The L1 Semantic Retrieval of L2 Words: Evidence from Advanced L2 Learners' Reaction Times

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Received: February 4, 2022 Accepted: March 7, 2022 Online Published: March 14, 2022

doi:10.5430/wjel.v12n1p334 URL: https://doi.org/10.5430/wjel.v12n1p334

Abstract

According to the first language (L1) lemma mediation hypothesis, second language learners, regardless of their level of second language (L2) proficiency, access the meaning of L2 words via their first language (Jiang, 2004). To test this hypothesis, a semantic judgment task was conducted on 30 advanced Arab speakers of English, in which they were presented with 86 pairs of English words and had to decide whether each pair was semantically related. Some semantically related pairs are classified as same translation pairs because their members share the same L1 translation, whereas others are semantically related but do not share the same L1 translation, hence they are classified as different translation pairs. Two instruments were used to record the reaction times and determine accuracy: DMDX and Gorilla. The results revealed that the highly proficient L2 speakers rated same translation pairs as semantically related significantly faster than their responses to different translation pairs. When compared with the 28 native speakers' results, there was a significant difference in the reaction times of the two groups. This provides evidence that the underlying processes of L1 and L2 vocabulary acquisition is substantially different: L2 learners rely on their well-established conceptual system to access the meaning of L2 words.

Keywords: lemma, mental lexicon, word mapping, vocabulary acquisition, conceptual system

1. Introduction

In the investigation of the processes underlying the acquisition of second language (L2) vocabulary, a controversial issue that is concerned with the L2 learners' retrieval of the meaning or concept of an L2 word arises: Do L2 learners retrieve their first language (L1) or the L2 meaning or concept of an L2 word? Three arguments were debated in the literature: (a) L2 learners map L2 words to L2 meanings or concepts in the same way L1 speakers do (Bogaards, 2001). (b) Beginning L2 learners map L2 words to L1 meanings or concepts, but with increased L2 expertise, they start remapping L2 words to L2 meanings or concepts (Guasch et al., 2008); (c) L2 learners map L2 words to L1 meanings or concepts, regardless of their expertise in L2 (Jiang, 2002, 2004). To investigate that controversial question, which has a significant implication for L2 vocabulary teaching and learning, as will be explained later, understanding the internal structure of words is extremely relevant. According to Levelt (1989, 1993), any lexical form stored in the mental lexicon has a lexical entry that is associated with two types of information, each consisting of two types of knowledge: lemma information, which is divided into the syntactic and semantic properties of the lexical item, and lexeme information, which is divided into morphological and phonological properties. These two types of information are essential for using a word properly. Because the main question of this research is concerned with the semantics of L2 words, the focus will be on the lemma subpart of the lexical entry, namely the semantic information of the lexical item.

L1 acquirers have a well-established semantic and lexical system because of the contextualized input to which they were exposed since they were young children. They learned words along with their meanings and concepts. In their monolingual lexicon, each stored lexical item is associated with its meaning or concept in the lemma subpart of its lexical entry. As a result, the access to those meanings or concepts is direct and straightforward. Automaticity is thus a feature of L1 vocabulary acquisition in the sense that native speakers recognise the meaning and concept of an L1 word immediately and use them properly and spontaneously (Jiang, 2004). However, in the literature of bilingual mental lexicon, debates about the nature of the semantic information associated with L2 words are longstanding. Jiang (2002, 2004) proposed a hypothesis of language processing which, as he argues, encapsulates the mechanism

