



## **CHAPTER THREE**

### **EXPERIMENTAL DESIGN AND RESULTS**

In this chapter, I will describe the present experiment, which investigates how our high school students and college students acquire English QNPs. In section 3.1, I will describe the background information of the subjects. In section 3.2, the methodologies adopted in the present experiment and the test materials will be presented. In section 3.3, I will show the procedures and in section 3.4, the expected findings will be reported.

#### **3.1 Subjects**

Two groups of students participated in this study (30 sophomores from the English Department in NTNU and 30 first-year high school students<sup>1</sup> from Municipal Kaohsiung Senior High School). The former group were high achievers in English and the latter group, comparatively speaking, were low achievers. Besides, there were two control groups, consisting of 18 native speakers of English and 15 Chinese majors. Before the experiment, the subjects were asked to fill out their background information (see Appendix A). Table 3-1 shows the information of the four groups:

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<sup>1</sup> There were 42 high school students answering the questionnaire of the study, but I excluded 12 students' answers from the raw data of the formal testing. Among the 12 students, 6 had better performance in English than the others and 6 performed worse than the others. The information of the students' performance on English was provided by their English teacher, Miss Xu.

Table 3-1: Personal Information of the Subjects

Group		E1 <sup>2</sup> (n = 30)	E2 (n = 30)	NE (n = 18)	NC (n = 15)
Gender	M	30	5	14	5
	F	0	25	4	10
Age	Mean	15.57	19.38	26.44	28.73
	SD	0.5683	0.6687	8.0016	4.280
	Range	15~17	18~22	20~53	24~41

As shown in Table 3-2, college students had been studying English for longer time than high school students had.

Table 3-2: English Learners' Language Background

Group \ Background	E1 (n=30)			E2 (n=30)		
	Mean	SD	Range	Mean	SD	Range
Number of Years of English Learning	4.48	1.2898	3~7	9.70	2.2614	8~17

### 3.2 Methodologies and Material

There were many kinds of methodologies used in the study of language acquisition, such as grammaticality judgment tasks, imitation tasks, translation tasks, or questionnaires (Larsen-Freeman & Long 1991). In the study of acquisition of quantification, the commonly adopted tasks were a picture identification task (Philip 1991; 1992, Roeper and de Villiers 1991, Takahashi 1991), a story-telling task (Crain *et al.* 1996), a truth value judgment task (Crain *et al.* 1996), and an act-out task (Lee 1991).

Even though some tasks were used to investigate the acquisition of QNPs, in the present study there are several reasons for not adopting them. First, the previous

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<sup>2</sup> E1 refers to the high school students, E2 refers to the college students, NE refers to the native speakers of English, and NC refers to the Chinese majors.

studies did not focus on the interpretation of ambiguity property of QNPs, which is however one purpose of the present study. As a result, the tasks adopted by previous researchers are not suitable for the present study. Second, all these studies were related to L1 acquisition of QNPs, not L2 acquisition. Third, in order to examine whether our subjects are aware of the ambiguity property of QNPs, it is necessary to design a task that can elicit distributive and collective readings. That is, if a subject prefers a distributive reading, he can choose the answer of that reading. If he thinks that both readings are fine, then he can choose both. In this way, how our subjects interpret QNPs can be truly reflected and the subjects would not feel being forced to make a choice on one of the readings when they think both readings are possible. Fourth, story-telling tasks and act-out tasks are suitable for kids. For adult subjects who can read and write, they may feel it is time-consuming for them to work on such tasks.

According to White (1989), giving two tasks in one experiment can reduce the influence of factors out of the experimenter's concern and prevent the response biases. Therefore, I designed two comprehension tasks for the present study, a picture-selection task and a problem-solving task. In the picture-selection task, two pictures were given with one test sentence. One picture corresponded to the distributive reading of the test sentence, and the other picture represented the collective reading. In the problem-solving task, one test sentence was embedded in a short story and at the end of the story, a question was given. The subjects were later asked to answer the question, following their interpretations of the test sentence in the story. The purpose of the present study was to examine Taiwanese students' interpretations of English test sentences containing QNPs; accordingly, except the test sentences, all information was given in Chinese.

All the test sentences that were used to examine Taiwanese students' interpretations of English QNPs in different syntactic constructions are shown in Table 3-3:

Table 3-3: Number of Test Sentences for Each Syntactic Construction

Syntactic Sequence	Task Construction	Picture- Selection Task	Problem- Solving Task
a universal QNP preceding an existential QNP (U > E)	Simple Active	2	2
	Simple Passive	2	2
	Double Object	2	2
	Dative	2	2
	Subject Control	2	2
	Object Control	2	2
an existential QNP preceding a universal QNP (E > U)	Simple Active	2	2
	Simple Passive	2	2
	Double Object	2	2
	Dative	2	2
	Subject Control	2	2
	Object Control	2	2
Fillers	Sentences containing only numeral QNPs	6	6
Total		30	30

For the English learners and English native controls, the test sentences were given in English. However, the test sentences for the Chinese native controls were written in Chinese. The Chinese test sentences were directly translated from their

English counterparts. For instance, the English test sentence, *Every child wants to eat one piece of chocolate cake*, was translated into *Meige haizi xiang yao chi yikuai dangao*.

The questionnaire was administered in two parts: a picture-selection task (see Appendix B) and a problem-solving task (see Appendix C). For each of these two tasks, 12 items were designed to test how the sequence of a universal QNP preceding an existential QNP in different syntactic constructions influenced the subjects' interpretations. The other 12 items were designed to examine the effect of an existential QNP preceding a universal QNP in six constructions. Therefore, there were 24 test sentences and 6 fillers for each task. In each task, all the test sentences were randomized. Examples of the test sentences for different syntactic constructions are shown in Table 3-4:

Table 3-4: Examples of the Test Sentences Used in Different Syntactic Constructions

Sequence	Tested Construction	Example
a universal QNP preceding an existential QNP (U > E)	Simple Active	Every child is eating one cake.
	Simple Passive	Every cat is being fed by one person.
	Double Object	The teacher bought every student one book.
	Dative	The man bought every flower for one woman.
	Subject Control	Every fisherman promised to take one person over the river.
	Object Control	Every person expects one football team to win the championship.
an existential QNP preceding a universal QNP	Simple Active	One girl is playing with every child.
	Simple Passive	One fish was caught by every bird.
	Double Object	The girl gave one beggar every coin.


