First Language Activation during Second Language Lexical Processing in a Sentential Context

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Lexicalization-patterns, the way words are mapped onto concepts, differ from one language to another. This study investigated the influence of first language (L1) lexicalization patterns on the processing of second language (L2) words in sentential contexts by both less proficient and more proficient Persian learners of English. The focus was on cases where two different senses of a polysemous word in Persian are realized by two independent words in English. For example, Persian uses 'ماه' to refer to both 'moon' and 'month' in English. In the present study, the researchers examined the processing of English translations (moon, month) of polysemous Persian words such as 'ماه' in a semantic anomaly judgment task. The participants who were two groups of more proficient and less proficient Persian learners of English were presented with two types of anomalous sentences: anomalous test sentences in which one of the two English words (e.g., month) was used in a context where the other word (e.g., moon) was appropriate (e.g., "A pleasant thing to watch at night is a full month") and anomalous control sentences in which the same word was used in a context where neither of the two words was appropriate (e.g., "A pleasant thing to eat at night is a full month"). The participants were asked to judge, as quickly and accurately as possible, whether the final word could complete the sentence meaningfully (YES response) or whether the final word was semantically unacceptable (NO response). The participants' reaction time (RT) for correct No responses and their error

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rates were recorded using DMDX, a psycholinguistics experimentation software package. Using two General Linear Model Repeated Measures, a main effect of sentence type was obtained in the analysis of both RT and errors. Also, there was an interaction between sentence type and proficiency level in the analysis of both RT and errors. The results are discussed in terms of the activation of the semantic specifications of L1 translation equivalent of L2 words.
Keywords: Bilingual Lexicon, Lexicalization Pattern, Lexical Processing, Polysemy, Translation Equivalent

Almost all readers of these lines will be those whose native language is not English, for instance, Persian, Turkish, or Kurdish. When they read these lines, does only their English lexicon play a role in the comprehension of the words of which the sentences consist, or does their native language lexicon also become activated? A person who is not a language researcher may reason that when bilinguals speak, they select the language they want to use, so they must be able to do the same when they read; therefore, reading must surely be a language-selective process. However, the available empirical evidence and theoretical viewpoints show that this process is completely different from what the above-mentioned intuition as to the separation of the two lexicons tells us.

It has always been assumed that, in a second language (L2) learning situation, learners rely extensively on their native language. Lado (1957), in his early and influential book *Linguistics across Cultures*, stated that "individuals tend to transfer the forms and meanings, and the distribution of forms and meanings of their native language to the foreign language" (p. 2). The language not in use has been shown to influence bilingual performance at all levels, including grammar (Dussias, 2003), phonology (Sundara, Polka, & Baum, 2006), and lexicon (Jared & Kroll, 2001). Cross-linguistic activation has been documented extensively at the level of the lexicon (Dijkstra, 2005). When bilinguals read or listen to words in their second language, the information about words in their first language (L1) is also active (Dijkstra & Van Heuven,

2002; Marian & Spivey, 2003). The evidence that demonstrates parallel activation of words in both languages suggests that acquiring proficiency in an L2 does not imply that the individual has acquired the ability to switch off the influence of the L1 and function autonomously in the L2.

One of the important questions for researchers studying bilingual lexical processing is the nature of language representation. The structure and representation of more than one language in memory has been a topic of investigation for quite some time. Early research (Potter, So, Von Eckardt, & Feldman, 1985) on the development of the bilingual lexicon proposed two bilingual memory structures. The *word association model* (Figure 1), proposes a bilingual memory architecture in which the bilingual's two languages interact at the lexical level, based on translation equivalents, and the bilingual's L2 is subordinated to the L1; Access to the conceptual
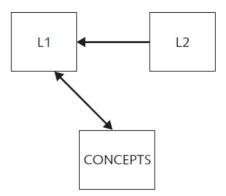

Figure 1. Word association model (adapted from Kroll & Stewart, 1994)

System via the L2 is not possible, unless the L2 word is translated into L1. Alternatively, the *concept mediation model* (Figure 2) assumes that the bilingual's two languages operate independently of each other, and that both lexicons are connected directly to the conceptual memory which is common to both languages.
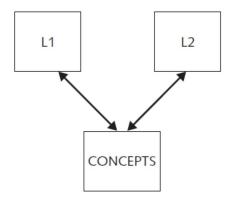
Figure 2. Concept mediation model (adapted from Kroll & Stewart, 1994)