underlying L2 vocabulary acquisition. He argues that L2 vocabulary acquisition has a different story from L1 vocabulary acquisition. Association and mediation are characteristics of L2 vocabulary acquisition; association is the feature of the early stages of L2 learning, whereas mediation is the feature of a more advanced stage. At an early stage of L2 learning, the learners come across many L2 words with meanings that are unknown to them because the semantic information slot in the lexical entries of these words are simply empty and need to be filled. Because they already have an L1 and their L1 conceptual and lexical system is very well established, they find it simpler and more straightforward to rely on their established system for associating the new L2 words with their L1 meanings or concepts via the strategy of L1 translation. The repeated association between an L2 word and the meaning of its L1 equivalent will result in a restructuring of its lexical entry: the L1 meaning in the lexical entry of the L1 equivalent word will be transferred into the empty space specified for the semantic information in the lexical entry of the L2 word. To put it simply, the L2 word has a lexical entry into which the L1 semantic information is copied. This linguistic phenomenon is referred to as L1 semantic transfer. At this stage, it can be said that the L2 word is 'mediated' by L1, hence the term L1 lemma mediation hypothesis (L1 LMH).

An online lexical judgment task was conducted by Jiang (2002) on highly proficient Chinese speakers of English. The researcher created lists of English word pairs that are semantically related that were divided into two lists: one list of pairs whose item members share the same Chinese translation and another list whose item members have different Chinese translations. These two lists were randomly mixed with a third list of semantically unrelated pairs. The participants were then required to judge each item that would appear on a computer screen as 'related' or 'unrelated' quickly and accurately, and their reaction times were recorded. The reaction times of the Chinese bilinguals significantly differed from those of the native speakers. The bilinguals rated same translation pairs as 'semantically related' significantly faster than different translation pairs. A similar online judgment experiment was also conducted on 15 Korean bilinguals who had to judge semantically related word pairs that either share or do not share the same Korean translation (Jiang, 2004). The experiment yielded the same results: same translation and different translation pairs were responded to with a significant difference. The main effect came from the Korean participants. The faster reaction times to same translation pairs were interpreted as due to the non-native speakers making a direct mapping from L2 lexical forms to L1 meanings that are already incorporated into the lexical entries of these L2 words. Yet their reaction times were still slower when compared with native speakers because the monolingual and bilingual mental lexicons are not the same. The significantly slow reaction time to different translation pairs was interpreted as follows: the moment the non-native speakers were presented with such pairs, they needed more time to verify whether the members of the pair share the same L1 translation, which has been used as strong evidence that even advanced L2 learners map L2 words to the meaning or concept that exists in their well-established L1 conceptual system.

L1 LMH opposes two prominent assumptions found in the literature of L2 vocabulary acquisitions: One hypothesis is that L2 learners have direct access to the meaning of L2 words (Bogaards, 2001; Brysbaert & Duyck, 2010). This implies that the lexical entry of the L2 word contains the new semantic information of that word. In (1), the new semantic information is incorporated into the lemma subpart of the lexical entry of the L2 word.

L2 learners of English: (1)

L2 English lexical form [L2 English meaning/ concept]

Because the main assumption is that the lexical entry of the L2 word contains the L2 meaning or concept, the prediction follows that L2 learners, regardless of their level of L2 proficiency, do not need to use the strategy of L1 translation to retrieve the meaning of L2 words. However, that assumption has been ruled out by many studies that present evidence of low-proficiency L2 learners' reliance on their L1 to access the meaning or concept of L2 words (Guasch et al., 2008; Kroll et al., 2010).

Another assumption is that the semantic processing of L2 words is influenced by the level of L2 proficiency. Kroll and de Groot (1997) proposed that at the earliest stages of L2 learning, learners map L2 words onto L1 meanings or concepts via L1 translation, but with the increasing level of L2 proficiency, L2 learners gradually abandon the strategy of L1 translation until they reassociate the L2 word with its L2 meaning or concept. The final stage of this model is when highly proficient L2 learners process the meaning of L2 words directly like native speakers; their L1 is no longer used as a means of mediation, and the lexical entry of an L2 word is restructured to contain a new meaning or concept. Several studies have shown results confirming the effect of L2 proficiency on the nature of the semantic retrieval of L2 words (Guasch et al., 2008), but contradicting compelling evidence is provided by results that support L1 LMH. Jiang (2002, 2004) summarized that even highly proficient learners rely on their L1 to process the meaning of their L2. Hence, the aim of the present study is to investigate the question, 'Do advanced L2 learners

