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Interference of L1 English in L2 French Lexical Processing

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Abstract

This study examines the interference, if any, caused by a first language (specifically English) in the processing of lexical items in a second language (French). Participants performed a computer-based translation recognition task where they were asked whether a pair of words, one French and the other English, represented an acceptable translation. Six different types of critical pairs were randomly alternated with actual translation pairs and unrelated distractor pairs. Each of the different categories of critical pairs had a different relationship with the L1 word, the L2 word, or both. Participants' scores on this task were then analyzed to determine the relative frequency at which each type of critical item was incorrectly identified as a correct translation pair. The present study was based on a translation recognition task from Sunderman and Kroll (2006), which dealt with native speakers of English learning Spanish as a second language.

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Introduction

This study examines the interference, if any, of L1 English on the processing of L2 French lexical items. It was done using a computerized test based on the translation task in Sunderman and Kroll (2006). In that study, the researchers were looking at native speakers of English learning Spanish as a second language, with a focus on different theories of second language lexical processing. Although I do not go into those theories here, I found the experiment design fascinating and decided to see if the results would extend to L2 French. Several changes were made necessary by limitations on time, resources, and funding, but I tried to replicate the portion of the original study I was using as closely as I reasonably could.

In this study, I examined the following questions:

1) Is L1 lexical information noticeably present when L2 words are being processed?
2) Does access to the meaning of L2 words increase with increasing proficiency?
3) Does grammatical class function as a clue to lexical status?
4) Do these effects differ for learners who are more or less proficient in French?
5) How do my results compare to those from Sunderman and Kroll (2006)?

Participants

The participants were fourteen students from Syracuse University, all of whom were 18 years old or older. Most participants were undergraduate students, but 3 were graduate students. One spoke Spanish natively, and another identified both English and Farsi as first languages. Their responses were not included in the group scores, but were analyzed separately and compared to the proficiency groups to which they would otherwise have been assigned. These tables can be found in Appendix C. One participant misunderstood the directions, and the results from that participant were discarded. Ultimately, the results from 11 of the participants were used in my analysis.

Participants were initially drawn from French classes at Syracuse University, but networking also proved to be an effective recruitment tool. Subjects were divided into two groups based on proficiency (7 beginning/intermediate and 6 intermediate/advanced), based on their responses on language history questionnaires. Participants were placed in the beginning/intermediate group using the following criteria:

- less than four semesters of college-level French courses completed
- most advanced current French class (if applicable) at the 100 or 200 level

    - if in a higher level course, difficulty/comfort level rated higher than 3 (on a scale from 1 – 5, where 1 is too easy and 5 is too difficult)
- no immersion experience
- self-ratings lower than 3 in any category of French proficiency (on the scale defined as 1--beginner, 3--intermediate, 5--native-like)

Participants were placed in the intermediate/advanced group using the following criteria:

- four or more semesters of college-level French courses completed
- most advanced current French class (if applicable) at the 300- or 400-level, with a difficulty/comfort rating of 3 or lower
- immersion experience
- Self-ratings higher than 3 in any category of French proficiency

Emphasis for these placements was primarily on years of college-level French instruction and the number level of the current French class, where applicable. Most participants fell clearly into one of the two groups based on these criteria. While this is, admittedly, not the best way of assigning students to proficiency groups, I did not feel that placement tests were necessary, and their scores on the correct translation pairs generally corroborated these placements.

Subjects were not compensated monetarily, but were given their chosen flavor of Insomnia© cookies after the testing session.

Materials and Design

There were 96 test items total, each consisting of a proposed translation pair including a French word and an English word. Half of these (48 pairs) were actual translation pairs where the English word was a translation of the French word, for example *bon / good*. 12 test items were pairs of random distractors which served as controls. These were pairs where the English word had no connection to the French word whatsoever. For 6 random distractors, the two words were from the same grammatical class (ex. *savon / lamb*, both of which are nouns*)*, and the other 6 contained words that were not matched on grammatical class (ex. *sucre* / *legal,* where *sucre* is a noun and *legal* is an adjective). The other 36 were critical items. These were the items I was mostly interested in. There were 6 categories of critical items, with 6 pairs in each. The categories were defined based on the second (English) word of the pair, and were broken down as follows:

- form neighbor of the French word, matched on grammatical class, where "form neighbor" is defined as a word with the same onset (Since this study dealt solely with written language, I based this on spelling without any consideration for phonology. A possible pair in this category would be *lit / light*, because they share the initial letters 'li' and are both nouns),