Potter et al. (1985) initially argued for the concept mediation model, even for learners at relatively early stages of acquisition because their study of translation and picture naming revealed a similar pattern of performance for learners and fluent bilinguals. However, subsequent research findings (Kroll & Curley, 1988; Chen & Leung, 1989) suggested a developmental transition from word association to concept mediation. As fluency in L2 increases, there is a corresponding increase in the degree to which meaning can be accessed directly for L2 words, and individuals begin to perform in accordance with the predictions of the concept mediation model (Talamas, Kroll, & Dufour, 1999). To account for the possibility that bilingual memory may be a function of L2 proficiency and translation direction, Kroll and Stewart (1994) incorporated both the word association and concept mediation models into the revised hierarchical model (RHM) (Figure 3).
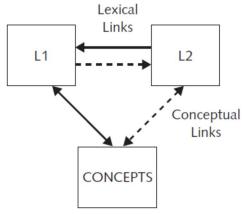
Figure 3. Revised hierarchical model (adapted from Kroll & Stewart)

According to the RHM, the bilingual lexicons are bi-directionally interconnected. The lexical link (represented by a solid line) from the L2 lexicon to the L1 lexicon is stronger than the L1 to the L2, to reflect the way the L2 was learned. Accordingly, during L2 acquisition, bilinguals learn to associate every L2 word with its L1 equivalent, thus forming a lexical-level association that remains active and strong. Moreover, the connection from the L1 to L2 language lexicon (depicted by a broken line) is assumed to be weaker because of a lack of translation practice (Kroll & Stewart, 1994). At the conceptual level, the conceptual link from the L1 (depicted by a solid line) is stronger than the link from the L2 (represented by a broken line). This difference in strength reflects the fact that L1 is the native language, and bilinguals are more familiar with word meanings in their L1 (Kroll & Sholl, 1992). Although it is theoretically possible that the link from L2 to the conceptual store may develop strong connections, Kroll and Stewart (1994) argue that this link remains weaker, even for bilinguals with high L2 proficiency levels. As far as an L2 word and its L1 translation equivalent share the same set of semantic features, L2 learners' reliance on L1 words to retrieve the meaning of L2 words would not lead to erroneous processing in the second language. However, not all L2 lexical items share the same semantic specifications with their L1 translation equivalents.

Lexicalization patterns (i.e., the way words are mapped onto concepts) differ across languages. Cross-linguistic differences in lexicalization patterns point to language-specificity in the mapping between words and concepts. An interesting case is where a polysemous word in the L1 is realized by independent words in the L2. For example, Persian uses the word 'ماه' to refer to both 'moon' and 'month' in English, whereas English uses different lexical items to distinguish these concepts. Of course, speakers of Persian appreciate the conceptual distinction between 'moon' and 'month'; it is just that they can use the same word 'ماه' to refer to both concepts. Words like 'ماه' are referred to as polysemous words because, unlike homonyms, native speakers rate their various senses as highly or moderately related (Elston-Güttler, 2000).

Given the language-specificity of lexicalization patterns, the question arises as to whether differing patterns in the bilingual's languages are kept distinct or interfere with each other in processing. Arguments can be made for either hypothesis. In favor of interference, one could appeal to the revised hierarchical model of Kroll and Stewart (1994). According to this model, second language words are produced and understood predominantly via lexical-level translation connections to first language words. Other studies (Chen & Leung, 1989; Kroll & Tokowicz, 2001) confirmed that direct connections from L2 words to conceptual representations strengthen only gradually as proficiency increases. This would mean that when a Persian learner of English reads the word 'moon', a lexical-level link would activate the Persian translation equivalent 'ماه'. If 'ماه' in turn activates its L1 meaning, then inappropriate conceptual features associated with the concept of 'month' would become activated. This would make it hard for the learner to distinguish between the L1 and the L2 lexicalization patterns, leading to interference in L2 semantic processing tasks. But one could equally make arguments in favor of L1 and L2 independence. It has been argued that even at low levels of proficiency, L2 learners have acquired direct connections between L2 forms and concepts. For example, there is considerable evidence for conceptual access from L2 words (Altarriba & Mathis, 1997; Frenck-Mestre & Prince, 1997).

Few studies have examined the effects of differing lexicalization patterns on L2 semantic processing. Also, most of the studies conducted in the field of bilingual lexical processing have used isolated, out-of-context lexical items as the stimuli for their experiments. Another problem with previous studies is that relatively few have taken a developmental approach to this issue to ask how the nature of activated lexical information of the language not in use changes with increasing proficiency in L2. The researchers' aim in this study was to see whether the findings of this study provide evidence in support of the idea that L2 learners, especially at early stages of learning, rely on L1 translation of L2 words to access the corresponding concept, and that even for advanced learners the L1 translation of L2 words remains activated when performing tasks in the L2. The present study was an attempt to answer the following research questions:

- RQ 1: Are semantic specifications of L1 translation equivalent of L2 words activated when learners are processing L2 words in a totally L2 task?
- RQ 2: Does proficiency level play a role in the activation of semantic specifications of L1 translation equivalents of L2 words?

