their counterparts with high span. Although there was a span effect for the fluent participants, there was no corresponding span effect for the nonfluent participants. If anything, the L1 cost was greater for the higher span individuals across the two groups (see Figure 3.9). These results provide preliminary evidence to suggest that during early stages of L2 acquisition, there are costs to processing L1, at least when the task environment also requires the use

of L2. For the less fluent individuals, the naming task becomes functionally mixed, because the activity of L2 may intrude into L1 performance, whereas for fluent bilinguals, there may be greater autonomy associated with each language.

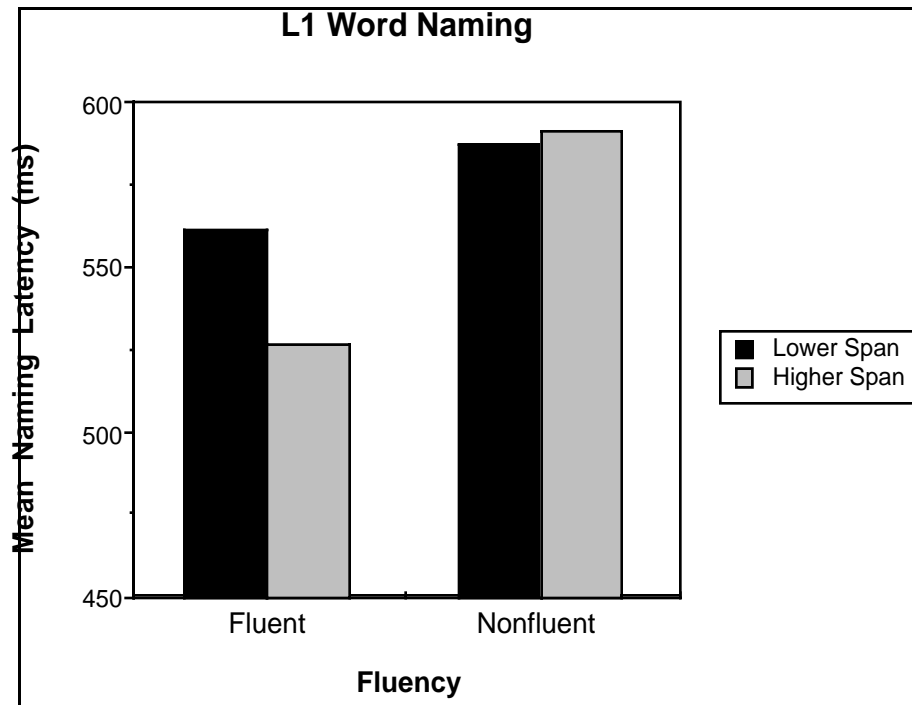


Figure 3.9. Mean word naming latencies for L1 (in milliseconds) as a function of fluency and memory span (Kroll, Dufour, Michael, & Tokowicz, 1998).

13 Conclusion

In this chapter we reviewed evidence which suggests that during early stages of L2 acquisition, learners have limited access to concepts for second language words. With increasing proficiency in L2, conceptual processing appears to become increasingly direct. The focus in past research on this topic has been on the nature of conceptual representations for L2 words and the form of the representational architecture that will support access for words in more than one language. More recent research suggests that the achievement of proficiency in a second language requires not only adequate representation of L2, but also the acquisition of control processes that allow the relative activation of the two languages to be modulated. In future work it will be critical that these two approaches come together to develop theories of the interplay between the representation of the two languages and the mechanisms that provide the basis for their control.

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