- form neighbor of the French word, not matched on grammatical class (A potential pair in this category would be *lit / limps*, because they share the initial letters 'li', and because one word is a noun and the other is a verb),
- form neighbor of the English translation, matched on grammatical class (Since the English translation of *lit* is *bed*, a possible pair in this category is *lit / bell*. *Bell* shares the same initial letters as the actual English translation, and is also a noun),
- form neighbor of the English translation, not matched on grammatical class (A possible pair from this category is *lit / beg*, because *beg* shares the same initial letters as the actual English translation, but is not a noun),
- semantic neighbor of the original translation pair, matched on grammatical class (In this case, a "semantic neighbor" was considered to be a word with a related meaning. A possible pair for this category would be *lit / blanket*, both of which are nouns and which are related based on what they refer to), and
- semantic neighbor, not matched on grammatical class (A possible pair in this category would be *lit / sleep*s, because *sleep* has a meaning related to that of *bed*, but is not a noun and is therefore from a different grammatical class).

The example in Table 1, modified from Sunderman and Kroll (2006), shows each of these categories for the translation pair *lit / bed*.

Table 1: Generating Possible Critical Pairs for *Lit / Bed*

	Form Neighbor French (orig. *lit)*	Form Neighbor English (orig. *bed*)	Semantic Neighbor
Matched on Grammatical Class	light	bell	blanket
Not Matched on Grammatical Class	limps	beg	sleep

It appears that Sunderman and Kroll (2006) had a slightly different breakdown than this, because they closely matched sets of random distractors with specific sets of critical items on word length and thus had more groups of random distractors. Although that probably gives more exact interference results, I chose to use only two groups of random distractors (matched and unmatched on grammatical class). In doing this, I hoped to make up for a much smaller sample size by having more critical items in each category, while keeping the same total number of items.

Most of the items, both critical and non-critical, were from Sunderman and Kroll (2006) or were translated from that study. Where possible, I used the English words from that study and translated them into French with the aid of a dictionary. The resulting translation pairs – including those used to create critical items – were reviewed by a member of the faculty of the French department at Syracuse University, and corrected or removed from the study where necessary.

Those test items which were not from Sunderman and Kroll (2006) were primarily replacing items which were cognates in French and English but not in Spanish and English, and thus had not been cognates in Sunderman and Kroll (2006). Because cognates such as *tâble* and *table* have similar forms in both French and English, I had several concerns about including cognates in the test items. First, I felt that the presence of too many cognates in the translation pairs could cause participants to become disoriented as to which language was presented first, even though the order was kept consistent throughout. Second, I worried that cognates would be too easy to respond to and would skew reaction time results, cause participants to respond carelessly, or allow their attention to wander. Third, I was concerned that recognition of a French word in a critical pair as a cognate could affect reaction time for that item or mask other interference effects. For these reasons, I replaced all cognates in critical items--and several (but not all) of the cognates in the translation pairs--with pairs that were not drawn from Sunderman and Kroll (2006).

Grids such as the one in Table 1 were made for all translation pairs designated to become critical items. Form neighbors were found with the aid of the *Oxford English Dictionary Online*. Semantic neighbors came, for the most part, from Sunderman and Kroll (2006). Critical items and random distractors were matched as closely as possible with their French partner on word length, measured by the number of letters and/or the physical length of the word on the screen. I tried to match test items on frequency of use, but, in

the time available, I had difficulty finding and accessing word frequency lists for French and English which used comparable ranking systems. Consequently, I was forced to rely on my own judgment to avoid extreme differences in frequency of use, wherever possible.

After the grids had been formed and I had all the potential critical items, I went through them to decide which ones should appear on the test. The pairs that were chosen were those which were clear examples of the categories they fell into and which were matched closely on word length. I first went through each grid and modified or eliminated any words whose grammatical class could be ambiguous. Most of these were nouns which could be verbs, or vice-versa, and could generally be taken care of by conjugating the verb a different way. For example, the word *crack* (V) was in the grid of the noun *montre*. Since the word *crack* on its own could be interpreted as either a noun (a crack) or a verb (to crack), I changed it to *cracked*. This was done to make grammatical class clear for all words so I could see the effect it had on processing more clearly. Second, I looked for any potential pairs which did not fit clearly into the category in which they had been generated. In the example using *lit* from Table 1 above, I eliminated the potential pair *lit / light* (form neighbor of French, matched on grammatical class) because they shared not only initial letters, but also a final 't'. This extra degree of similarity could have an effect on the processing of this pair other than that for other form neighbors. Next, I eliminated the words that did not match well on word length. For example, once again using

the grid for *lit*, the potential second word *blanket* is a great deal longer than *lit*, so the pair *lit / blanket* (semantic neighbor, matched on grammatical class) was eliminated from consideration. The potential pairs *lit / limps* (form neighbor of French, not matched on grammatical class) and *lit / sleep* (semantic neighbor, not matched on grammatical class) were also eliminated, for the same reason. At this point, I had either found the best pair for each item (one where the two were of comparable lengths and was clearly an example of the category of critical item it fell into), or had narrowed the options down to two or three. In the case of *lit*, I was left with two options – the pair *lit / bell* (form neighbor of English, matched on grammatical class) and the pair *lit / beg* (form neighbor of English, not matched on grammatical class. Although both were equally acceptable, I chose the pair *lit / beg* because I found that there were fewer acceptable potential pairs which were not matched on grammatical class than there were of those which were. When I was finished, I had chosen one pair from each grid of potential pairs, and had 6 pairs from each category. A list of all proposed translation pairs, organized by category, can be found in Appendix A.