(E > U)	Dative	The mommy duck gave one fish to every baby duck.
	Subject Control	One child is trying to jump over every hurdle.
	Object Control	One teacher expects every student to finish her own paper on time.

In the picture-selection task, two pictures were given for each test sentence. One picture corresponded to the distributive reading of the test sentence and the other picture to the collective reading. All the test sentences were presented in a multiple-choice format, in which four options were given for each test sentence. The subjects were asked to choose one option out of the four, based on their interpretation of the QNPs in the test sentence. In this task, it was possible for the subjects to choose the option of both the distributive and collective readings. An example of a test sentence used in the picture-selection task is given in Table 3-5<sup>3</sup>:


Table 3-5: A Test Sample Used in the Picture-Selection Task

(        ) There are two pictures below. Which one / ones do you think represent(s) the meaning / meanings of the sentence, “*One fish was caught by every bird*”?

①Picture 1      ②Picture 2      ③Both pictures      ④None



**Picture 1**



**Picture 2**

<sup>3</sup> For the English native controls, the task was given in English.

In the problem-solving task, all the test sentences were embedded in short stories. At the end of a story, the subjects were asked, “If you were one of the characters of the story, what would you do?” At the end of every question, a classifier and a noun were given in parentheses, which restricted the subjects’ answers to one question. In this task, it was also possible for the subjects to give both the distributive and collective readings. All they had to do was to write down two answers. Before doing the problem-solving task, the subjects were given clear instructions of how to complete the task. A sample of a test sentence used in the problem-solving task is shown in Table 3-6<sup>4</sup>:

Table 3-6: A Test Sample Given in the Problem-Solving Task

<p>School A is going to hold a sports meet. Ten desks in Mary’s class will be used on that day. Mary’s teacher asks Mary whether these ten desks have been moved. Mary says, “<i>Every desk was moved by one student.</i>” If you were Mary’s teacher, how many presents would you buy for the student / students that helped to move the desks?</p> <p style="text-align: right;"><b>( present / presents )</b></p>
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### 3.3 Procedures

The present experiment had three stages (i.e., the pilot study, formal testing and scoring).

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<sup>4</sup> The task for the English native controls was in English.

### 3.3.1 Pilot Study

In the pilot study, two pretests were given to ensure the validity of the tasks. In the first pretest, one English major and one non-English major were asked to do the two tasks. This pretest aimed at examining whether the subjects knew how to do the experiment. The results showed that it was difficult for the subjects to answer questions in the problem-solving task. Even though they had been given a classifier and a noun at the end of each question, they still asked for explanation for doing the task several times. Therefore, I revised the format by providing examples and some instructions at beginning of the two tasks.

In the second pretest, I e-mailed the questionnaire consisting of a picture-selection task and a problem-solving task to six English majors studying in the Graduate Institute of English Department in NTNU and six non-English majors who were graduate students, too. There were 14 English test sentences and 14 Chinese test sentences for each task. The results showed that although the subjects knew how to do the problem-solving task, it still took time. The results of the second pretest are discussed below:

Table 3-7: Test Sentences in the Picture-Selection Task

Sentence	SA		SP		DO		Da		Raising		SC		OC	
	U+E	E+U	U+E	E+U	U+E	E+U	U+E	E+U	U+E	E+U	U+E	E+U	U+E	E+U
No.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)

Among the 14 English test sentences in the picture-selection (PIS) task, the subjects preferred the reading that the preceding QNP had wide scope over the following QNP, except sentences (7), (8), and (9). The reason for the different interpretations of QNPs in (7) and (8) might be that dative constructions are derived from the double object constructions (Aoun & Li 1989). Accordingly, the interpretation that the following QNP had wide scope was predominant in (7) and (8).



In sentence (9), even though a universal QNP preceded an existential QNP, the wide scope interpretation of the existential QNP was more salient for the subjects. The different interpretation of QNPs in sentence (9) might result from the experimental flaw. Sentence (9) was revised. Except sentence (9), there seemed to be no significant construction effects in the PIS task. The findings also indicated that our English majors had a higher tendency of choosing ambiguous readings than the non-English majors, especially when a universal QNP preceded an existential QNP.

Table 3-8: Test Sentences in the Problem-Solving Task

Sentence	SA		SP		DO		Da		Raising		SC		OC	
	U+E	E+U	U+E	E+U	U+E	E+U	U+E	E+U	U+E	E+U	U+E	E+U	U+E	E+U
No.	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)

Similar to the findings in the PIS task, the findings of the problem-solving (PRS) task showed that there were no construction effects. In these constructions, the subjects preferred the reading that the preceding QNP had wide scope over the following QNP. In this task, some English majors chose ambiguous readings while interpreting sentences (15), (21), and (23) but none of the non-English majors did so while interpreting the test sentences. However, the percentage of choosing ambiguous readings in this task was lower than that in the PIS task. Sentences (15), (21), and (23), which were interpreted as ambiguous by some English majors, contained a universal QNP preceding an existential QNP. Moreover, the group effect was found in response to sentences (20), (23), and (28). After taking a closer look at the three sentences, I found that the group effects resulted from the experimental flaws. In (20), the relationship between the direct object and indirect object was unclear and thus confused the subjects. In (23), the tense and aspect were too complicated for the non-English majors to interpret it. In (28), the vocabulary ought to be simplified.

Accordingly, I revised the test sentences in the formal testing (for more information, please see Appendix F).