Method

Participants

Forty Persian learners of English at Iran Language Institute in Boukan participated in the experiment and were compensated monetarily. All the participants had normal or corrected-to-normal visual acuity and had no known reading disorders. As a preliminary step, 80 learners were categorized into two proficiency groups based on their experience in English. The less proficient group (n= 42) composed of beginning and intermediate language learners with three to six semesters of language instruction in the institute, whereas the more proficient group (n= 38) included intermediate and advanced language learners with seven or more semesters of language instruction in the institute. Admittedly, determining proficiency based on classroom experience alone is

not sufficient because the nature and quality of the instruction can vary widely. Therefore, we obtained further information from the 80 learners to better assess their proficiency. Because the focus of the present study was on L2 learners' word processing abilities, the researcher decided not to use a general language proficiency test. Instead, a vocabulary test was thought to be more appropriate for the purpose of the study. To select the final 40 participants (20 participants in each group) and assign them to the two participant groups based on their vocabulary knowledge, version 1 of the Vocabulary Levels Test (VLT) developed by Nation (1983, 1990) was administered to the 80 learners. Finally, the 20 best learners from each group were selected for the experiment based on their scores on the VLT and with the following criteria:

- the less proficient group: learners with a minimum score of 20 in the 2nd 1000 word level and 10 in the 3rd 1000 word level, and a total score of less than 40;
- the more proficient group: learners with a minimum score of 30 in the 2nd 1000 word level and 20 in the 3rd 1000 word level, and a total score of more than 70.

Instruments

To select the final 40 participants (20 participants in each group) and assign them to the two participant groups based on their vocabulary knowledge, version 1 of the Vocabulary Levels Test developed by Nation (1983, 1990) was administered to the 80 learners. The Vocabulary Levels Test (VLT) is based on a frequency list of the word families of English ranked from the most frequent word to the least frequent words. This list is then divided up into levels of 1000 words. Five levels are chosen for testing – the 2nd 1000 word level, the 3rd 1000 word level, the 5th 1000 word level, the academic word level, and the 10th 1000 word level. A representative sample of 30 words is taken from each of the five levels for the test. Therefore, the total score of the VLT is 150. The VLT is designed to give an estimate of vocabulary size for second language learners. The results from the VLT can be used in research studies where an estimate of lexical size at the relevant frequency level is considered informative (Cobb, 1997;

Schmitt & Meara, 1997; Laufer & Paribakht, 1998). There are two versions of the VLT. Schmitt, Schmitt, and Clapham (2001) checked the two versions of the test for reliability and validity and concluded that the VLT provides accurate estimates of the vocabulary size of learners at the targeted frequency level.

Materials

An initial list of 25 polysemous Persian nouns which had two different English translations for their two different meanings was generated by the researcher. In other words, the generated list consisted of 25 English semantically related noun pairs which had the same Persian translation equivalent, e.g., 'hour' and 'clock' are both translated into 'ساعت' in Persian. As explained earlier, a word is considered to be polysemous if native speakers of the given language judge different meanings of the given word to be semantically related. To control for relatedness over the selected Persian polysemous words, a norming questionnaire, measuring the semantic relatedness of the different meanings of these words, was administered to 30 native Persian speakers who were undergraduate students of mechanical engineering (mean age of 22) at Amir Kabir University of Technology and had little knowledge of English and answered the questionnaire voluntarily. The questionnaire was in Persian and was used to make sure that the words chosen for the study. For each selected Persian polysemous noun, two sentences were constructed for each of its two different meanings. For each item, the informants read two Persian sentences containing the polysemous Persian noun as in "جلسه دو ساعت طول کشید" ("The meeting lasted two hours") and روی" "دیوار اتاق خوابم، یک ساعت قشنگ دارم" ("On the wall of my bedroom, I have a beautiful clock"). After reading the sentences, the informants had to judge on a scale of 1 to 5 how related the meanings of the underlined words in the respective sentences were: 1= the same meaning; 2= very similar; 3= fairly similar; 4= rather different; 5= very different.

The mean relatedness judgment score and standard deviation for each polysemous noun was calculated. The best items were chosen with the following criteria:

- simple (not compound) nouns;
- meanings clearly within semantic relatedness score range of 1 to 2.5;
- SDs (informant variation) as low as possible;
- word items with unambiguous English translations (as indicated by the *Aryanpur Progressive Persian-English Dictionary*); and
- word items whose two English translations cannot be used interchangeably.