Once the test items had all been chosen, I entered them into the experiment design software Superlab Pro 4.0. Each test item was coded by category as in the list mentioned above. This software randomized the order of test items for each participant. The experiment and software were kept on a laptop, which was used for both experiment design and for testing.

Procedure

Participants were tested individually. There was some variation in the actual testing environment caused by scheduling, but testing areas were chosen for low noise level, few to zero people nearby, and lack of distractions. Test areas included two empty classrooms, sectioned off group rooms in a computer lab, and open tables in a quiet study area in a campus library.

A language history questionnaire (Appendix B) and informed consent form were handed out at the beginning of each testing session. The questionnaire included (1) the number level (100, 200, etc.) of the participant's highest current French course and his/her estimation of the difficulty of that course on a scale of 1 – 5 (1 being too easy, 5 being too difficult), (2) semesters of college-level French courses completed, (3) study abroad, learning community, and other immersion experience, and (4) a self-report of proficiency at speaking, reading, listening comprehension, writing, and overall proficiency. Each participant also signed a statement that he/she was 18 years of age or older.

Participants were informed that personal information would be kept anonymous and confidential. To accomplish this, each participant was randomly assigned a two-digit participant number.

The main task was a computerized translation recognition task based on the one in Sunderman and Kroll (2006). Subjects were given instructions both verbally and on the computer screen. They were asked to determine

whether a pair of words represented an acceptable translation from French to English, and were instructed to press the [y] key if they felt it did, and the [n] key if they felt it did not. Ten practice pairs preceded the actual test items, and participants were given the opportunity to ask questions both before and after the practice items.

The practice and test items appeared on the computer screen one pair at a time. Each pair was preceded by a fixation point for 300 ms. The L2 (French) word appeared first, remaining for 400 ms. It was followed by a blank screen for 100 ms, which was in turn replaced by the L1 (English) word. The L1 word remained on the screen until the participant selected either [y] or [n]. Essentially, when the participant reads the L2 word on the screen, s/he begins to process it. The second word presented is a possible L1 meaning, and the participant is asked whether that word matches what his/her internal lexical processing produced. Since the words appear in such a short time span, the answers are based more on gut reactions than on conscious thought processes. If a participant accepts an incorrect pair, that theoretically indicates that the second word is a possible translation at some point during his/her lexical processing of the L2 word.

Participants were instructed to guess if they were unsure. Reaction times were recorded to the nearest millisecond from the time the English word appeared.

Some participants complained that the French word disappeared too quickly. The timing was set to match that of the translation recognition task

in Sunderman and Kroll (2006), and was purposefully fast to activate the types of processing strategies both they and I were examining. However, this may have been too fast for some participants to read the French word, and that may have caused some inaccuracy in the data.

Methods of Analysis

Reaction Time

Following the example of Sunderman and Kroll (2006), reaction times faster than 300 ms or slower than 3000 ms were treated as outliers and discarded. Means for each subject were calculated individually, and reaction times 2.5 standard deviations above or below the mean were also treated as outliers. This was to weed out responses which showed too much conscious thought or too little consideration, and which therefore did not reflect the processing strategies in question. Less than 1% of the data in Sunderman and Kroll (2006) were excluded based on these guidelines. My numbers were slightly higher; approximately 7% of my total data were considered outliers. As part of that, approximately 5% of my critical items were excluded for these reasons.

Translation Pairs

The responses of all participants to the actual translation pairs such as *bon / good* were analyzed for both accuracy and reaction time, and these results supported the distribution of subjects into the two proficiency groups. Accuracy for these items meant a response of [y], accepting the item as a correct translations pair. The advanced/intermediate group responded to more items per person average after outliers were removed (93.4 items), were more accurate (they accepted actual translation pairs 86.6% of the time), and

responded more quickly (1155 ms) than the beginning/intermediate group (85.3 items per person average, with an accuracy rate of 83.3%, and an average reaction time of 1323 ms). Reaction times for translation pairs were also analyzed by group and compared with the response times and accuracy scores for the critical items for those groups. The intermediate/advanced group responded more quickly to the translation pairs than either the critical pairs or the random distractors (on average, 185 ms and 293 ms faster, respectively). This indicates that, at least for more proficient learners, there is interference in the processing of both types of "no" items, but the most difficulty in processing the random distractors, perhaps because the random distractors did not match any of the possibilities generated through lexical processing. The beginning/intermediate learners were slightly slower (9 ms on average) in responding to translation pairs than in responding to critical pairs, but responded more quickly (94 ms on average) to translation pairs than to random distractors. This shift indicates more consistent processing times at higher proficiency levels, and perhaps more confidence in the results of their processing strategies as well.