access the meaning of L2 words directly or via their L1? The study will be conducted on Arab–English bilinguals by measuring their reaction times whilst they are making judgments on semantically related and unrelated pairs of English words. To the knowledge of the researcher, this kind of investigation has not been conducted on Arab L2 speakers of English. Only one study (Alshehri, 2021) tested L1 LMH on Arab–English bilinguals, but it was an offline lexical judgement task. The result of the study confirms Jiang's hypothesis. However, because the study does not measure the L2 learners' reaction times, the interpretation of the results was still open to the possibility that they had the chance to translate while they were making judgments on whether a word pair is semantically related or unrelated. Measuring the participants' reaction times in the present study will eliminate that possibility and yield stronger results. Following some of the procedures taken in Jiang's experiment (2004), as summarized above, Arab L2 speakers will be presented with same and different translation word pairs. By comparing their reaction times with that of native speakers, the following is predicted: (a) if the advanced L2 speakers map L2 words to L2 meanings or concepts, their reaction times will not be significantly different from that of native speakers, but (b) if they map L2 words to L1 meanings or concepts, their reaction times will be significantly different from that of native speakers, especially when they are presented with different translation pairs. This means that L2 learners will take a longer time to respond because they do not perform direct mapping from L2 word to L2 meaning. They need their L1 as a means of mediation. This indirect process will cause a delay in their responses.

Another purpose of the present study is to make contribution to the psycholinguistic literature of L2 vocabulary acquisition which, as noted by Jiang (2004), is limited when compared to the pedagogically related issues. There is an extensive amount of research on effective techniques of teaching L2 vocabulary (Clenton & Booth, 2020; Coady & Huckin, 1997; de la Fuente, 2006; Nation, 2008), effective strategies used by L2 learners to increase the size of their vocabulary (Newton, 2020; Schmitt, 1997; Schmitt & Schmitt, 2014; Webb & Nation, 2017), and assessment of L2 learners' vocabulary knowledge (O'Dell et al., 2000; Read, 2013). The importance of natural processing studies in L2 vocabulary acquisition is derived from the perspective that understanding the processes underlying L2 vocabulary acquisition will have a significant implication on teaching and learning L2 words, specifically on determining whether the L1 should be taken advantage of in the L2 classroom. The use of the L1 in L2 teaching or learning has been discouraged mainly because it does not align with the principles of popular teaching methods, such as the communicative language method. However, if the results show that even advanced L2 speakers still associate L2 words with L1 meanings or concepts, this will question the rejection of the L1 in the L2 classroom based on its role in hindering L2 learning.

2. Reaction Time Experiment

2.1 Participants

Thirty advanced Arab speakers of English and 28 monolingual native speakers of English participated in the experiment. Fourteen Arabs, who were English teachers, volunteered to participate in the experiment: 12 had master's degrees, and two had PhDs. Ten obtained their degrees from the UK or USA and four from Saudi Arabia. Master's degree holders had received an average of 6 years of previous formal instruction and training in English, compared to PhD holders' average 13 years. Their proficiency was also demonstrated by their high scores, with an equivalent of 6.5 in IELTS or above, which had been earned for admission to their postgraduate programmes.