Applying the above criteria yielded the final 10 best items for the experiment. For each of the 10 items chosen, we constructed sentences for the actual experiment. First, the researchers constructed two anomalous test sentences (20 in total) for each noun. Sentences were constructed carefully by using an English analogue version of the Persian sentences used in the norming questionnaire, but with the two English translation equivalents of the polysemous Persian word as sentence-final words. The sentence-final words were then switched across sentences, yielding the two anomalous sentences (e.g., "The meeting lasted two clocks" and "On the wall of my bedroomو I have a beautiful hour"), each used on different presentation lists (see Appendix 2 for the list of test sentences).

The rationale for this word switching was to create a context in which the other translation was acceptable in order to test the ability to distinguish between the two English words that are non-specific in Persian. In a pen-and-paper pre-test, two Australian native speakers of English who were friends of the researchers were asked to judge the sentences as ending with a semantically incongruent word. If any respondent indicated that an anomalous word ending the sentence was semantically acceptable, the sentence was modified.

Next, 20 control sentences were constructed by mirroring the syntax of the test sentences and having the same sentence-final words as the test sentences, e.g., "My professor published two clocks" and "In the magazine, I read an interesting hour" (see Appendix 3 for the list of control sentences). Anomalous control

sentences were designed to be semantically unacceptable and, crucially, unlike the anomalous test sentences, the Persian translation of the sentence-final word had to be unacceptable in the context. As in above, the control sentences were given to the two native speakers of English in a pen-and-paper task. If any respondent indicated that an anomalous word ending the sentence was semantically acceptable, the sentence was modified.

Last, 30 non-anomalous filler sentences were constructed, e.g., "The children were playing with a ball". The filler sentences were needed in order for the test items to elicit both YES and NO responses. If the test items included only anomalous items requiring a NO response, the participants could notice it and just press the NO button. When both anomalous and non-anomalous items were included and randomized, the participants actually had to recognize the sentence-final words and retrieve their semantic contents before they could make judgments.

Procedure

The experiment was conducted under computer control. The test program was written and administered with DMDX, a psycholinguistic experimentation software package developed by Kenneth Forster and Jonathan Forster at the University of Arizona. All the participants were tested individually seated at a laptop computer placed at a comfortable reading distance. The participants had normal or corrected-to-normal visual acuity. The program was configured such that the 'right shift' key on the keyboard made the YES response, and the 'left shift' key made the NO response. The directions, with examples, were given both orally and in written form on the screen in both Persian and English prior to the start of the experiment. The researchers chose Persian polysemous nouns whose two different meanings were realized by two independent words in English. For example, the two different meanings of the word 'ماه' in Persian are translated into 'moon' and 'month' in English. The participants were presented with two types of anomalous sentences: anomalous test sentences in which one of the two English words, e.g., month, was used in a context where the other word, e.g., moon, was

appropriate (e.g., "A pleasant thing to watch at night is a full month") and anomalous control sentences in which the same word was used in a context where neither of the two words was appropriate (e.g., "A pleasant thing to eat at night is a full month"). The participants were asked to judge, as quickly and accurately as possible, whether the final word could complete the sentence meaningfully (YES response) or whether the final word was semantically unacceptable (NO response). Using DMDX, a psycholinguistics experimentation software package, the participants' reaction time (RT) for correct NO responses and their error rates were recorded.

The critical difference between the two types of sentences was that the L1 translation of the final word would make the test sentences acceptable. If an L2 word's semantic content does not come from its L1 translation equivalent, then the learners' performance on the two conditions should not differ significantly. However, if semantic specifications of L1 translation equivalents of L2 words are activated, as the semantic transfer hypothesis suggests, compared to the control sentences, the learners should show slower reaction times or increased error rates on the test sentences because of the appropriateness of the L1 translation equivalent words in that context. For each trial, a sentence (all but the last word) was presented centered on the screen. The participants read the sentence, and then pressed YES when ready. At that point, the sentence disappeared from the screen, and the sentence-final word appeared centered on the screen after 250 milliseconds (ms).

Once the sentence-final word appeared, the participant responded YES if the word made sense as a completion of the sentence and NO if it did not. The word disappeared when the participant made a response or automatically after 5000 ms. The inter-trial-interval was 3000 ms., and the participants were required to make their responses as quickly and accurately as possible. The participants' reaction time and error rates were recorded by the program. The reaction time was the duration between the appearance of the sentence-final word on the screen and the pressing of a response key by the participant. After the

session, each participant completed a checklist of all the words used in the experiment and had to indicate whether the words used in the experiment and their meanings were familiar.