Critical Items

For critical items, the correct response was always [n]. Therefore, accuracy for critical items indicates the percentage of times the participants rejected pairs from that category. For example, 88.2% accuracy on semantic neighbors which were matched on grammatical class means that participants

(in this case, the beginning/intermediate group) correctly rejected semantic neighbors matched on grammatical class 88.2 % of the time, and incorrectly accepted them 11.8% of the time. This is true for all critical items, as well as for random distractors.

Only correct answers were included when calculating the mean response times for critical items. The magnitude of interference for each type of critical item was calculated as the difference between the trials for that category of item and the relevant random distractors. This is based on Sunderman and Kroll (2006), but with some modification because I treated my "unrelated" (random) trials differently, as described in the "Materials and Design" section. Because interference is figured this way, it could be either helpful interference (participants responded faster and/or were more accurate because of it) or harmful interference (participants took longer to respond and/or were less accurate because of it). In most cases, I was interested in the magnitude of interference more than whether it was helpful or harmful.

Results and Analysis

Beginning/intermediate learners generally showed more interference from form neighbors (of either French or English) than semantic neighbors in both reaction time and accuracy, which indicates that processing at lower proficiency levels is more focused on form than on meaning – i.e., finding or determining the correct translation in the L1 rather than focusing on what the L2 word refers to in the world. Intermediate/advanced learners generally showed the same pattern as far as accuracy, but the opposite for reaction time. This shows some movement toward a focus on meaning in more proficient learners. The interference from form neighbors of the English translation in accuracy was higher for the more proficient learners, as was that from semantic neighbors. Because interference from form neighbors of the English translation indicates the presence of the L1 in L2 processing, this would ordinarily indicate that more proficient learners are more concerned with the English translation during their processing than less proficient learners are. However, it could also indicate that learners move away from "frenchifying" English words as they increase in proficiency. Because English is closely related to French and contains so many French borrowings and cognates, beginning students often pepper their French speech with English words modified to sound French without realizing that they are doing so. Acceptance of form neighbors of French could also indicate a process similar to this, but in reverse. Since the pattern in my results which shows more

interference from form neighbors of the English word at higher proficiency levels could be interpreted as an evolution beyond this subconscious reliance on these pretend cognates (as opposed to false cognates, which are words which appear – or sound – similar in two languages but have very different meanings), these results are not as counterintuitive as they at first appear to be.

Grammatical class has a visible effect on reaction time for intermediate/advanced learners in all cases, and for beginning/intermediate learners in most cases, which means that it is a clue to lexical status for both these groups, and increasingly so at higher levels of proficiency. Since the effect of grammatical class is not nearly as pronounced in accuracy, it does not always seem to be a useful clue, but it is present during processing. The one case where grammatical class does help accuracy for both groups is in the random distractors. Both groups were most accurate on random distractors from a different grammatical category, which makes me believe that grammatical class on its own is a useful clue, but when mixed with other types of interference it can just as likely complicate the issue further. The fact that Intermediate/advanced learners reacted more quickly to lexical or semantic neighbors in the same grammatical class than to related pairs in different grammatical classes supports this idea, and indicates that this effect of grammatical class is more pronounced at higher proficiency levels. Since both groups had about the same accuracy for semantic neighbors which were and were not matched on grammatical class, the interference from meaning

seems to be stronger than the effect of grammatical class. Accuracy on these items is actually slightly lower in the more proficient group, which could support the idea that meaning is more important at a higher proficiency level, but the differences are really too small to say for sure.