The native speakers (mean age = 45.31) and the remaining 16 of the Arab participants were selected online and were financially compensated. The online recruitment was due to the COVID-19 crisis, which prevented the author from personal contact. The selection measures were followed carefully through a website[1] specializing in recruiting participants and with which the online experiment design tool website used for this study is linked. For native speakers, a prescreening was carried out based on English as L1 and monolingualism. For Arabs, the prescreening was based on Arabic as L1, and high fluency in English. However, there was no screening measure for English proficiency tests, so a question was included in the questionnaire about whether the participants had taken such a test, the name of the test, and the score. Because the participant will be compensated and to prevent disinformation, all of the participants who filled in the questionnaire were invited to take the experiment and were compensated, but later, the data of those who did not provide evidence for their proficiency was discarded. Thirty-one Arabs participated, but only 16 who had test scores that are equivalent of 6.5 or above in IELTS were included. Moreover, the questionnaire revealed that 11 of those bilinguals had early exposure to English before the age of 10 and five between the ages of 11 and 15. Their educational backgrounds are as follows: three hold diplomas, seven hold bachelor's degrees, five hold master's degrees, and one holds a PhD. Overall, the mean age of the Arab participants is 29.1, and the mean

[1] https://www.prolific.co

length of exposure to English is 10.26 years.

2.2 Stimuli

Forty-two semantically related word pairs and 44 semantically unrelated word pairs were included in the experiment. For the semantically related word pairs, 29 were taken from Jiang (2002, p. 637), and 13 were created by the author. The semantic relatedness of the 42 items had been judged by three English native speakers for this experiment. The members of the related word pairs were separated; the first members were given to three Arabs. Everyone was required to give the first translation that comes to mind. A week later, they were required to do the same with the second members of the word pairs. The next step was to rejoin the members of the word pairs along with their three translations. If the two members of a word pair were given one translation by the three judges, this pair will be categorised under the same translation type. For example, the three judges agreed that *talented* and *gifted* are both translated as 'mawhoob'. Conversely, if the two members of a word pair were given different translations, then the word pair were categorised under 'different translation' type. For example, the three judges gave *discover* and *find* different translations, with *discover* as 'yaktashef' and *find* as 'yajed'. The result included 22 same translation pairs and 20 different translation pairs. The unrelated word pairs were taken from Jiang (2002, p. 637). They served as distractors, so they were not included in the analysis. The 44 unrelated pairs, along with the 22 same translation and twenty different translation pairs, were randomly mixed by implementing the Latin square technique.

2.3 Experimental Tools and Procedures

Two instruments were used to record reaction times and determine accuracy: DMDX for the 14 offline participants and Gorilla for the 44 online participants.

2.3.1 DMDX

DMDX is a software package for Microsoft Windows System developed by Ken Forster at the University of Arizona, and it is available for free download from the university's website.[1] It was chosen for its reliability, flexibility, and millisecond accuracy (Forster & Forster, 2003).The parameters of the experiment, the instruction, the practice items, and the experiment trials were prepared in a rich text format script by using Visual DMDX software created by Garaizar & Reips (2015), which is a powerful tool for those who are new to coding. The input device was the keyboard, which means that the participants will use a keyboard to respond to the trials. The time limit for each stimulus on the screen was 1,670 milliseconds (ms).

The title of the experiment, 'A Semantic Judgment Task', appears on a screen, followed by another screen displaying the instructions of the experiment: participants should press the right shift key if they think that the word pair is semantically related, and the left shift key if they think that the word pair is not semantically related, and they need to respond as quicky and accurately as possible. On the same screen of instructions, there is an option to press the spacebar to proceed to the practice trials if they feel ready. The practice trials consisted of six pairs of words. First, a fixation screen appears that lasts for 500 ms and is followed by a practice item that is displayed on the centre of the screen. The time is recorded once the stimulus appears on the screen until a response is made. The time limit for the stimulus display is 1,670 ms. If the participant does not respond within this time frame, a fixation screen reappears for 500 ms, followed by a screen with a new practice item, and so on until a message appears indicating the end of practice with the option to proceed to the experiment if they feel ready by pressing the spacebar. That process of the practice session was repeated for the experiment session.

