3 RESULTS

The results of the experiment consisted of two elements: the post-test information and the data from the testing phases. The information solicited from the post-test was first used to determine if any subjects and/or verb stimuli needed to be eliminated based on subjects' language proficiency and prior vocabulary knowledge. Following this, the data from the first and delayed second test were tabulated and means were calculated prior to statistical analysis. As a point of information, the complete data from both testing sessions showing all 42 subjects and 45 verb stimuli may be found in Appendix E. Finally, the post-test responses regarding the psychotypological views of the subjects were tabulated, and the subjects' comments with respect to their use of strategies and their participation were recorded.

3.1 Analysis of post-test: subject/stimuli validity

Of the 65 original subjects who were present for the first day of testing session, only 42 were present for the delayed second test session and the post-test questionnaire. The 23 subjects who did not complete the post-test were therefore eliminated from the study. After evaluating the subjects (discussed below), the total number remaining in the experiment was 40 subjects.

Language proficiency

The first step of the analysis of the results was to evaluate the subjects' English level to ensure they were at an advanced level. TOEFL scores of over

500 were accepted, as well as similar qualifying certification (Cambridge or PET). Bilingual education (reaching an advanced level in high school English) was also accepted, as was successful completion of one the university's advanced English courses. Subject #21 did not provide evidence of his/her English level, but as the English knowledge section of the post-test questionnaire showed that the subject knew over 93% of the verb items, his/her responses were included in the study. Subject #2 reported a TOEFL score of 480, and since an evaluation of the English knowledge section of the post-test questionnaire revealed only an 84% comprehension level, the subject's data were consequently excluded from the results. In addition, subject #13 did not complete the French knowledge section. As his/her prior knowledge of the verb stimuli could not be established, this subject's data were also excluded from the results. The data from a total number of 40 subjects were therefore used in the results analysis. A complete listing of the subjects' reported English level information from the post-test questionnaire may be found in Appendix F.

Prior knowledge of stimuli

The second step of the analysis was to evaluate the subjects' prior knowledge of both English and French verbal stimuli. A minimum of 75% of the subjects affirming knowledge of each English verb was considered the limit to maintain the English verb in the study and use the data in the analysis of the results. This corresponded to at least 30 of the 40 subjects marking the *yes* box next to the English verbs. A check in the *yes* box signified that they knew the

verb. Subjects were only required to mark a *yes* or *no* box in a self-assessment of their own knowledge. An analysis of the post-test questionnaire revealed that six English verbs were unknown to more than 25% of the subjects. These included four English-French cognate verbs (*rejoice* [62.5%], *plead* [67.5%], *mock* [70%], and *lodge* [72.5%]) and two Non-cognate verbs (*gaze at* [47.5%] and *stroll* [60%]). These were removed from the study. Although several of these verbs were close to the 75% minimum required and would have permitted a larger number of verb stimuli in each condition to remain if kept in the study, they were removed to maintain the integrity of the study. The average rate of prior English knowledge for the remaining verb stimuli was 94.9% -- clearly over the 75% minimum. As further evidence of English knowledge, all stimuli were reviewed by 26 Spanish L1 speakers (with advanced English as their L2) who were not participants in the experiment. These included fellow graduate students and high school seniors in a bilingual Mexican school. These speakers stated that while some of the English verbs were lower in frequency, they were familiar with them. In three cases of English verb knowledge (*hasten*, *hesitate*, and *sour*) further analysis of the data showed that the subjects chose the English frame for the French verb, and there was an assumption by the researcher that the subject knew the English verb.

A maximum of 25% of the subjects affirming knowledge of the French verbs was considered the limit to maintain the French verb in the study and use the data in the analysis of the results. This corresponded to no more than 10 of the 40 subjects marking the *yes* box next to the French verbs. A check in the *no* box signified they did not know the verb. Subjects were required to mark a *yes* or *no*

box in a self-assessment of their own knowledge, and to provide a translation equivalent of the verb if they marked the *yes* box. An analysis of the post-test questionnaire revealed that four French verbs were known to more than 25% of the subjects. These included two English cognate verbs (*marier* [40%] and *paniquer* [27.5%]) and two Non-cognate verbs (*souvenir* [57.5%] and *essayer* [45%]). It is important to note that some subjects may have marked the *yes* box of any of the French verbs, implying that they knew the verb and thereby disqualifying it while in actuality it may have been an attempt at guessing or they may have been influenced by the similarity due to cognate status with their L1. In these cases, if further analysis of the data showed that the subject did not provide a correct Spanish translation or did not choose the correct frame for the verb, there was an assumption that the subject did not know the verb and the *no* box should have been marked.