Data analysis

Only correct NO responses on critical trials were included in the RT analyses. Following Sunderman and Kroll (2006), unsuitable data outside the cutoff of 4000 ms and those that were 2.5 standard deviations above or below each participant's mean (reaction time) RT for each of the overall conditions were discarded from the analyses and treated as outliers. Over all conditions, this accounted for 5.5% of data for the less proficient learners and 3.5% of data for the more proficient learners. Data trimming was done in this way because it is typically thought that extremely fast scores reflect anticipatory processes whereas extremely slow scores are due to lapses in attention or other processing strategies and therefore, do not reflect the processes of interest (Ratcliff, 1993). The level of significance adopted for this study was .05 and version 17.0 of SPPS software was used for all statistical analyses. The participants' error rates and their RT were recorded. Two General Linear Model Repeated Measure procedures were performed on correct NO RT and error data, one treating the participants as a random factor (F1), the other treating items as a random factor (F2). They are referred to as participant analysis and item analysis, respectively. In the analyses, sentence type was treated as a within-participants and between-items factor, and proficiency was treated as a between-participants and within-items factor.

Design

This study had a 2×2 mixed design with two independent variables, each having two levels. These independent variables were the between-participant factor of Proficiency Level (less proficient vs. more proficient learners) and the within-participant factor of Sentence Type (anomalous test sentences in which Persian translation of the sentence-final English word was

acceptable vs. anomalous control sentences in which Persian translation of the sentence-final English word was not acceptable). The dependent variables were reaction time in millisecond measures and the percent of error rates on the semantic anomaly judgment task.

Results

Results of the analysis of reaction times for correct NO responses

      Two General Linear Model Repeated Measure procedures were first performed on the participants' reaction times (RTs) for the analysis of the main effects of proficiency (more proficient vs. less proficient learners) and sentence type (test vs. control sentences), one treating participants as a random factor (F1), the other treating items as a random factor (F2) (see Table 3 for subject analysis results). The average reaction time from the two groups of participants in each condition and the difference between them (starred if significant) is presented in Table 1.

Table 1
Participants' Reaction Time in Milliseconds on the Test and Control Sentences in the Semantic Anomaly Judgment Task

	Test sentences	Control sentences	Difference
More proficient	1380	1160	220 **
Less proficient	1691	1258	433 **
Total	1535.5	1209	326.5 **

Note: Difference is starred if the main effect of sentence type (difference between test sentences and control sentences) for reaction times is significant in a one-way ANOVA by subjects performed for that condition, * p<.05, ** p<.01.

The descriptive statistics for the participants' reaction times are shown in Table 2. There was a main effect of proficiency in reaction time. It took more proficient and less proficient learners an average of 1270 ms and 1475 ms, respectively, to respond to the experiment items. The 205 ms difference was significant by both subject analysis (F1) and item analysis (F2), $F1$ (1, 38) = 210.70, p = .000; $F2$ (1, 38) = 288.08, p = .000.

Table 2
Descriptive Statistics for Participant Reaction Times

	Proficiency	Mean	Std. Deviation	N
Test	Less proficient	1691.50	44.61	20
	More proficient	1379.95	81.07	20
	Total	1535.72	170.46	40
Control	Less proficient	1257.75	31.20	20
	More proficient	1160.00	50.58	20
	Total	1208.87	64.58	40

There was also a main effect of sentence type in reaction time. The control sentences (1209 ms) were responded to 327 ms faster than test sentences (1536 ms), and the difference was significant by both subject analysis (F1) and item analysis (F2), $F1$ (1, 38) = 1030.92, p = .000; $F2$ (1, 38) = 572.48, p = .000 (see Table 3).

Table 3

General Linear Model Repeated Measures Results for Participant Reaction Times

Tests of Within-Subjects Contrasts

Source	condition	Type III Sum of Squares	df	Mean Square	F	Sig.
Condition	Linear	2136618.45	1	2136618.45	1030.92	.000
Condition * Proficiency	Linear	228552.20	1	228552.20	110.27	.000
Error(condition)	Linear	78756.35	38	2072.53		

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1.50E8	1	1.50E8	37897.17	.00
Proficiency	837632.45	1	837632.45	210.70	.00
Error	151065.35	38	3975.40		

Results of the analysis of errors

Two General Linear Model Repeated Measure procedures were first performed on the participants' error rates for the analysis of the main effects of proficiency (more proficient vs. less proficient learners) and sentence type (test vs. control sentences), one treating the participants as a random factor (F1), the other treating items as a random factor (F2) (see Table 6 for the subject analysis results). The average error rates in percentages from the two groups of the participants in each condition and the difference between them (starred if significant) are presented in Table 4.