Each participant was invited to an office room with good lighting and a comfortable atmosphere. The researcher sat with each participant separately, explained the procedure clearly, and answered any question the participant might have. They then signed a consent form and filled a questionnaire about their educational background, age, length of exposure to English, and proficiency test scores. All participants were ensured that their identities would remain confidential and that they would be given an identification number on the DMDX rather than their names. They were also assured that the task would not judge their competence at English, which was a concern for one of the participants. The DMDX was installed on the researcher's laptop, and the participants were showed how to respond by pressing the right and left shift keys. The participant was then left alone in the room to complete the experiment. To ensure the validity of the experiment, two participants were asked to do the experiment twice. The results showed that there was no significant difference in the reaction times and accuracy. The repeated trials were then discarded. Only their first attempt was included in the data set.

[1] http://www.u.arizona.edu/~kforster/dmdx/download.htm

2.3.2 Gorilla: A Web-Based Experiment Design Tool

Gorilla is an online-experiment design tool launched in 2016 with which a reliable, accurate-to-the-millisecond web-based experiment can be built (Anwyl-Irvine et al., 2020). Because of COVID-19 and the need to avoid of personal contact with participants, we selected a representative number of participants to ensure the validity of the present study would not have been met without an online experiment. With this tool, the same procedure with DMDX was followed. The difference was that the questionnaire and the consent statements had to be filled in online before the start of the task. Using the Gorilla task builder, four blocks were created. The first block included the title of the experiment and the instructions. The participants were requested to take their time reading the instructions before pressing the spacebar. Then, the practice block, which contained six practice items, began. Each item was separated by a fixation screen that lasted for 500 ms. The participants had to press F if they thought a word pair was semantically related and K if they thought it was semantically unrelated. The time limit for each stimulus was 1,670 ms. By the end of the practice session, a screen appeared indicating the end of the practice and the start of the experiment, advising them to press the spacebar when ready. The main task block was the same as the practice block. The final block announced the end of the experiment with a link that redirected the participants back to the recruitment server to receive their payments. The whole experiment did not take more than 10 minutes.

3. Results

This section presents the data analysis and interpretation of the results. The data were coded and analysed with appropriate statistical analysis using SPSS version 27. Only correct responses were included. The statistical tests performed in this study include outlier detection and descriptive and inferential analyses.

3.1 Handling Outliers

The following table shows the minimum and maximum values of the z-score of the dependent variable, which is reaction time. Any value of z-score lower than -2.6 or higher than 2.6 is considered an outlier that should be excluded to decrease the variability of the data. The reaction time data reveal a minimum value of -2.24 (> -2.6) and a maximum value of 2.28 (< 2.6), hence ruling out the existence of outliers.

3.2 Statistical Analysis

Table 1 and Figure 1 show native speakers' and non-native speakers' mean RTs when they responded to same and different translation pairs. Different translation pairs received longer RTs.

Table 1. Mean RTs to same and different translation pairs by native and non-native speakers

Participant type	Word-pair type	Mean RTs
Native speakers	Same translation	839
	different translation	928
Non-native speakers	Same translation	1,035
	different translation	1,048

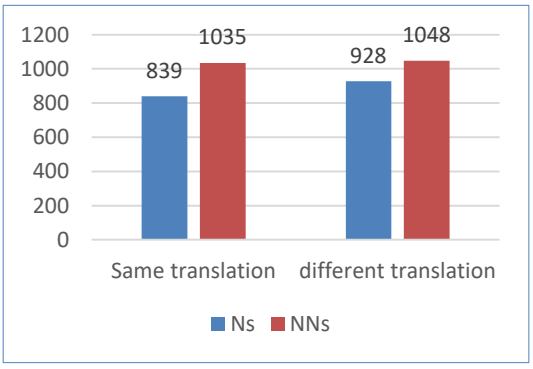


Figure 1. Native and non-native speakers' RTs for same and different translation pairs