The results of the second pretest showed that there were no construction effects, that English majors had higher tendency of choosing ambiguous readings than non-English majors, and that the subjects had higher tendency of choosing ambiguous readings when a universal QNP preceded an existential QNP. As for the task effects, English majors had more ambiguous readings in the picture-selection task than in the problem-solving task.

### **3.3.2 Formal Testing**

After several revisions, the final versions of the picture-selection task and the problem-solving task were used for the present study. The subjects were informed that the tests were only used for a research purpose and that they had the right to know the procedures and results of the research. The formal testing was given in two settings (one in the English Department and the other in Municipal Kaohsiung Senior High School). In filling in the questionnaire, the subjects were told that they could ask questions if they had any difficulty understanding the pictures and the words in the English sentences. After the subjects finished the tasks, all their responses were collected. They were all given a small gift to show my appreciation.

### **3.3.3 Scoring**

After the data were collected, there followed the scoring and statistical analyses. All the collected answers were put in order and tabulated. Sentences containing only numeral QNPs were fillers so they were not analyzed for the results.

Every response was entered into the SPSS statistics package and processed by

the computer. The Chi-square test and posterior comparisons<sup>5</sup> were applied for data analysis.

### **3.4 Results**

In this section, I will first present the results of the problem-solving task and then the results of the picture-selection task.

#### **3.4.1 The Problem-Solving Task**

The results of the problem-solving task are presented in the following tables with respect to the different syntactic constructions (i.e., simple active, simple passive, double object, dative, subject control, and object control constructions), responded to by our college students, high school students, native speakers of English, and the Chinese majors.

##### **3.4.1.1 Simple Active Constructions**

Table 3-9 shows the results of the subjects' responses to simple active constructions with a universal QNP in the subject position and an existential QNP in the object position:

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<sup>5</sup> According to Lin (1992), if chi-square shows that the differences are significant, posterior comparisons will be needed to understand what really causes the differences.

Table 3-9: Subjects' Interpretations of Simple Active Sentences with a Universal QNP Preceding an Existential QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1 <sup>6</sup>	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1 <sup>7</sup>	100	86.7	61.1	100	0	3.3	22.2	0	0	10.0	16.7	0
N2	96.7	90.0	88.9	93.3	0	3.3	0	6.7	3.3	6.7	11.1	0
Average	98.35	88.35	75.0	96.65	0	3.3	11.1	3.35	1.65	8.35	13.9	0

As can be seen above, Groups 1 and 2 was all in favor of the distributive reading in response to N1 and N2; however, Group 1 preferred the distributive reading more. Table 3-9 also shows that Group 2 had higher percentages of choosing the collective and ambiguous readings than Group 1. However, the Chi-square test showed that the differences in Group 1's and Group 2's interpretations of N1 and of N2 were not significant (E1 vs. E2:  $\chi^2 < 5.991$ ,  $p > 0.05$ ). Compared with the English native controls, Groups 1 and 2 liked the distributive reading more and their percentages of choosing the ambiguous reading were lower in interpreting N1 and N2. According to the Chi-square test and posterior comparisons, Group 1's interpretations of N1 were significantly different from the native controls in the distributive reading (E1 vs. NE:  $\chi^2 = 12.000$ ,  $\psi = 0.389 \pm 0.282$ ). With respect to the comparisons of Group 2's interpretations of N1 with NE's, the Chi-square test and posterior comparisons showed that Group 2 also responded significantly differently from NE in the distributive reading (E2 vs. NE:  $\chi^2 = 8.056$ ,  $\psi = 0.256 \pm 0.249$ ). While interpreting N2, the Chi-square test showed that both Groups 1 and 2 did not perform significantly differently from NE.

The experimental groups and the Chinese majors had similar interpretations of N1 and N2. However, the English native controls liked the distributive reading less

<sup>6</sup> E1 refers to the high school students, E2 refers to the college students, NE refers to the native speakers of English, and NC refers to the Chinese majors.

<sup>7</sup> In both tasks, I asked two questions for every syntactic construction with either of the two sequences. In the two questions, one was referred to as N1 and the other was N2.

than the Chinese majors in response to N1 (NE vs. NC in N1:  $\chi^2 = 7.404$ ,  $\psi = 0.389 \pm 0.281$ ).

To sum up, the two experimental groups and the Chinese majors responded to N1 and N2 similarly; however, there were significant differences between Group 1 and NE, between Group 2 and NE, and between NC and NE in interpreting N1.

Table 3-10 shows the results of the subjects' responses to simple active constructions consisting of an existential QNP in the subject position and a universal QNP in the object position:

Table 3-10: Subjects' Interpretations of Simple Active Sentences with an Existential QNP Preceding a Universal QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	0	0	0	0	100	100	83.3	100	0	0	16.7	0
N2	0	0	16.7	0	100	96.7	55.6	100	0	3.3	27.8	0
Average	0	0	8.35	0	100	98.35	69.45	100	0	1.65	22.25	0

As shown in Table 3-10, different from their responses to simple active constructions with a universal QNP preceding an existential QNP, Groups 1 and 2 preferred the collective reading when the sequence of QNPs was reversed. As we can see in Table 3-10, the interpretations of N1 and of N2 of Groups 1 and 2 were similar. According to the Chi-square test, Groups 1 and 2 did not show any significant difference in interpreting N1 and N2 (E1 vs. E2:  $\chi^2 < 5.991$ ,  $p > 0.05$ ). Different from our English native controls, Groups 1 and 2 had higher percentages of the collective reading. The Chi-square test showed that Group 1's and Group 2's interpretations of N1 were not significantly different from the English native controls; however, the Chi-square test indicated that in response to N2, Groups 1 and 2 responded significantly differently from our English native controls (E1 vs. NE:  $\chi^2$

= 16.000; E2 vs. NE:  $\chi^2 = 12.718$ ). Posterior comparisons further showed that Groups 1 and 2 significantly preferred the collective reading more than the English native controls (E1 vs. NE:  $\psi = 0.444 \pm 0.287$ ; E2 vs. NE:  $\psi = 0.441 \pm 0.298$ ). Besides, posterior comparisons indicated that Group 1 was less in favor of the ambiguous reading of N2 than our English native controls (E1 vs. NE:  $\psi = 0.278 \pm 0.259$ ). Therefore, we know that the two experimental groups' interpretations of N1 and N2 were similar and they all preferred the collective reading more than the English control group.