Table 2: Reaction Time and Percent Accuracy by Proficiency Level

	Beginning/Intermediate				Intermediate/Advanced			
	Same Grammatical		Different Grammatical		Same Grammatical		Different Grammatical	
	RT	% Acc	RT	% Acc	RT	% Acc	RT	% Acc
Form neighbors to French	1282	91.2%	1110	78.1%	1223	86.2%	1315	75.0%
Random Distractors	1458	82.9%	1376	94.3%	1585	80.0%	1310	93.3%
Interference	**176**	**8.3%**	**266**	**16.2%**	**362**	**6.2%**	**5**	**18.3%**
Form neighbors to English	1311	91.2%	1465	88.9%	1262	90.0%	1501	86.7%
Random Distractors	1458	82.9%	1376	94.3%	1585	80.0%	1310	93.3%
Interference	**147**	**8.3%**	**89**	**5.4%**	**323**	**10.0%**	**191**	**6.6%**
Semantic Neighbors	1360	88.2%	1354	87.9%	1214	86.2%	1496	86.2%
Random Distractors	1458	82.9%	1376	94.3%	1585	80.0%	1310	93.3%
Interference	**98**	**5.3%**	**22**	**6.4%**	**371**	**6.2%**	**186**	**7.1%**

Comparisons with Sunderman and Kroll

In order to make as close a comparison as possible, I re-analyzed my results to include only those participants who matched Sunderman and Kroll's participant pool by removing the participants who were not currently in a French class. This put 3 participants in the beginning/intermediate group and 2 in the intermediate/advanced group. Table 3 shows the modified results, and Table 4 shows the data from Sunderman and Kroll (2006).

Table 3: Reaction Time and Percent Accuracy of Participants in French Classes by Proficiency Level

	In French Course Beginning/Intermediate				In French Course Intermediate/Advanced			
	Same Grammatical		Different Grammatical		Same Grammatical		Different Grammatical	
	RT	% Acc	RT	% Acc	RT	% Acc	RT	% Acc
Form neighbors to French	1261	100.0%	1057	70.6%	1348	91.7%	1274	81.8%
Random Distractors	1234	83.3%	1209	94.1%	1484	75.0%	1320	83.3%
Interference	**27**	**16.7%**	**152**	**23.5%**	**136**	**16.7%**	**46**	**1.5%**
Form neighbors to English	1310	88.9%	1425	88.9%	1459	91.7%	1500	100.0%
Random Distractors	1234	83.3%	1209	94.1%	1484	75.0%	1320	83.3%
Interference	**76**	**5.6%**	**216**	**5.2%**	**25**	**16.7%**	**180**	**16.7%**
Semantic Neighbors	1251	94.1%	1305	82.4%	1496	58.3%	1500	83.3%
Random Distractors	1234	83.3%	1209	94.1%	1484	75.0%	1320	83.3%
Interference	**17**	**10.8%**	**96**	**11.7%**	**12**	**16.7%**	**180**	**0.0%**

Table 4: Reaction Time and Percent Accuracy by Proficiency Level (from Sunderman and Kroll, 2006)

	Beginning/Intermediate				Intermediate/Advanced			
	Same Grammatical		Different Grammatical		Same Grammatical		Different Grammatical	
	RT	% Acc	RT	% Acc	RT	% Acc	RT	% Acc
Form neighbors to French	1039	77%	1016	88%	935	87%	902	93%
Unrelated Distractors	995	87%	1012	89%	888	95%	897	95%
Interference	**44**	**10%**	**4**	**1%**	**47**	**8%**	**5**	**2%**
Form neighbors to English	1027	85%	1017	89%	902	91%	883	95%
Unrelated Distractors	941	89%	1016	90%	901	95%	894	95%
Interference	**86**	**4%**	**1**	**1%**	**1**	**4%**	**11**	**0%**
Semantic Neighbors	1066	73%	1077	80%	965	83%	955	89%
Unrelated Distractors	979	88%	989	87%	879	95%	879	95%
Interference	**87**	**15%**	**88**	**7%**	**86**	**12%**	**76**	**6%**

Sunderman and Kroll (2006) found that all participants were less accurate on word pairs in the same grammatical class than they were on word pairs in different grammatical classes, regardless of proficiency level. Although this same general pattern occurred in my data as well, there were three rather blatant exceptions. These were in form neighbors of the French word for both proficiency levels, and in semantic neighbors for the beginning/intermediate group. Still, findings from both studies indicate that grammatical class is a useful part of L2 lexical processing.

Sunderman and Kroll also found that the more proficient subjects showed a faster reaction time overall, and were generally faster at rejecting critical items from a different grammatical class than from the same grammatical class. The reverse was found to be true for the less proficient subjects. This was essentially what I was expecting to find, since it would

indicate that more advanced learners processed L2 words more quickly and had a better (or at least more efficient) understanding of grammatical class. My results did not match this. In fact, the more proficient learners in my study showed higher reaction times in every category than the less proficient learners. For both proficiency groups, there was no real tendency to be faster with items from the same or from different grammatical categories.

Both groups in Sunderman and Kroll's study showed more interference in terms of accuracy from semantic neighbors than from form neighbors of the L2 word (in their case, Spanish), and more interference from the form neighbors of the L2 word than from the form neighbors of the L1 translation, as illustrated below. This indicates that meaning is more strongly present in the lexical processing of participants from both proficiency groups than form, and that the L1 has a comparatively weak presence in L2 lexical processing.