Interestingly, the mean RT difference between same and different translation pairs spent by native speakers is longer than non-native speakers, which would be problematic for the study if inferential analyses show that an 89-ms difference is statistically significant, whereas the 13-ms difference is not. To get a deeper meaning for the 89-ms and 13-ms differences in RTs, several one-way analyses of variance (ANOVA) by subject and item analysis for native

speakers and non-native speakers were run. First, to determine whether there is a significant difference in RT to pair type (same translation vs. different translation pairs) produced by native speakers by subject analysis, the following one-way ANOVA has been conducted:

Table 2. Subject analysis: One-way ANOVA (pair type in RT) for native speakers

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4,095,676.040	18	227,537.558	6.003	.000
Within Groups	26,685,319.179	704	37,905.283		
Total	30,780,995.219	722			

Table 2 shows the p-value is < 0.05, indicating a rejection of the null hypothesis, i.e., there is a significant difference in response time to pair type (same vs. different pairs) produced by native speakers. Another one-way ANOVA has been conducted to determine whether there is a significant difference in RT to pair type (same vs. different pairs) produced by native speakers by item analysis.

Table 3. Item analysis: One-way ANOVA (pair type in RT) for native speakers

		Type III Sum of Squares	df	Mean Square	F	Sig.
Pair type	Sphericity Assumed	2,755,183.108	1	2,755,183.108	170.826	.000
	Greenhouse–Geisser	2,755,183.108	1.000	2,755,183.108	170.826	.000
	Huynh–Feldt	2,755,183.108	1.000	2,755,183.108	170.826	.000
	Lower-bound	2,755,183.108	1.000	2,755,183.108	170.826	.000

The result presented in Table 3 again shows that there is a significant difference in response time to pair type (same vs. different pairs) produced by native speakers in item analysis. To sum up, in both tests, the 89-ms difference in response time to same translation pairs vs. different translation pairs was statistically significant.

Second, for non-native speakers, the 13-ms difference in response time seems much lower in comparison to native speakers, so the same tests were run for non-native speakers, one by subject analysis and another by item analysis. Table 4 shows that just as with native speakers, there is a significant difference in response time to pair type (same vs. different pairs) produced by non-native speakers by subject:

Table 4. Subject analysis: One-way ANOVA (pair type in RT) for non-native speakers

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	21,903,897.874	29	755,306.823	19.254	.000
Within Groups	38,874,951.192	991	39,228.003		
Total	60,778,849.066	1,020			

Another one-way ANOVA has been conducted to determine whether the 13-ms difference in response time to pair type (same vs. different pairs) produced by non-native speakers by item analysis is significant:

Table 5. Item analysis: One-way ANOVA (pair type in RT) for non-native speakers

		Type III Sum of Squares	df	Mean Square	F	Sig.
Pair type	Sphericity Assumed	1084707.920	1	1084707.920	85.100	.000
	Greenhouse–Geisser	1084707.920	1.000	1084707.920	85.100	.000
	Huynh–Feldt	1084707.920	1.000	1084707.920	85.100	.000
	Lower-bound	1084707.920	1.000	1084707.920	85.100	.000

Again, as with native speakers, the results show a significant difference in response time to pair type (same vs. different pairs) produced by non-native speakers in item analysis. To sum up the above results, the native speakers and non-native speakers show similar patterns that would be taken as evidence against L1 LMH; they show a significant difference in response time between same and different translation pairs. However, the results are still open for the interpretation that both groups responded to same translation pairs significantly faster because of their synonymous nature, and the above results would not give enough insight into the process underlying L2 vocabulary acquisition. Consequently, more tests were conducted; a one-way ANOVA to examine the effect of participant type in reaction times, another one to examine the effect of pair type in reaction times, and a two-way ANOVA test to examine the interaction between participant and pair types in reaction times.

A one-way ANOVA was carried out to examine the effect of participant type in reaction times. The results showed a significant result: $F(1,17)= 207.2$, $P= .001$. The descriptive analysis in Table 6 shows that the main effect comes from non-native speakers (Mean RT= 1,040) who responded to the related items 160 ms slower than native speakers.