The interpretations of N1 and N2 of the Chinese controls were similar to those of the experimental groups. However, compared with the English native controls, they preferred the collective reading more and the ambiguous reading less in interpreting N2 (NC vs. NE in N2:  $\chi^2 = 8.800$ ,  $\psi$  of the collective reading =  $0.444 \pm 0.287$ ,  $\psi$  of the ambiguous reading =  $0.278 \pm 0.258$ ).

Generally speaking, the experimental groups' and the Chinese control group's interpretations of QNPs in simple active constructions were quite similar. They preferred the distributive reading when a universal QNP preceded an existential QNP and the collective reading when the sequence of QNPs was reversed. They significantly preferred the preceding QNP to have a wide scope interpretation more than the native controls.

#### **3.4.1.2 Simple Passive Constructions**

Presented in Table 3-11 are the subjects' interpretations of QNPs, a universal QNP preceding an existential QNP, in simple passive constructions:

Table 3-11: Subjects' Interpretations of Simple Passive Sentences with a Universal QNP Preceding an Existential QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	56.7	53.3	22.2	60.0	33.3	30.0	50.0	26.7	10.0	16.7	27.8	13.3
N2	73.3	56.7	11.1	66.7	20.0	36.7	72.2	20.0	6.7	6.7	16.7	13.3
Average	65.0	55.0	16.65	63.35	26.65	33.35	61.1	23.35	8.35	11.7	22.25	13.3

As we can see in Table 3-11, in response to N1 and to N2, Groups 1 and 2 preferred the distributive reading. Group 1 liked the distributive reading more than Group 2. The Chi-square test showed that Groups 1 and 2 did not have any significant differences in interpreting N1 and N2. Table 3-11 also illustrates that the interpretations of Groups 1 and 2 were different from the English control group, who were more in favor of the collective reading in response to N1 and N2. According to the Chi-square test, in response to N1 the two experimental groups' interpretations were not significantly different from the English native controls. With regard to N2, the Chi-square test and posterior comparisons indicated that Groups 1 and 2 significantly preferred the distributive reading more than the English native controls and that the percentages of the choices of the collective reading by Groups 1 and 2 were significantly lower than the English control group (E1 vs. NE:  $\chi^2 = 17.542$ ,  $\psi$  of the distributive reading =  $0.622 \pm 0.268$ ,  $\psi$  of the collective reading =  $0.522 \pm 0.315$ ; E2 vs. NE:  $\chi^2 = 9.823$ ,  $\psi$  of the distributive reading =  $0.456 \pm 0.287$ ,  $\psi$  of the collective reading =  $0.355 \pm 0.337$ ).

Compared with the Chinese native controls, the two experimental groups did not show any significant difference in interpreting N1 and N2. Nevertheless, the Chinese controls preferred the distributive reading more and the collective reading less than the English controls (NC vs. NE:  $\chi^2 = 11.607$ ,  $\psi$  of the distributive reading =  $0.556 \pm 0.349$ ,  $\psi$  of the collective reading =  $0.522 \pm 0.413$ ) when they interpreted N2.

The four groups' responses to the simple passive constructions with an existential QNP preceding a universal QNP are shown in Table 3-12:

Table 3-12: Subjects' Interpretations of Simple Passive Sentences with an Existential QNP Preceding a Universal QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	36.7	46.7	83.3	33.3	53.3	46.7	5.6	66.7	10.0	6.7	11.1	0
N2	36.7	36.7	72.2	33.3	50.0	50.0	5.6	66.7	13.3	6.7	22.2	0
Average	36.7	41.7	77.75	33.3	51.65	48.35	5.6	66.7	11.65	6.7	16.65	0

Table 3-12 shows that different from their responses to simple passive sentences with a universal QNP preceding an existential QNP, Groups 1 and 2 liked the collective reading more when a universal QNP followed an existential QNP. According to the Chi-square test, Groups 1 and 2 did not significantly differed in response to N1 and N2. Nevertheless, our English native controls preferred the distributive reading in interpreting N1 and N2, shown in Table 3-12. The significant differences between the experimental groups and the English control group were found after the Chi-square test (E1 vs. NE in N1:  $\chi^2 = 11.787$ ; E2 vs. NE in N1:  $\chi^2 = 8.855$ ; E1 vs. NE in N2:  $\chi^2 = 10.044$ ; E2 vs. NE in N2:  $\chi^2 = 10.044$ ). Posterior comparisons showed that Groups 1 and 2 responded significantly differently from the English control group in the distributive and collective readings (E1 vs. NE in N1:  $\psi$  of the distributive reading =  $0.466 \pm 0.304$ ,  $\psi$  of the collective reading =  $0.477 \pm 0.260$ ; E2 vs. NE in N1:  $\psi$  of the distributive reading =  $0.366 \pm 0.310$ ,  $\psi$  of the collective reading =  $0.411 \pm 0.260$ ; E1 vs. NE in N2:  $\psi$  of the distributive reading =  $0.355 \pm 0.337$ ,  $\psi$  of the collective reading =  $0.444 \pm 0.260$ ; E2 vs. NE in N2:  $\psi$  of the distributive reading =  $0.355 \pm 0.337$ ,  $\psi$  of the collective reading =  $0.444 \pm 0.260$ ).