Relative Interference – Sunderman and Kroll (2006)

Semantic neighbors > form neighbors of L2 > form neighbors of L1

A different pattern emerged in my data. For less proficient learners, form neighbors of the L2 word showed the most interference, followed by semantic neighbors, which showed more interference than form neighbors of the L1 translation. In the case of French, as I mentioned above, I think the relative strength of the presence of the form of the L2 is due to the similarity of many French and English words and the reliance of many beginning French learners on pretend cognates. The people I have spoken with who have

studied Spanish as a second language said that this is not as prevalent in beginning learners of Spanish. If this is true, it is a possible reason for the difference in relative strength of L2 form interference in the present study and in Sunderman and Kroll (2006).

Relative Interference -- Beginning/Intermediate Group

Form neighbors of L2 > semantic neighbors > form neighbors of L1

For more proficient learners, it was form neighbors of the L1 translation which showed the most interference, and semantic neighbors which showed the least. This still shows that form is more present in processing than meaning, but indicates movement away from the reliance on pretend cognates mentioned above.

Relative Interference -- Intermediate/Advanced Group

Form neighbors of L1 > form neighbors of L2 > semantic neighbors

From this, it becomes obvious that my results do not replicate those of Sunderman and Kroll, except in the case of grammatical class. This could be for several reasons. One is that any patterns emerging in the data are purely random. Although this is a possible reason, it would be irresponsible to prefer this reason over others without more data. The difference in our results could also reflect a difference between French and Spanish, although these two languages are closely related. A far more plausible reason is my small sample

size. The tendency of small samples to be more prone to individual variation is the main reason I included as many participants as I could, and this sort of individual variation could be partly why my results do not match those from Sunderman and Kroll (2006). A fourth possibility is variations, either intentional or not, in the experiment design. Even a difference in the verbal instructions (such as whether participants are told that reaction time matters) could have had an effect on these results. The fact that I pulled one task out of an experiment which was originally much longer could also have affected my results.

Further Analysis and Future Research

Although the distinction between proficiency groups was foremost in my mind throughout this study, there are several other aspects which could prove interesting for further study. Many of these came from interesting patterns I noted while doing the analysis above, from the responses participants gave on their language history questionnaires. In those cases, I have provided the data from the relevant groups, and a brie description of the general patterns I saw.

Immersion vs. No Immersion

4 participants had immersion experience of some kind, mostly one semester study-abroad experience in Strasbourg. 7 participants indicated that they did not have any immersion experience. Overall, the effects on reaction time were much more pronounced in students who had immersion experience compared to those who did not, and the effects on accuracy were smaller. Students with immersion experience were faster and more accurate on critical pairs in the same grammatical class than students without immersion experience, but slower and less accurate on those from different grammatical classes.

Table 5: Reaction Time and Percent Accuracy by Immersion Experience

	Immersion (4 participants)				No Immersion (7 participants)			
	Same Grammatical		Different Grammatical		Same Grammatical		Different Grammatical	
	RT	% Acc	RT	% Acc	RT	% Acc	RT	% Acc
Form neighbors to French	1191	82.6%	1298	81.1%	1289	92.5%	1150	78.4%
Random Distractors	1663	87.5%	1236	87.5%	1428	82.9%	1412	92.7%
Interference	**472**	**4.9%**	**62**	**6.4%**	**139**	**9.6%**	**262**	**14.3%**
Form neighbors to English	1188	87.5%	1490	95.8%	1351	90.0%	1477	90.5%
Random Distractors	1663	87.5%	1236	87.5%	1428	82.9%	1412	92.7%
Interference	**475**	**0.0%**	**254**	**8.3%**	**77**	**7.1%**	**65**	**2.2%**
Semantic Neighbors	1252	87.0%	1475	91.3%	1342	82.5%	1388	87.2%
Random Distractors	1663	87.5%	1236	87.5%	1428	82.9%	1412	92.7%
Interference	**411**	**0.5%**	**239**	**3.8%**	**86**	**0.4%**	**24**	**5.5%**

Graduate vs. Undergraduate

Since the graduate students in this study were in the Beginning/intermediate proficiency group, I have compared them with only the undergraduate students from that group. There were 2 graduate students and 4 undergraduate students in the beginning/intermediate proficiency group. These two groups showed opposite effects from grammatical class. The graduate students showed greater interference from critical items in the same grammatical class than from different classes in both reaction time and accuracy. The undergraduate students showed greater interference from items in different grammatical classes. Overall, the graduate students tended to be more accurate than undergraduate students, but also took longer.