Table 4

Participants' Error Rates in Percentages on the Test and Control Sentences in the Semantic Anomaly Judgment Task

	Test sentences	Control sentences	Difference
More proficient	16 %	6.5 %	9.5 % **
Less proficient	29 %	11 %	18 % **
Total	22.5	8.75	13.75 % **

Note: Difference is starred if the main effect of sentence type (difference between test sentences and control sentences) for error rates is significant in a one-way ANOVA by subjects performed for that condition, * $p<.05$, ** $p<.01$.

The descriptive statistics for the participants' error rates are shown in Table 5. There was a main effect of proficiency in error rate. There was a difference of 8.75 % in error rates between the more proficient (11.25 %) and the less proficient (20 %) learners, and this difference was significant by both subject analysis (F1) and item analysis (F2), *F1* (1, 38) = 26.60, *p* = .000; *F2* (1, 38) = 67.85, *p* = .000.

Also, there was a main effect of sentence type in error rate. The participants responded to the test sentences with a mean error rate of 22.5 % which was 13.75 % less accurate than the error rate for the control sentences (8.75 %). This difference was significant by both subject analysis (F1) and item analysis (F2), *F1* (1, 38) = 84.15, *p* = .000; *F2* (1, 38) = 44.38, *p* = .000 (see Table 5).

Table 5

Descriptive Statistics for Participant Error Rates

	Proficiency	Mean	Std. Deviation	N
Test	Less proficient	.290	.085	20
	More proficient	.160	.075	20
	Total	.225	.103	40
Control	Less proficient	.110	.064	20
	More proficient	.065	.058	20
	Total	.087	.064	40

Like the data for reaction time, there was also an interaction between proficiency and sentence type in error rate which was significant by both subject analysis (F1) and item analysis (F2), F1 (1, 38) = 8.04, p = .007; F2 (1, 38) = 16.00, p = .000 (see Table 6).

Table 6

General Linear Model Repeated Measures Results for Participant Error Rates
Tests of Within-Subjects Contrasts

Source	condition	Type III Sum of Squares	df	Mean Square	F	Sig.
Condition	Linear	2136618.45	1	2136618.45	1030.92	.000
Condition * Proficiency	Linear	228552.20	1	228552.20	110.27	.000
Error(condition)	Linear	78756.35	38	2072.53		

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1.50E8	1	1.50E8	37897.17	.00
Proficiency	837632.45	1	837632.45	210.70	.00
Error	151065.35	38	3975.40		

The results of the General Linear Model Repeated Measures procedures performed on the participants' RT and error rates showed that there was a main effect of sentence type in the analysis of both RT and error rates. The participants' correct NO responses to the test sentences were on average 327 ms slower than their responses to the control sentences, and the test sentences were responded to with an average of 13.75 % more errors than the control sentences. The differences were significant by both subject analysis and item analysis.

Discussion

These results of this study suggest that while an L2 learner is processing an L2 word in a totally L2 context, the semantic specifications of its L1 translation equivalent are activated which causes slower responses or increased error rates on the part of the learner. The results of the one-way ANOVAs performed separately for the two groups added more support to these results. Both more proficient and less proficient learners were slower and less

accurate on the test sentences than the control sentences, and the RT and error rate differences between the two conditions were significant by both subject analysis and item analysis.

The researchers were also interested to see if there was a significant difference between more and less proficient learners in terms of the activation of the semantic specifications of L1 translation equivalent of L2 words. This issue was posed in the second research question. The results of the General Linear Model Repeated Measures procedures performed on the participants' RTs and error rates showed that there was interaction between proficiency and sentence type in the analysis of both RTs and error rates (see Table 3 for RTs and Table 6 for error rates). This interaction between the two independent variables was significant by both subject analysis and item analysis and indicates that the two groups of learners produced different patterns of results. In other words, the 433 ms difference in RTs and 18 % difference in error rates between the test and control sentences produced by the less proficient learners were significantly greater than the 220 ms difference in RTs and 9.5 % difference in error rates produced by the more proficient learners. These results suggest that as proficiency increases, the activation of L1 translation equivalent for L2 words is decreased, and that more proficient learners gradually become able to directly access the meaning of L2 words without reliance on lexical information of their L1 translation equivalents.