As far as the Chinese native controls are concerned, their interpretations of



Chinese QNPs were similar to the experimental groups' interpretations of English QNPs in response to N1 and N2. Compared with the English controls, they preferred the distributive reading less and the collective reading more (NC vs. NE in N1:  $\chi^2 = 14.208$ ,  $\psi$  of the distributive reading =  $0.5 \pm 0.367$ ,  $\psi$  of the collective reading =  $0.611 \pm 0.372$ ; NC vs. NE in N2:  $\chi^2 = 11.787$ ,  $\psi$  of the distributive reading =  $0.389 \pm 0.370$ ,  $\psi$  of the collective reading =  $0.611 \pm 0.372$ ).

To sum up, similar to their interpretations of QNPs in simple active constructions, Group 1, Group 2 and the Chinese native controls preferred the preceding QNP to have a wide scope interpretation when they interpreted QNPs in simple passive constructions. Their interpretations of QNPs interacting in simple passive constructions were significantly different from the English native controls, who preferred the following QNP in passive constructions to have a wide scope interpretation and liked the ambiguous reading more.

### 3.4.1.3 Double Object Constructions

Presented in Table 3-13 are the four groups' responses to double object constructions with a universal QNP preceding an existential QNP:

Table 3-13: Subjects' Interpretations of Double Object Sentences with a Universal QNP Preceding an Existential QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	53.3	73.3	61.1	66.7	40.0	23.3	22.2	26.7	6.7	3.3	16.7	6.7
N2	83.3	83.3	66.7	80.0	13.3	13.3	11.1	13.3	3.3	3.3	22.2	6.7
Average	68.3	78.3	63.9	73.35	26.65	18.3	16.65	20.0	5.0	3.3	19.45	6.7

Table 3-13 indicates that Groups 1 and 2 preferred the distributive reading when interpreting double object constructions with a universal QNP preceding an existential

QNP. In response to N1, Group 2 preferred the distributive reading more, but in response to N2, Groups 1 and 2 had similar interpretations. The Chi-square test indicated that the percentage differences between Groups 1 and 2 were not significant. Compared with the English control group, Group 1 had a lower percentage of the distributive reading in response to N1 and Groups 1 and 2 exhibited more distributive readings and fewer ambiguous readings of N2. However, after the test of Chi-square, it was found that the Groups 1 and 2 were not significantly different from the control group in the distributive, collective, and ambiguous readings in interpreting N1 and N2 ( $\chi^2 < 5.991, p > 0.05$ ).

The Chinese control group's interpretations of Chinese QNPs were similar to the experimental groups' and the English native controls' interpretations of English QNPs ( $\chi^2 < 5.991, p > 0.05$ ).

Subjects' responses to double object constructions in which an existential QNP preceded a universal QNP are shown in Table 3-14:

Table 3-14: Subjects' Interpretations of Double Object Sentences with an Existential QNP Preceding a Universal QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	0	3.3	5.6	13.3	93.3	90.0	83.3	80.0	6.7	6.7	11.1	6.7
N2	0	3.3	0	6.7	100	90.0	83.3	93.3	0	6.7	16.7	0
Average	0	3.3	2.8	10.0	96.65	90.0	83.3	86.65	3.35	6.7	13.9	3.35

Table 3-14 shows that different from the results shown in Table 3-13, Groups 1 and 2 preferred the collective readings of N1 and N2. Group 1 seemed to have a higher percentage of choosing the collective reading than Group 2. However, the Chi-square test indicated that there was no significant difference between Groups 1 and 2. Table 3-14 also revealed that Groups 1 and 2 were more in favor of the

collective reading than the native controls; however, the Chi-square test showed that the interpretations of Groups 1 and 2 were not significantly different from the English native control group. Accordingly, in interpreting double object constructions with an existential QNP preceding a universal QNP, there was no significant difference among the three groups ( $\chi^2 < 5.991$ ,  $p > 0.05$ ).

Similar to the results shown in Table 3-13, the Chinese control group's interpretations of Chinese QNPs, in double object constructions with an existential QNP preceding a universal QNP, were similar to the experimental groups' and the English native controls' interpretations of English QNPs ( $\chi^2 < 5.991$ ,  $p > 0.05$ ).

In general, similar to the interpretations of QNPs in simple active and simple passive constructions, the two experimental groups and the Chinese native controls preferred the preceding QNP to have a wide-scope interpretation in interpreting QNPs in double object constructions. Their preference for the preceding QNP to have a wide-scope interpretation was similar to the English control group's.

#### 3.4.1.4 Dative Constructions

Shown in Table 3-15 are the results of the subjects' interpretations of dative sentences with a universal QNP preceding an existential QNP:

Table 3-15: Subjects' Interpretations of Dative Sentences with a Universal QNP Preceding an Existential QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	25.0	26.7	22.2	33.3	68.3	66.7	66.7	60.0	6.7	6.7	11.1	6.7
N2	20.0	30.0	27.8	40.0	70.0	63.3	61.1	53.3	10.0	6.7	11.1	6.7
Average	22.25	28.35	25.0	36.65	69.15	65.0	63.9	56.65	8.35	6.7	11.1	6.7

Different from the interpretations of QNPs in simple actives, simple passives, and double object constructions, in the dative constructions Groups 1 and 2 did not show any preference for the preceding QNP to have a wide scope interpretation. In interpreting QNPs in dative constructions, Groups 1 and 2 liked the following QNP to have a wide scope interpretation. Table 3-15 illustrates that Groups 1 and 2 liked the collective reading, but Group 1's percentage of the collective reading was higher than Group 2's in response to N1 and N2. The Chi-square test showed the differences were not significant. Therefore, the interpretations of N1 and N2 of Group 1 were not significantly different from those of Group 2. The Chi-square test also indicated that the two experimental groups' interpretations of N1 and N2 were similar to the English control group's. No significant differences existed among the three groups ( $\chi^2 < 5.991, p > 0.05$ ).