The tally for the removal of verb stimuli for each condition thus far was as follows:

English Cognate:	4 English verbs	+	2 French verbs	=	6 total
Non-Cognate:	2 English verbs	+	2 French verbs	=	4 total

In order to maintain an equal number of stimuli in each condition for clearer statistical analysis, a total of six stimuli verbs were targeted for removal in each condition, giving 11 stimuli verbs per condition.

In an interesting aspect of the French section of the post-test, more than the 25% limit of subjects reported a prior knowledge of nine of the Spanish cognate verbs even though it was confirmed by French professors that these nine verbs had not yet been seen by the students. There are three possible explanations for this. First, the subjects may have felt they knew the verb previously since they had been exposed to it four times during the experiment. Second, the close similarity in form of these Spanish/French cognates may have influenced the subjects to report that they knew the French verb even though they had not, in reality, been exposed to the verb previously. Third, although perhaps less likely, the subject could actually have seen the verbs outside of class in other "French exposure" opportunities. An analysis of the test responses demonstrates that a significant number subjects did not apparently know the frame use for these French verbs. Since these verbs are in the Spanish cognate condition, however, the students could coincidentally choose the Spanish frame while not really knowing the French verb. Additionally, the verbs in question were not only true cognates but also exact translation equivalents, so when asked for the definition, the subjects could respond with the Spanish translation and be correct.

In order not to lose a larger number of verb stimuli because of undue cognate influence, the six verbs with the highest rate of mention were removed (*solliciter* [28/40], *féliciter* [25/40]*, manifester* [23/40]*, postuler* [19/40], *laver* [17/40], and *durer* [16/40]) and the three verbs with the lowest rate of mention (*sentir* [15/40], *calciner* [14/40], and *obstiner* [11/40]) were allowed to remain in the study.

As six verb stimuli needed to be extracted from each condition (due to the total six verbs being removed from the Spanish and English cognate conditions), an additional two verbs had to be removed from the non-cognate condition. The verb *réveiller* [8/40] and *rêver* [6/40] were chosen because of their status as the next-highest French verbs to be recognized. English verb stimuli were not chosen because almost all of the subjects reported knowing all of the remaining non-cognate English verb stimuli. The average rate of prior French knowledge for the remaining verb stimuli was 14.4%, well below the 25% minimum. The average rate of prior French knowledge for the stimuli was: 21.7% in the Spanish cognate condition, 11.1% in the English cognate condition, and 10.6% in the Non-cognate condition.

The data from a total number of 9 verbs per condition were therefore used in the results analysis. A complete listing of the subjects' reported English and French prior knowledge of the verb stimuli may be found in Appendix G.

The final tally for the removal of verb stimuli for each condition was as follows:

Spanish Cognate:	0 English verbs	+	8 French verbs	=	8 total
English Cognate:	4 English verbs	+	2 French verbs	=	6 total
Non-Cognate:	2 English verbs	+	2 French verbs	=	4 total
					---
					18 total

3.2 Analysis of test data

From the first test and the delayed second test data, the averages (means) for each subject's responses in the three conditions were calculated based on the rate of use of the Spanish frame for each item. A "1" was assigned each time a subject chose the Spanish frame use, and a "0" each time a subject chose the English frame use. Since the subjects were required to choose between the two sentences (A or B) in the testing phase, the rate of English frame use would simply be a mirror image of the Spanish frame use. A breakdown of the 40 subjects' frame selection of the nine verb stimuli from the first test session and the delayed second test session may be found in Appendix H. Data were statistically analyzed using GraphPad's Instat 3.0b software.