The results of this study confirm L1 influence on L2 lexical processing in instances where lexicalization patterns differ between L1 and L2. The L1 influence is indicated by the significant main effect of sentence type in the analysis of the participants' both RTs and error rates. The participants responded to the test sentences slower and less accurately (a mean RT of 1536 and a mean error rate of 22.5 %) than the control sentences (a mean RT of 1209 ms and a mean error rate of 8.75 %). The significant difference (327 ms in RTs and 13.75 % in error rates) between the participants' performance on the two conditions would be hard to explain if one does not assume such influence from L1. The difference cannot be explained by arguing that the

two types of sentences were responded to differently because they had different syntax or length. As mentioned earlier, they were quite comparable in these two respects. An important question which has to be answered here is "how does the L1 lexicon affect L2 lexical processing in a way that an L2 lexical item is processed slower and less accurately in the test sentence than in the control sentence?"

Jiang (2000) has argued that even advanced L2 learners might simply utilize copies of L1 lexical-semantic information in order to map L2 words onto their corresponding meanings. On this view, an L2 learner judges the test sentences (e.g., "The meeting lasted two clocks") slower and less accurately than the control sentences (e.g., "My professor published three clocks") because the activation of semantic specifications of the L1 translation of the sentence-final word causes the learners to judge the test sentences to be semantically acceptable.

The immediate problem with this approach, however, is to explain how it is that our participants were able to produce correct NO response 77.5 % of the time, if only more slowly than in the control condition. This shows that most of the time they were able to derive a meaning interpretation of, say, clock that was sufficient to reject as a completion of "The meeting lasted two …" Jiang (2002) argues that learners can use explicitly available declarative knowledge to distinguish the uses of L2 words that share common L1 translations, while at the level of implicitly represented word meanings they could still be utilizing the semantic specifications inherited from L1. On this view, the interference (i.e., the slower RTs and increased error rates) experienced by learners is a result of explicit knowledge overriding the incorrect YES response delivered by implicit knowledge. Therefore, all test sentences are first judged by the learners to be semantically acceptable based on the activation of semantic specifications of the L1 translation of the sentence-final words but most of them are later judged to be semantically unacceptable based on the learners' explicit knowledge. If that explicit knowledge about the uses of L2 words that share common L1 translation is not available to learner, he judges the test sentence to be semantically acceptable. When

available, the use of explicit knowledge to reject the test sentences makes the reaction time to be slower than the control sentences. Jiang (2002) further points out that:

> Lexical information can be represented within or outside lexical entries. What is represented within the lexical entry can be retrieved automatically in spontaneous communication. It is also stable and affects lexical processing in a consistent way. What is represented outside a lexical entry (i.e., explicit lexical knowledge) may be stored in a general memory system and can also be retrieved in communication. However, its contribution to lexical production is not automatic or consistent. Instead, applying such knowledge is often an effortful process that requires attentional resources. (p. 633)

Given the nature of the decision task in this study, the researchers cannot rule out the possibility that performance was contaminated by explicit knowledge. There is no way of knowing exactly how 'on line' a task has to be in order to prevent learners from using their explicit knowledge, and this makes Jiang's proposal difficult to falsify. However, we should note that the overall difference in reaction time between the test sentences and the control sentences was only 327 ms. A greater reaction time increase might have been expected if learners were using explicitly retrieved declarative knowledge to override implicitly generated YES responses. This issue becomes more prominent if we consider the data for the more proficient learners separately and exclude the data for the less proficient learners. The difference in reaction time and error rate between the two types of sentences for the more proficient learners was 220 ms and 9.5 %, respectively.

Conclusion

It seems that the more proficient learners utilize correct L2 form-meaning mappings in order to derive a correct NO response most of the time, but the L1 concept also becomes somewhat active due to lexical-level translation links, leading to increases in

reaction time and error rates. The co-activation of L1 concepts via lexical-level translation connections could reflect the residual effects of an earlier stage of lexical development at which the learner was more reliant on lexical-level translation connections (Kroll & Stewart, 1994). The significant difference between the more and the less proficient learners' RTs and error rates in the two conditions can be explained by arguing that as proficiency increases the co-activation of L1 concepts via lexical-level translation connections decreases and direct L2 form-meaning mappings become stronger.