Similar to the experimental groups' and the English native controls' interpretations of QNPs in the dative construction, the Chinese controls also preferred the following QNP to have a wide-scope interpretation in response to N1 and N2 ( $\chi^2 < 5.991, p > 0.05$ ).

Table 3-16 shows the results of the subjects' interpretations of dative constructions in which an existential QNP preceded a universal QNP:

Table 3-16: Subjects' Interpretations of Dative Sentences with an Existential QNP Preceding a Universal QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	60.0	66.7	55.6	66.7	26.7	23.3	11.1	20.0	13.3	10.0	33.3	13.3
N2	73.3	86.7	72.2	93.3	16.7	6.7	5.6	0	10.0	6.7	22.2	6.7
Average	66.65	76.7	63.9	80.0	21.7	15.0	8.35	10.0	11.65	8.35	27.75	10.0

Table 3-16 shows that in response to N1 and N2, Groups 1 and 2 preferred the distributive reading; however, Group 2 was more in favor of this reading. After the test of Chi-square, we know that Group 1 did not show any significant differences from Group 2 in the three readings of N1 and N2. As can be seen above, Groups 1 and 2 had higher percentages of the distributive and collective readings and lower percentages of the ambiguous reading than the English control group in interpreting N1 and N2. Nevertheless, the Chi-square test showed that the percentage differences between the experimental groups and the English control group were not significant ( $\chi^2 < 5.991, p > 0.05$ ).

Compared with the experimental groups and the English native controls, the Chinese majors did not show any significant difference in interpreting N1 and N2. That is to say, the Chinese native controls also preferred the following QNP to have a wide-scope interpretation ( $\chi^2 < 5.991, p > 0.05$ ).

Generally speaking, the experimental groups preferred the following QNP to have a wide scope interpretation when they interpreted QNPs interacting in the dative constructions. The experimental groups' interpretations were similar to the control groups'.

#### **3.4.1.5 Subject Control Constructions**

Presented in Table 3-17 are the subjects' responses to subject control sentences where a universal QNP preceded an existential QNP:

Table 3-17: Subjects' Interpretations of Subject Control Sentences with a Universal QNP Preceding an Existential QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	73.3	80.0	66.7	66.7	20.0	3.3	11.1	26.7	6.7	16.7	22.2	6.7
N2	93.3	83.3	83.3	100	3.3	13.3	5.6	0	3.3	3.3	11.1	0
Average	83.3	81.65	75.0	83.35	11.65	8.3	8.35	13.35	5.0	10.0	16.65	3.35

As shown in Table 3-17, both the experimental groups preferred the distributive reading. Compared with Group 1, Group 2 had a higher percentage of the distributive reading in interpreting N1 and a lower percentage of this reading in response to N2. The Chi-square test indicated that the percentage differences between Groups 1 and 2 were not significant. Compared with the English control group, the experimental groups liked the distributive reading more and preferred the ambiguous reading less in response to N1 and N2. However, according to the Chi-square test, we know that the percentage differences shown above between the experimental groups and the English control group were not significant ( $\chi^2 < 5.991, p > 0.05$ ).

The Chinese native controls' interpretations of N1 and N2 were similar to those of the experimental groups' and the English native controls'. They also preferred the preceding QNP to have a wide scope interpretation ( $\chi^2 < 5.991, p > 0.05$ ).

The above analyses tell us that the experimental groups, similar to the native controls, preferred the preceding universal QNP to have a wide scope interpretation when they interpreted QNPs in the subject control constructions.

The three groups' responses to subject control sentences with an existential QNP preceding a universal QNP are presented in Table 3-18:

Table 3-18: Subjects' Interpretations of Subject Control Sentences with an Existential QNP Preceding a Universal QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	13.3	20.0	11.1	0	80.0	66.7	72.2	93.3	6.7	13.3	16.7	6.7
N2	0	0	0	0	100.0	100.0	77.8	100	0	0	22.2	0
Average	13.3	10.0	5.55	0	90.0	83.35	75.0	96.65	3.35	6.65	19.45	3.35

As shown above, in response to N1, Group 1 was more in favor of the collective reading and less preferred the distributive and ambiguous readings than Group 2. As for N2, the interpretations of Group 1 were the same as those of Group 2. The Chi-square test showed that Groups 1 and 2 did not show any significant differences in interpreting N1 and N2. Compared with the English control group, Group 1 had a higher percentage and Group 2 had a lower percentage of the collective reading when they interpreted N1. As for N2, the two experimental groups preferred the collective reading more and the ambiguous reading less than the English control group. The Chi-square test indicated that the differences between the experimental groups and the English native controls were not significant in interpreting N1. Concerned with the three groups' interpretations of QNPs in N2, it was found that there were significant differences between the experimental groups and the English control group (E1 vs. NE:  $\chi^2 = 7.273$ ; E2 vs. NE:  $\chi^2 = 7.273$ ) in the collective and ambiguous readings, according to posterior comparisons ( $\psi$  of the collective reading =  $0.222 \pm 0.191$ ;  $\psi$  of the ambiguous reading =  $0.222 \pm 0.191$ ).

The Chinese majors' interpretations of Chinese QNPs in N1 and N2 were similar to the interpretations of English QNPs of the experimental groups. Compared with the English control group, the Chinese majors preferred the collective reading more in response to N2 (NC vs. NE:  $\chi^2 = 5.994$ ,  $\psi$  of the collective reading =  $0.222 \pm 0.221$ ).

After the above description of the subjects' interpretations of QNPs in the subject control constructions, we know that Group 1, Group 2 and the Chinese controls had similar interpretations and they preferred the preceding QNP to have a wide scope interpretation more than our English controls. Moreover, the English native controls were more in favor of the ambiguous reading.