First testing session

The means from first test session are shown in Table 2. Results from the first testing session showed that the SpCog condition was where the Spanish frame was most frequently chosen. In the EngCog condition, the Spanish frame was chosen less often, i.e., the English frame was favored. The NoCog condition showed that the Spanish frame was chosen at a slightly greater rate than in the EngCog condition, but the English frame was still favored.

Condition	Mean	SD	SEM
SpCog	5.2	2.1507	0.34006
EngCog	3.975	1.7757	0.28077
NoCog	4.05	1.9075	0.30160

Table 2: Mean, Standard Deviation (SD), and Standard Error of Mean (SEM) of Spanish frame use per condition from the first testing session

These results are shown as percentages of Spanish frame selection in the form of a table (see Table 3) and a graph (see Figure 12):

	SpCog	*EngCog*	*NoCog*
Spanish Frame	57.58%	44.12%	45.00%
English Frame	42.22%	55.88%	55.00%

Table 3: Mean percentages of Spanish frame use per condition from the first testing session

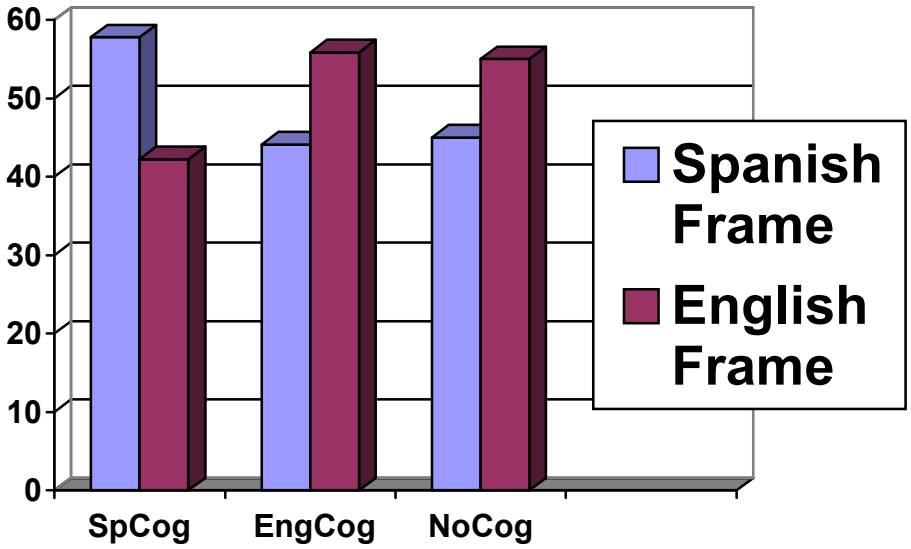

Figure 12: Mean percentages of Spanish frame use per condition from the first testing session

The results of an ANOVA showed that for the first testing session there was an extremely significant cognate status effect between conditions ($F(2,119) = 10.486$, $p < 0.0001$). This indicated that the variation among condition means was significantly greater than expected by chance. The details from the ANOVA are presented in Table 4:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square
Treatment (between conditions)	2	37.717	18.858
Individual (between subjects)	39	304.99	7.820
Random (residual)	78	140.28	1.799
	119	482.99	

F = 10.486 = MStreatment/MSresidual

Table 4: Intermediate calculations and ANOVA result for the first testing session

An assumption test was done to check if the matching of data was effective. The assumption test used another value of F of 4.348 and a different value of p. Since the p value was < 0.0001, and considered extremely significant, there was significant variation among means and the matching was apparently effective.

The Tukey-Kramer Multiple Comparison Test was then performed on the data from the first testing session in order to determine which means were significantly different from other means, and the results are presented in Table 5:

Comparison	Mean Difference	q	p value
SpCog vs. EngCog	1.225	5.777	*** p<0.001
SpCog vs. NoCog	1.150	5.423	*** p<0.001
EngCog vs. NoCog	-0.075	0.3537	ns p>0.05

Difference	Mean Difference	95% Confidence Interval From	To
SpCog - EngCog	1.225	0.5070	1.943
SpCog - NoCog	1.150	0.4320	1.868
EngCog - NoCog	-0.075	-0.7930	0.6430

Note: If the value of q is greater than 3.386 then the p value is less than 0.05.

