Chapter III

The following sections present the results and discuss the statistical analyses performed on the data to identify the possible interactions between the conditions.

3.1. Data trimming

In a translation recognition task, it is important for the participants to have knowledge of the stimuli. Data from participants who obtained a 10% error rate or above were eliminated from the analysis, reducing the final sample size from 46 to 35 participants. It was considered that these participants did not have representative knowledge of the stimuli for the target population. Table 2 summarizes the total error rates and specifies the number of participants. The mean error rate for the 46 participants was 7%, and 5% for the 35 participants which suggests that the words were accurately chosen for the translation recognition task.

Error Rate	Total Number of Participants	Removed
0%	1	
1%	3	
2%	3	
3%	6	
4%	2	
5%	4	
6%	7	
7%	3	
8%	2	
9%	4	
10%	3	X
11%	1	X
12%	1	X
15%	4	X
19%	1	X
21%	1	X

Table 2. Error rates with respective number of participants

The overall mean RTs across 35 participants and 88 items was calculated and the standard deviation was obtained, summarized in Table 3. A difference between the mean reaction times across the participants and items surfaced after the elimination of the data from the 11 participants. Also, all the RTs below or above two and a half times the standard deviation were discarded from the analysis to eliminate any outliers.

	Mean Reaction Time (M)	Standard deviation (SD)	Sample size (N)
Participant Means	840.3279627	184.36	35
Item Means	846.6679	158.05	88

Table 3. Participant and item mean reaction times.

3.2. Results

Empirical results have traditionally identified a concreteness effect where concrete words are recognized faster than abstract words (de Groot, 1992a; de Groot et al.,1994; van Hell and de Groot; Schönpflug, 1997; Tokowicz and Kroll, in press). In order to identify a concreteness effect for the present data, the mean reaction times were obtained across participants and items and are summarized in Table 4. The mean reaction time for concrete words is faster than the mean reaction times for abstract words across items and across participants.

	Mean Reaction Time (M)	Standard deviation (SD)	Sample size (N)
Participant Means			
Concrete	740.1418484	111.74	35
Abstract	785.9603368	111.4	35
Item Means			
Concrete	738.8469663	75.615	44
Abstract	786.275085	96.584	44

Table 4. Participant and item mean reaction times, standard deviations and sample size for concrete and abstract words

In order to test whether these means were significantly different, an unpaired t-Test was performed. With an alpha level of 0.05, the difference across participants was not considered quite significant. The difference across items on the other hand was considered to be statistically significant, $F = 6.58$, $p < 0.0121$.

Empirical results from previous studies further shown ambiguity effects (Tokowicz and Kroll, 2000; in press). It was thus important to identify whether ambiguity effects manifested themselves independently of concreteness effects for the present data. The mean reaction times were obtained across participants and items summarized in Table 5. The mean reaction times for the multiple translation equivalents are slower across participants and items than for the single translation equivalents.

	Mean Reaction Time (M)	Standard deviation (SD)	Sample size (N)
Participant Means			
Multiple Translation Equivalents	780.269126	106.11	35
Single Translation Equivalents	744.6388388	117.38	35
Item Means			
Multiple Translation Equivalents	781.9731334	89.832	44
Single Translation Equivalents	743.148918	85.768	44

Table 5. Participant and item mean reaction times, standard deviations and sample size for multiple and single translation equivalents.

In order to test whether these means were significantly different, an unpaired t-Test was performed. With an alpha level of 0.05, the difference across participants was not statistically significant. The difference across items was considered significant, $F = 4.3$, $p < 0.0411$.

The present study sought to identify an interaction across the four conditions. The mean reaction times were obtained across the four conditions for participants and are summarized in Table 6. Only the correct data from the true translation pairs were considered in the statistical analysis. The mean reaction time for concrete words with single translations was recognized faster, followed by concrete words with multiple

translations, than abstract words with single translations and finally, the abstract words with multiple translations were recognized the slowest.

Condition	Mean Reaction Time (M)	Standard deviation (SD)	Sample size (N)
Condition 1 Concrete Single (CS)	723.3736615	123.04	35
Condition 2 Concrete Multiple (CM)	755.3380616	107.55	35
Condition 3 Abstract Single (AS)	766.9873261	119.49	35
Condition 4 Abstract Multiple (AM)	805.1497692	92.781113.96	35

Table 6. Mean reaction times, standard deviation and sample size across participants.

In order to test whether these means were significantly different, a one-way Analysis of Variance (ANOVA) test was performed. With an alpha level of 0.05, the difference across participants was statistically significant, $F (3, 136) = 2.96$ $p < 0.0347$.

In light of these findings, a Tukey-Kramer Multiple Comparisons Test was performed to identify significant differences between the individual conditions. A significant difference between Condition 1 (CS) and Condition 4 (AM) is reported where q is greater than 3.683 and is $p<0.05$. The reaction times for participants under Condition 4 were slower than those from Condition 1.

A second analysis was performed on the items' means. The mean reaction time and the standard deviation were obtained and are summarized in Table 7. Similar results were obtained to the participant analysis where concrete words with multiple and

single translations were recognized faster than the abstract words with single and multiple translations.

Condition	Mean Reaction Time (M)	Standard deviation (SD)	Sample size (N)
Condition 1 Concrete Single (CS)	720.183637	69.657	22
Condition 2 Concrete Multiple (CM)	757.5102957	78.266	22
Condition 3 Abstract Single (AS)	766.114199	95.421	22
Condition 4 Abstract Multiple (AM)	806.4359711	95.626	22

Table 7. Mean reaction times, standard deviation and sample size across items

In order to test whether these means were significantly different, an ANOVA test was performed. With an alpha level of 0.05, the difference across items was statistically significant, $F_{(3, 84)} = 3.77$, $p < 0.0136$, indicating a significant difference between these conditions.

In light of these findings, a Tukey-Kramer Multiple Comparisons Test was performed to identify significant differences between individual conditions. Similar results were again obtained where the means from the abstract multiple and the concrete single interact significantly where abstract words with multiple translations are recognized more slowly than concrete words with single translations. The value of q was greater than 3.716 and the P value is less than 0.05.

In both the analyses for participants and for items, the abstract multiple and concrete single conditions are significantly different in the expected direction. The

mean reaction time is greater for the abstract multiple condition than the single concrete condition. Let us now consider these results in detail in light of the DFM (de Groot, 1992a).