### 3.4.1.6 Object Control Constructions

Table 3-19 shows the subjects' interpretations of QNPs, a universal QNP preceding an existential QNP, in object control constructions:

Table 3-19: Subjects' Interpretations of Object Control Sentences with a Universal QNP Preceding an Existential QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	93.3	90.0	61.1	100	3.3	6.7	11.1	0	3.3	3.3	27.8	0
N2	93.3	83.3	72.2	86.7	6.7	6.7	11.1	13.3	0	10.0	16.7	0
Average	93.3	86.65	66.65	93.35	5.0	6.7	11.1	6.65	1.65	6.65	22.25	0

Similar to simple actives, simple passives, double object constructions, and subject control constructions in which the subjects preferred the preceding QNP to have wide scope over the following QNP, it was found that in object control constructions Groups 1 and 2 also preferred the preceding universal QNP having scope over the following existential QNP; that is, they all preferred the distributive reading. As can be seen in Table 3-19, the percentage of the distributive interpretation of Group 1 was higher than that of Group 2. The Chi-square test indicated that Groups 1 and 2 did not respond significantly differently when they interpreted N1 and N2. Compared with the English native controls, the two experimental groups preferred the distributive reading more and were less in favor of the ambiguous reading. In response to N2, there was no significant difference between the experimental groups



and our English native controls in the distributive, collective, and ambiguous readings; however, in response to N1, Groups 1 and 2 significantly differed from the English control group in the distributive reading (E1 vs. NE:  $\chi^2 = 7.904$ ,  $\psi = 0.322 \pm 0.303$ ; E2 vs. NE:  $\chi^2 = 6.830$ ,  $\psi = 0.289 \pm 0.222$ ).

The Chinese native controls' interpretations of Chinese QNPs in N1 and N2 were similar to the experimental groups'. Compared with the English controls, the Chinese majors preferred the distributive reading more in response to N1 (NC vs. NE:  $\chi^2 = 7.404$ ,  $\psi = 0.389 \pm 0.281$ ).

Presented in Table 3-20 are the results of the subjects' interpretations of object control constructions with an existential QNP preceding a universal QNP:

Table 3-20: Subjects' Interpretations of Object Control Sentences with an Existential QNP Preceding a Universal QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	3.3	6.7	6.7	6.7	90.0	90.0	86.7	93.3	6.7	3.3	6.7	0
N2	3.3	3.3	0	6.7	93.3	96.7	83.3	93.3	3.3	0	16.7	0
Average	3.3	5.0	3.35	6.7	91.65	93.35	85.0	93.3	5.0	1.65	11.7	0

Generally speaking, Groups 1 and 2 had similar interpretations of N1 and N2. Different from the English native controls, Groups 1 and 2 had higher percentages of the collective reading and lower percentages of the ambiguous reading. However, the differences were not significant, according to the Chi-square test. The Chinese majors' interpretations of N1 and N2 were similar to those of the experimental groups and the English native controls.

To sum up, the subjects had similar interpretations of QNPs in object control constructions and they preferred the preceding QNP to have a wide scope

interpretation more than our English controls. Moreover, the English native controls were more in favor of the ambiguous reading.

### 3.4.2 The Picture-Selection Task

The results of the picture-selection task are presented in this section with respect to the different syntactic constructions (i.e., simple active, simple passive, double object, dative, subject control, object control constructions), responded to by our subjects.

#### 3.4.2.1 Simple Active Constructions

The subjects' responses to simple active sentences with a universal QNP preceding an existential QNP are shown in Table 3-21:

Table 3-21: Subjects' Interpretations of Simple Active Sentences with a Universal QNP Preceding an Existential QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	70.0	63.3	44.4	66.7	13.3	23.3	16.7	20.0	16.7	13.3	38.9	13.3
N2	66.7	46.7	22.2	66.7	23.3	43.3	27.8	26.7	10.0	10.0	50.0	6.7
Average	68.35	55.0	33.3	66.7	18.3	33.3	22.25	23.35	13.35	11.65	44.45	10.0

In response to N1 and N2, Groups 1 and 2 liked the distributive reading. Group 1 was more in favor of the distributive reading and less preferred the collective reading than Group 2. However, the Chi-square test indicated that the percentage differences shown in Table 3-21 were not significant. Concerned with the comparisons with our English native controls, the experimental groups' interpretations of QNPs in N1 were similar to the English control group's. As for N2, Group 1 was significantly different from our English control group in choosing the distributive and ambiguous readings (E1 vs. NE:  $\chi^2 = 11.733$ ,  $\psi$  of the distributive reading =  $0.445 \pm 0.319$ ,  $\psi$  of the

ambiguous reading =  $0.4 \pm 0.319$ ); Group 2 significantly had a lower percentage of the ambiguous reading than the native controls (NE vs. E2:  $\chi^2 = 9.719$ ,  $\psi$  of the ambiguous reading =  $0.4 \pm 0.319$ ). In general, Groups 1 and 2 did not show any significant difference in interpreting QNPs in simple active constructions and compared with the English native controls they preferred the preceding QNP to have a wide scope interpretation more and liked the ambiguous reading less.

The Chinese native controls did not exhibit any significant difference from the experimental groups in response to N1 and N2. However, they preferred the distributive more and ambiguous readings less than the English control group when interpreting N2 (NC vs. NE:  $\chi^2 = 13.337$ ,  $\psi$  of the distributive reading =  $0.445 \pm 0.382$ ,  $\psi$  of the ambiguous reading =  $0.433 \pm 0.376$ ).