Table 5: Tukey-Kramer Multiple Comparisons Test for the first testing session

The results of the Tukey-Kramer Multiple Comparisons test showed a significant difference between the SpCog vs. EngCog scores and the SpCog vs. NoCog scores, both of which had a p value of less than 0.001. It should be noted, however, that the EngCog vs. NoCog scores demonstrated no significant difference with a p value of greater than 0.05.

The possibility existed that the subjects might have chosen the correct French sentence because of their knowledge of French rather than the cross-linguistic influence from the cognates. In the SpCog condition, the French sentences that were correct included 10 Spanish frames, 4 English frames, and 1

of either frame use. The subjects mostly chose the Spanish frame, proving that the possibility existed. The EngCog condition contained 5 Spanish frames, 7 English frames, 2 of either frame use, and 1 of neither in the correct French sentences. As the subjects chose more English frames in this condition, the possibility could still exist. The correct French sentences in the NoCog condition included 11 Spanish frames and 4 English frames. Since the subjects chose more English frames than Spanish frames in this condition, the possibility that the subjects chose their responses based on their knowledge of French became remote.

Delayed second testing session

The means from the delayed second test session (held a week later) are shown in Table 6. Results from the delayed second testing session showed that the Spanish frame was once again chosen most often in the SpCog condition with an almost identical rate as the first testing session (difference of 0.025). As in the first testing session, the Spanish frame was chosen less in the EngCog condition. This meant that the English frame was still favored, although to a lesser degree. The NoCog condition continued to show a lower rate of Spanish frame selection than English frame selection, even slightly lower than the EngCog condition. Both the EngCog and NoCog conditions, however, demonstrated a smaller rate of English frame selection than in the first testing session. Interestingly, the NoCog condition showed a slightly higher rate of English frame selection than the EngCog condition (difference of 0.25). This point is addressed in the Discussion section.

Condition	Mean	SD	SEM
SpCog	5.175	2.1230	0.33567
EngCog	4.275	2.1242	0.33586
NoCog	4.25	2.0096	0.31744

Table 6: Mean, Standard Deviation (SD), and Standard Error of Mean (SEM) of Spanish frame use per condition from the delayed second testing session

These results are shown as percentages of Spanish frame selection in the form of a table (see Table 7) and a graph (see Figure 13):

	SpCog	*EngCog*	*NoCog*
Spanish Frame	57.50%	47.50%	47.22%
English Frame	42.50%	52.50%	52.78%

Table 7: Mean percentages of Spanish frame use per condition from the delayed second testing session

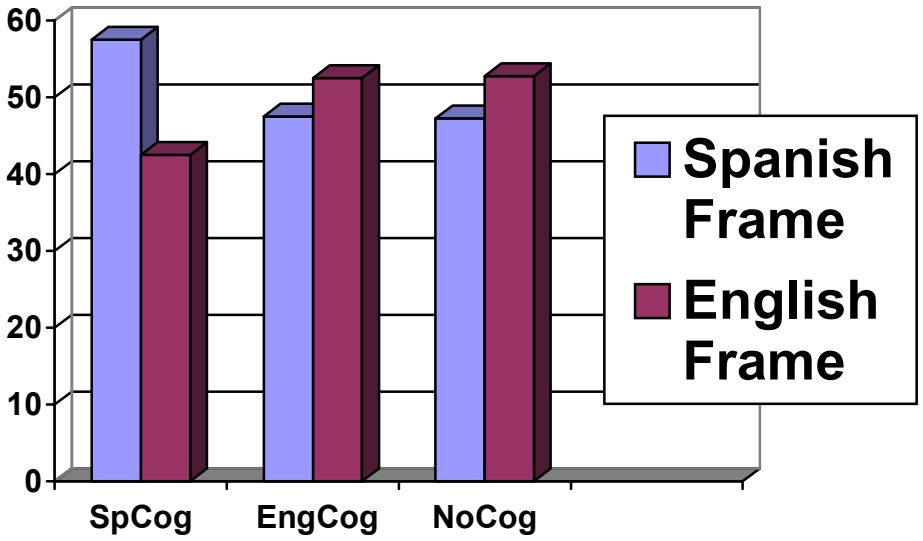

Figure 13: Mean percentages of Spanish frame use per condition from the delayed second testing session