Table 6. Participants' RTs to semantically related word pairs

Participant Type	Mean RT
Native speakers	880 ms
Non-native speakers	1,040 ms
Difference	160 ms

The eta squared, which depicts the level of the main effect of the participant type, was also calculated using formula (2):

$$n^2 = \frac{SS\,Between}{SS\,Total} \quad (2)$$

According to the p-values (< 0.05), the main effect from the independent variable is significant. The value of the eta squared is 0.106, indicating a 10.6% variability of the dependent variable that can be explained by independent variables.

Another one-way ANOVA was run to examine the effect of pair type in reaction times. The results showed a significant effect, F(1,17) = 12.9, P = .001. The descriptive analysis in Table 7 reveals that the main effect comes from different translation pairs (Mean RT = 997) that received 42 ms slower RTs than same translation pairs.

Table 7. Participants' RTs to related word pairs

Pair Type	Mean RT
Same translation	955 ms
Different translation	997 ms
Difference	42 ms

The eta squared was also calculated, which shows the level of the main effect of the pair type. The value of the eta squared is 0.0073, indicating a 0.73% variability of the dependent variable that can be explained by independent variables.

To confirm the above two one-way ANOVA results, the data were analysed using a two-way ANOVA test with participant type and pair type as independent variables. The results revealed main effects of participant type and pair type in reaction times: F(1,17) = 201.4, P = .001 and F(1,17) = 21.4, P = .001, respectively. Non-native speakers took a longer time to respond to the experiment items, whereas different translation pairs received a longer time than same translation pairs. Moreover, the two-way ANOVA revealed that the interaction between pair type and participant type in the reaction time was significant: F(1,17)= 11.5, P= .001. This suggests that the 196 ms difference between native speakers and non-native speakers' RTs to same translation was significantly greater than the 120 ms difference in their RTs to different translation pairs. Non-native speakers were the source of the main effect, as represented in Table 8.

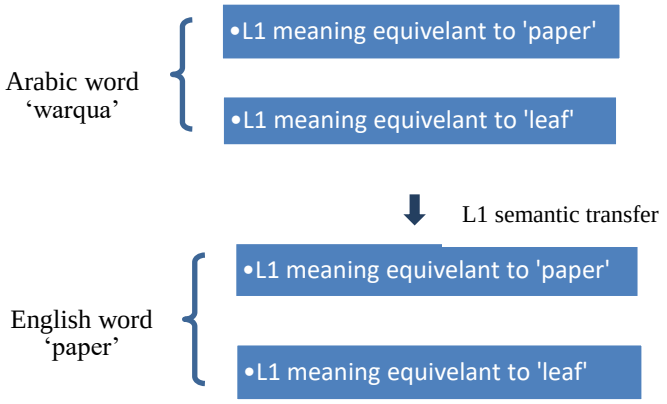
Table 8. The interaction between participant type and pair type in RTs

Pair Type	participant type	Mean RTs
Same translation	Native speakers	839
	Non-native speakers	1,035
	Difference	196
Different translation	Native speakers	928
	Non-native speakers	1,048
	Total	120
Total	Native speakers	880
	Non-native speakers	1,040
	Difference	160

4. Discussion

The results have shown that L2 learners acquire new L2 words with the L1 meanings and concepts associated with them. The significant difference in non-native speakers' RTs (mean = 1,040 ms) when compared with native speakers' (mean = 880 ms) has demonstrated that the language processing underlying L2 vocabulary acquisition is substantially different from that underlying L1 vocabulary acquisition. The delay in RT is taken as evidence that L2 learners did not have that automaticity enjoyed by native speakers in retrieving the meaning of words presented in the experiment. They still had to rely on their L1 to make their judgement on whether the word pair is semantically related. Different translation pairs received significantly slower RTs (1,048 ms) than native speakers (928 ms) because non-native speakers were faced with that moment that questions whether the members of the pair share the same L1, hence causing the delay of meaning retrieval. The results of the present study contribute to the literature of