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Appendices

Appendix 1: The Ten Polysemous Persian Words and Their Two Different English Translations

The polysemous Persian word	The two different English translations
ساعت	Hour & Clock
ماه	Moon & Month
صدا	Sound & Voice
فصل	Season & Chapter
زبان	Tongue & Language
اسم	Name & Noun
رنگ	Color & Paint
زمین	Earth & Ground
هدف	Purpose & Target
سطح	Level & Surface

Appendix 2: Anomalous Test Sentences

1. On the wall of my bedroom, I have a beautiful **hour**.
2. The meeting lasted two **clocks**.
3. He stayed in Paris for three **moons**.
4. A good thing to watch at night is a full **month**.
5. The singer has a nice **sound**.
6. The two cars clashed and made a loud **voice**.
7. The book has five **seasons**.
8. Summer is my favorite **chapter**.
9. People of the neighbor country speak a different **tongue**.
10. When he was eating the food, he bit his **language**.
11. 'Money' is an example of uncountable **names**.
12. She introduced herself and asked my **noun**.
13. He used a pencil to mix the **colors**.
14. Yellow is my favorite **paint**.
15. To reach water, they had to dig 50 meters below the **earth**.
16. The moon goes around the **ground**.
17. The airplane bombarded some **purposes**.
18. She had the operation for cosmetic **targets**.

19. This metal has a very smooth **level**.
20. This language institute has students of different **surfaces**.

Appendix 3: Anomalous Control Sentences
1. In the book, I read an interesting **hour**.
2. My teacher wrote two **clocks**.
3. The number of dead people reached fifty **moons**.
4. A good thing to eat at night is a full **month**.
5. The singer drives an expensive **sound**.
6. The old man smiled and borrowed my **voice**.
7. Our body has different **seasons**.
8. Pizza is my favorite **season**.
9. People of the neighbor house are moving to another **tongue**.
10. When he was walking in the park, he met his **language**.
11. Potato grows in cold **names**.
12. He closed the book and put it on the **noun**.
13. He used a ladder to climb the **color**.
14. Australia is my favorite **paint**.
15. To prepare the breakfast, they needed two liters of **earth**.
16. The bird drinks **ground**.
17. The child put on his warm **purposes**.
18.She cleaned the house with the electric **target**.
19. This factory produces baby **level**.
20.My father has a very kind **surface**.

فعال شدن زبان اول هنگام پردازش واژگان در زبان دوم در یک بافت جمله ای

بهرام بهین

آسو بایزیدی

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الگوهای واژه گزینی (شیوه ی ایجاد پیوند بین کلمات و مفاهیم) از زبانی به زبان دیگر متفاوت است. مطالعه ی حاضر تاثیر الگوهای واژه گزینی زبان اول بر پردازش کلمات در زبان دوم را در یک زمینه ی جمله ای مورد بررسی قرار میدهد. تمرکز این تحقیق بر روی مواردی میباشد که در آن دو معنای متفاوت یک کلمه ی چند معنا در فارسی به دو کلمه متفاوت در انگلیسی ترجمه می شوند. مثلا، در زبان فارسی کلمه ی "ماه" بر هر دو مفهوم ماه (آسمان) و ماه (سال) در زبان انگلیسی دلالت میکند. در این مطالعه، پردازش ترجمه های انگلیسی لغات فارسی چند معنا مانند "ماه" در یک آزمون قضاوت نابهنجاری معنایی مورد بررسی قرار میگیرد. شرکت کنندگان در این تحقیق به دو نوع جمله واکنش نشان دادند: جملات نابهنجار آزمایشی که در آن یکی از آن دو کلمه انگلیسی در زمینه ای بکار برده شده است که جای کلمه ی مناسب دیگر را گرفته است، و جملات نابهنجار گواه که در آن همان کلمه در زمینه ای بکار برده شده است که هیچکدام از آن دو کلمه مناسب نبودند. از شرکت کنندگان خواسته شد که با حداکثر سرعت و دقت تصمیم بگیرند که آیا کلمه ی آخر میتواند جمله را بطور معنادار تکمیل کند (جواب **بلی**) و یا اینکه کلمه ی آخر از نظر معنایی غیر قابل قبول است (جواب **خیر**). زمان واکنش شرکت کنندگان برای جوابهای **خیر** صحیح و میزان خطای آنها در مورد جوابهای **بلی** ثبت گردید. هم در تحلیل داده های مربوط به زمان واکنش و هم در تحلیل داده های مربوط به میزان خطا، تاثیر نوع جمله و همچنین تاثیر متقابل بین نوع جمله و سطح بسندگی زبانی شرکت کنندگان مشاهده گردید. نتایج بدست آمده با توجه به فعال سازی ویژگیهای معنایی معادل ترجمه ای زبان اول کلمات زبان دوم مورد بحث

قرار گرفته اند. یافته های این مطالعه رهنمودهایی برای روشهای یادگیری و آموزش لغات در زبان دوم بدست میدهند.

کلیدواژه ها: واژگان دوزبانه، الگوی واژه گزینی، پردازش واژگان، چندمعنایی، معادل ترجمه ای