The results of an ANOVA for the delayed second testing session showed that there was a smaller level of cognate status effect than in the first test. It was, however, still significant ($F(2,119) = 4.426$, $p = 0.0151$). While this still indicated that the variation among condition means was significantly greater than expected by chance, the overall variation was less significant than it was in the first testing phase. The details from the ANOVA are presented in Table 8:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square
Treatment (between conditions)	2	22.217	11.108
Individual (between subjects)	39	313.47	8.038
Random (residual)	78	195.78	2.510
	119	531.47	

F = 4.426 = MStreatment/MSresidual

Table 8: Intermediate calculations, ANOVA Table for the delayed second testing session

An assumption test was again done to check if the matching of data was effective. The assumption test used another value of F of 3.202 and a different value of p. The assumption test arrived at the p value of < 0.0001, the same as in the first testing session. It was considered extremely significant, and again there was significant variation among means and the matching was apparently effective.

Similarly, the Tukey-Kramer Multiple Comparison Test was performed on the data from the delayed second testing session in order to determine which means were significantly different from other means and the results are presented in Table 9:

Comparison	Mean Difference	q	p value
SpCog vs. EngCog	0.900	3.593	* p<0.05
SpCog vs. NoCog	0.925	3.693	* p<0.05
EngCog vs. NoCog	0.025	00.0998	ns p>0.05

Difference	Mean Difference	95% Confidence Interval From	To
SpCog - EngCog	0.900	0.5178	1.748
SpCog - NoCog	0.925	0.07678	1.773
EngCog - NoCog	0.025	-0.8232	0.8732

Note: If the value of q is greater than 3.386 then the p value is less than 0.05.

Table 9: Tukey-Kramer Multiple Comparisons Test for the delayed second testing session

The results of the Tukey-Kramer Multiple Comparisons test for the delayed second testing session showed a significant difference between the SpCog vs. EngCog scores and the SpCog vs. NoCog scores, both of which had a p value of less than 0.05. While still significant, there was a lesser degree of significance when compared to the first testing session. As in the first testing session results, it should be noted that the EngCog vs. NoCog scores demonstrated no significant difference with a p value of greater than 0.05.

3.2 Analysis of post-test: psychotypological views and comments

The information elicited in the final two sections of the post-test questionnaire provided valuable insight into the thought processes of the subjects as they participated in the experiment. The post-test questionnaire and the subjects' responses were originally in Spanish.

Psychotypological data

The results from the five multiple-choice questions on the psychotypological views and beliefs of the relationships between Spanish, English, and French are presented in Table 10. A complete listing of the subjects' responses may be found in Appendix I.

Question	*Options*	*% Response*
Which of the languages is more similar to French?	Spanish	94.9
	English	5.1
Which languages are the most similar?	French/Spanish	89.7
	French/English	7.7
	Spanish/English	2.6
For a native Spanish speaker, which language is easier to learn?	French	48.7
	English	51.3
For a native English speaker, which language is easier to learn?	Spanish	38.5
	French	61.5
Historically, like in a family tree, which is the correct relationship among the three languages? (see "trees" in Appendix C)	((Eng, Sp) Fr)	10.3
	(Fr, Eng, Sp)	25.6
	((Fr, Eng) Sp)	5.1
	((Fr, Sp) Eng)	59.0

Table 10: Psychotypology results from the post-test questionnaire

Subject comments

Three open-ended questions were presented to the subjects. Subjects were free to answer the questions in as short or as long as a response as they desired. Two of the questions focused on the strategies the subjects may have utilized. The questions were:

1) Did you utilize any special strategy when *studying the words* during the original presentation last week? What were they?

2) Did you utilize any special strategy when *choosing the correct sentence* during the testing sessions? What were they?

The third question allowed the subjects to express any comment or question they may have had during the experiment:

3) Do you have any other comments about the study or your participation?

A complete listing of the subjects' responses to the three questions may be found in Appendix J, and a discussion of those responses may be found in section 4.5.

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The interpretation and implications of the results from both testing sessions and the post-test questionnaire are elaborated on in the next chapter.