Table 6: Reaction Times and Percent Accuracy of Graduate and Undergraduate Students

	Graduate Students (2 participants)				Undergraduate Students (4 participants)			
	Same Grammatical		Different Grammatical		Same Grammatical		Different Grammatical	
	RT	% Acc	RT	% Acc	RT	%Acc	RT	% Acc
Form neighbors to French	1349	83.3%	1201	90.9%	1250	95.5%	1050	71.4%
Random Distractors	1551	75.0%	1420	91.7%	1416	87.0%	1354	95.7%
Interference	**202**	**75.8%**	**219**	**0.8%**	**166**	**8.5%**	**304**	**24.3%**
Form neighbors to English	1308	91.7%	1435	100.0%	1312	90.9%	1482	83.3%
Random Distractors	1551	75.0%	1420	91.7%	1416	87.0%	1354	95.7%
Interference	**243**	**16.7%**	**15**	**8.3%**	**104**	**3.9%**	**128**	**12.4%**
Semantic Neighbors	1486	100.0%	1357	100.0%	1297	90.9%	1352	81.0%
Random Distractors	1551	75.0%	1420	91.7%	1416	87.0%	1354	95.7%
Interference	**65**	**25.0%**	**63**	**8.3%**	**119**	**3.9%**	**2**	**14.7%**

Current French Class vs. No Current French Class

5 participants were currently enrolled in French classes at the time that they performed the translation recognition task, and 6 participants were not currently enrolled in a French class at that time. Participants who were not currently enrolled in a French class showed a great deal of interference from items in the same grammatical class on reaction time, both compared to items from different grammatical classes, and to the reaction time results of both groups overall. Those who were currently in a French course showed more interference on reaction time from items in different grammatical classes than from those in the same grammatical class. They were most accurate on items which were form neighbors to the English translation, and had a wider range of accuracy scores in different categories.

Table 7: Reaction Times and Percent Accuracy of Participants by Current Enrolment in French Classes

	Currently in French Course (5 participants)				Not Currently in French Course (6 participants)			
	Same Grammatical		Different Grammatical		Same Grammatical		Different Grammatical	
	RT	% Acc	RT	% Acc	RT	% Acc	RT	% Acc
Form neighbors to French	1294	96.7%	1150	75.0%	1214	81.8%	1256	87.5%
Random Distractors	1328	80.0%	1251	89.7%	1665	88.6%	1416	97.2%
Interference	**34**	**16.7%**	**101**	**14.7%**	**451**	**6.8%**	**160**	**9.7%**
Form neighbors to English	1371	90.0%	1457	93.3%	1218	94.1%	1503	86.1%
Random Distractors	1328	80.0%	1251	89.7%	1665	88.6%	1416	97.2%
Interference	**43**	**10.0%**	**206**	**3.6%**	**447**	**5.5%**	**87**	**11.1%**
Semantic Neighbors	1325	79.3%	1390	82.8%	1293	91.2%	1446	90.9%
Random Distractors	1328	80.0%	1251	89.7%	1665	88.6%	1416	97.2%
Interference	**3**	**0.7%**	**139**	**6.9%**	**372**	**2.6%**	**30**	**6.3%**

Other Areas for Future Research

There are other areas in which it could be interesting to expand this research but which are not part of the data available here. These include other first and second languages, the amount of time since the participants have had regular exposure to and/or instruction in the L2, results of near-native speakers as opposed to native speakers, bilingual speakers of the "L1" language and a related or unrelated language, and results of learners who know a third language, related to one, both, or neither of the main languages in question. It would also be useful to conduct this experiment in French with a larger sample size, and possibly broken down into more proficiency groups showing a wider range of proficiencies.

Works Cited

Sunderman, Gretchen and Judith F. Kroll. "First Language Activation During Second Language Lexical Processing: An Investigation of Lexical Form, Meaning, and Grammatical Class." *Studies in Second Language Acquisition* 28 (September 2006): 387-422.

Appendix A

Form neighbor of French word, same grammatical class		
aveugle / average	mouton / mountain	visage / vision
farine / farmer	pain / pair	voiture / violet
Form neighbor of French word, different grammatical classes		
argent / argues	graduit / graduate	pont / point
craie / crash	marrié / march	sol / solar
Form neighbor of English word, same grammatical class		
bras / army	froid / comic	roue / wheat
chien / dot	maison / hound	vieux / odd
Form neighbor of English word, different grammatical classes		
chose / third	lit / beg	porte / carrot
court / robber	part / leaf	salle / roam
Related meaning same grammatical class		
cheval / cowboy	doigt / thumb	soie / wool
clé / door	nez / mouth	vague / sea
Related meaning, different grammatical classes		
chat / purr	lapin / hop	pense / brain
film / watch	neige / white	tasse / drink
Random distractor, same grammatical class		
lettre / portal	ordures / picture	savon / lamb
met / was	répare / strike	table / speed
Random distractor, different grammatical classes		
corde / sheer	glace / whirl	riz / idle
crayon / grassy	montre / cracked	sucre / legal
Translation pairs		
banque / bank	ivre / drunk	insiste / insists
élémentaire / basic	orielle / ear	prison / jail
plage / beach	terre / earth	dame / lady
évêque / bishop	père / father	loi / law
sang / blood	chiffre / figure	local / local
calendrier / calendar	écume / foam	déjeuner / lunch
menton / chin	suit / follows	minute / minute
comédie / comedy	fôret / forest	mère / mother
concéde / concede	fourchette / fork	mythe / myth
actuel / current	chance / fortune	voisin / neighbor
décrit / describe	bon / good	cahier / notebook
mourit / die	super / great	gens / people
poupée / doll	grandit / grows	privé / private
incertitude / doubt	mal / harm	fils / son
rêve / dream	hôtel / hotel	semaine / week
robe / dress	humain / human	fenêtre / window