second language acquisition from a psycholinguistic perspective (Bialystok & Feng, 2009; Cook, 2008; Cummins, 2007; Jiang, 2004, 2002). The findings support the use of L1 and translation in L2 classrooms, hence challenging the practice of the absolute abandonment of L1 by well-known teaching methods such as communicative language. Two terms are relevant to this discussion: crosslingual teaching and intralingual teaching (Hall & Cook, 2012). Crosslingual teaching is when language teachers use or refer to the L1 of their students. This would happen if they shared with the students the same L1 or at least had knowledge of their students' L1. However, intralingual teaching is when the target language is used, a practice that is widely favourable because it involves deeper cognitive processes and increases the chances for students to retain L2 words in their mental lexicon (Hedge, 2001). However, for Stern (1992), the domination of one strategy or practice over another should depend on the goal or the context of learning. If the goal is to enhance students' L2 proficiency, then intralingual teaching should dominate. Crosslingual teaching is beneficial in translation and L2 vocabulary classes to prevent problems concerning the processing of L2 words, more specifically when a wrong L2 word–L1 meaning association occurs. To illustrate the potential problem of wrong L2 form–L1 meaning mapping, the L2 word 'paper' and the Arabic word 'warqua' are perfect translations, but 'warqua' is also the Arabic translation of L2 word 'leaf'. Let's say, for example, an Arabic-speaking learner of English associates the L2 word 'paper' with two L1 meanings: (a) the exact meaning of paper in English, and (b) 'leaf'. According to the theory of L1 LMH, the repeated association via L1 translation will result in incorporating the wrong L1 meaning into the lexical entry of the L2 word, making it very hard to unlearn.



(3)

Figure 2. The wrong association between the English word and the Arabic meaning

What would happen in such an instance is that, if the use of an Arabic or bilingual dictionary is not an option in the L2 classroom and/or if the learners are not made aware of the semantic nature of 'paper' and its Arabic correspondent 'warqua', some L2 learners may map the L2 word 'paper' onto the two L1 meanings via L1 translation, hence producing utterances like *'*The papers of the tree have turned yellow'* or *'*I want a white leaf to write on'*. To minimise this from happening and to help learners associate the correct L1 meaning with its L2 word, crosslingual teaching should be implemented if the teacher shares the same L1. Otherwise, they should require them to consult a bilingual dictionary. If the teacher draws the students' attention to the fact that they cannot use the L2 word 'paper' to refer to the tree leaf, this will help them associate the L2 word with its correct L1 meaning.

In conclusion, this research investigated the processing nature of L2 word processing to meaning and whether it is impacted by L2 proficiency. An online judgment task that measured the duration of time that advanced L2 learners spent from the presentation of an English word pair on a computer screen until when they decided on whether it is semantically related. The results have shown that advanced L2 speakers use L1 as a means of mediation between an L2 word and its meaning. The results suggest the importance of crosslingual teaching in L2 vocabulary and translation learning context, a suggestion that does not abandon the importance of intralingual teaching. Rather, a balance between the two practices is highly recommended.

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Appendix

Same-translation pairs	*Different-translation pairs*
refuse reject	achievement success
anxious worried	advice suggestion
chance opportunity	apology regret
*smart intelligent	artist painter
danger risk	clinic hospital
error mistake	conclusion decision
glad pleased	creation invention
goal aim	door gate
*quick fast	exist live
journey trip	draw paint
*sick ill	inform tell
*difficult hard	real true
doubt suspect	say speak
*admit confess	enjoy like
*brave courageous	equipment machine
*begin start	estimate evaluate
*talented gifted	good nice
*delicious tasty	high tall
*fix repair	learn study
*choose select	reaction response
*help assist	
*afraid scared	

Note: Pairs with * are created by the author.