Appendix B

Language History Questionnaire

1. What is your first language? _____
   Please list any other languages you speak/ have studied
   _____
   _____

2. How many semesters of college-level French classes have you completed?
   _____

If you are currently taking a French class, what number is it? (if you are in more than one, list the highest)
FRE _____

Please mark on the scale how difficult you find this class:

1	2	3	4	5
too easy		challenging enough		too challenging

5. If you are currently taking classes at SU/ESF, what year are you (eg. Sophomore, Junior, graduate student, etc)?
   _____

4. Have you participated in study abroad, learning community, or another immersion program? _____

If yes, please explain:
_____
_____
_____
_____
_____

4. Please mark where *you* think you fall on the following scales.

Reading French:

1	2	3	4	5
beginner		intermediate		native-like

Speaking French:

1	2	3	4	5
beginner		intermediate		native-like

Understanding spoken French:

1	2	3	4	5
beginner		intermediate		native-like

Writing French:

1	2	3	4	5
beginner		intermediate		native-like

Overall French proficiency:

1	2	3	4	5
beginner		intermediate		native-like

Your participant number is

_____

When prompted for your name, please enter this number.

Appendix C

Table 8: Reaction Time and Percent Accuracy for Bilingual Learner Compared to Other Beginning/Intermediate Learners of French

	Bilingual, English and Farsi				Beginning/Intermediate			
	Same Grammatical		Different Grammatical		Same Grammatical		Different Grammatical	
	RT	% Acc	RT	% Acc	RT	% Acc	RT	% Acc
Form neighbors to French	998	100.0%	1068	66.7%	1282	91.2%	1110	78.1%
Random Distractors	1401	100.0%	1666	100.0%	1458	82.9%	1376	94.3%
Interference	**403**	**0.0%**	**598**	**33.3%**	**176**	**8.3%**	**266**	**16.2%**
Form neighbors to English	1218	100.0%	923	83.3%	1311	91.2%	1465	88.9%
Random Distractors	1401	100.0%	1666	100.0%	1458	82.9%	1376	94.3%
Interference	**183**	**0.0%**	**743**	**16.7%**	**147**	**8.3%**	**89**	**5.4%**
Semantic Neighbors	1302	100.0%	1339	100.0%	1360	88.2%	1354	87.9%
Random Distractors	1401	100.0%	1666	100.0%	1458	82.9%	1376	94.3%
Interference	**99**	**0.0%**	**327**	**0.0%**	**98**	**5.3%**	**22**	**6.4%**

Table 9: Reaction Time and Percent Accuracy for Non-Native Speaker of English Compared to Other Intermediate/Advanced Learners of French

	L1 Spanish				Intermediate/Advanced			
	Same Grammatical		Different Grammatical		Same Grammatical		Different Grammatical	
	RT	% Acc	RT	% Acc	RT	% Acc	RT	% Acc
Form neighbors to French	1112	100.0%	1842	100.0%	1223	86.2%	1315	75.0%
Random Distractors	1060	100.0%	944	75.0%	1585	80.0%	1310	93.3%
Interference	**52**	**0.0%**	**898**	**25.0%**	**362**	**6.2%**	**5**	**18.3%**
Form neighbors to English	2130	100.0%	1977	100.0%	1262	90.0%	1501	86.7%
Random Distractors	1606	100.0%	944	75.0%	1585	80.0%	1310	93.3%
Interference	**524**	**0.0%**	**1033**	**25.0%**	**323**	**10.0%**	**191**	**6.6%**
Semantic Neighbors	1516	80.0%	1414	100.0%	1214	86.2%	1496	86.2%
Random Distractors	1606	100.0%	944	75.0%	1585	80.0%	1310	93.3%
Interference	**90**	**20.0%**	**470**	**25.0%**	**371**	**6.2%**	**186**	**7.1%**