Shown in Table 3-22 are the results of the subjects' interpretations of simple active sentences in which an existential QNP preceded a universal QNP:

Table 3-22: Subjects' Interpretations of Simple Active Sentences with an Existential QNP Preceding a Universal QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	3.3	3.3	16.7	0	86.7	93.3	44.4	93.3	10.0	3.3	38.9	6.7
N2	6.7	3.3	0	6.7	93.3	96.7	72.2	93.3	0	0	27.8	0
Average	5.0	3.3	8.35	3.35	90.0	95.0	58.3	93.3	5.0	1.65	33.35	3.35

Similar to their interpretations of simple active constructions with an existential QNP preceding a universal QNP in the problem-solving task, Groups 1 and 2 preferred the collective reading in interpreting N1 and N2. According to the Chi-square test, Group 1 had similar interpretations of N1 and N2 to Group 2. As shown in Table 3-22, our experimental groups had higher percentages of the collective reading and lower percentages of the ambiguous reading than the English

control group. The Chi-square test indicated that the differences between the experimental groups and the English native control group were significant (E1 vs. NE in N1:  $\chi^2 = 9.738$ , E1 vs. NE in N2:  $\chi^2 = 10.120$ ; E2 vs. NE in N1:  $\chi^2 = 14.519$ , E2 vs. NE in N2:  $\chi^2 = 9.702$ ). According to posterior comparisons, Group 1 responded significantly differently from the control group in the collective reading (E1 vs. NE:  $\psi$  of the collective reading =  $0.423 \pm 0.324$ ) and Group 2 showed significant differences from the control group in the collective and ambiguous readings (E2 vs. NE:  $\psi$  of the collective reading =  $0.489 \pm 0.038$ ,  $\psi$  of the ambiguous reading =  $0.356 \pm 0.293$ ) while interpreting QNPs in N1. As for N2, Groups 1 and 2 showed significantly less preference for the ambiguous reading than the English native controls (E1 vs. NE:  $\psi$  of the ambiguous reading =  $0.278 \pm 0.259$ ; E2 vs. NE:  $\psi$  of the ambiguous reading =  $0.278 \pm 0.259$ ).

The Chinese majors' interpretations of Chinese QNPs were similar to the experimental groups'. However, compared with the English controls, they preferred the collective reading more in response to N1 and the ambiguous reading less in interpreting N2 (NC vs. NE in N1:  $\chi^2 = 8.938$ ,  $\psi$  of the collective reading =  $0.489 \pm 0.327$ ; NC vs. NE in N2:  $\psi$  of the ambiguous reading =  $0.278 \pm 0.258$ ).

To sum up, our experimental groups and Chinese control group had similar interpretations of QNPs in simple active constructions in the picture-selection task. Compared with the English control group, they showed more preference for the preceding QNP having a wide scope interpretation and they had lower percentages of the ambiguous reading.

### 3.4.2.2 Simple Passive Constructions

The four groups' responses to simple passive constructions in which a universal QNP preceded an existential QNP are shown in Table 3-23:

Table 3-23: Subjects' Interpretations of Simple Passive Sentences with a Universal QNP Preceding an Existential QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	56.7	50.0	16.7	53.3	30.0	36.7	33.3	33.3	13.3	13.3	50.0	13.3
N2	63.3	46.7	5.6	60.0	30.0	36.7	61.1	20.0	6.7	16.7	33.3	20.0
Average	60.0	48.35	11.15	56.65	30.0	36.7	47.2	26.65	10.0	15.0	41.65	16.65

Groups 1 and 2 preferred the preceding universal QNP to have wide scope interpretations when they interpreted N1 and N2. However, Group 2 had a lower percentage of the distributive reading and a higher percentage of the collective reading than Group 1. According to the Chi-square test, Groups 1 and 2 had similar interpretations. Table 3-23 shows that in response to N1 our experimental groups preferred the distributive reading and the English control group preferred the ambiguous reading. According to the Chi-square test and posterior comparisons, Groups 1 and 2 responded significantly differently from the English native controls in choosing distributive and ambiguous readings (E1 vs. NE:  $\chi^2 = 9.945$ ,  $\psi$  of the distributive reading =  $0.4 \pm 0.309$ ,  $\psi$  of the ambiguous reading =  $0.367 \pm 0.326$ ; E2 vs. NE:  $\chi^2 = 8.953$ ,  $\psi$  of the distributive reading =  $0.333 \pm 0.279$ ,  $\psi$  of the ambiguous reading =  $0.367 \pm 0.326$ ). As for N2, our native controls preferred the distributive reading less than Groups 1 and 2. The Chi-square test and posterior comparisons showed that the two experimental groups significantly differed from the English native controls in the distributive reading (E1 vs. NE:  $\chi^2 = 16.427$ ,  $\psi = 0.577 \pm 0.253$ ; E2 vs. NE:  $\chi^2 = 8.915$ ,  $\psi = 0.411 \pm 0.246$ ). The above description of the

results tells us that Groups 1 and 2 had similar interpretations of N1 and N2. They preferred the distributive reading more and were less in favor of the ambiguous reading than the native speakers of English.

Concerned with the comparisons with the experimental groups, the interpretations of Chinese QNPs of the Chinese controls were similar to those of English QNPs of Groups 1 and 2. Nevertheless, there were significant differences between the Chinese majors' interpretations of Chinese QNPs and the English controls' interpretations of English QNPs. In response to N1, the Chinese controls preferred the distributive reading more and the ambiguous reading less than the English control group (NC vs. NE:  $\chi^2 = 9.945$ ,  $\psi$  of the distributive reading =  $0.366 \pm 0.357$ ,  $\psi$  of the ambiguous reading =  $0.367 \pm 0.326$ ). As for N2, the Chinese majors liked the distributive reading more (NC vs. NE:  $\chi^2 = 11.796$ ,  $\psi$  of the distributive reading =  $0.544 \pm 0.337$ ).

The results of the three groups' interpretations of simple passive with an existential QNP and a universal QNP are shown below:

Table 3-24: Subjects' Interpretations of Simple Passive Sentences with an Existential QNP Preceding a Universal QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	26.7	23.3	66.7	26.7	63.3	60.0	0	66.7	10.0	16.7	33.3	33.3
N2	0	13.3	5.6	0	100	83.3	72.2	100	0	3.3	22.2	0
Average	13.35	18.3	36.15	13.35	81.65	71.65	36.1	83.35	5.0	10.0	27.75	16.65

In Table 3-24, we can see that in response to N1, Groups 1 and 2 preferred the collective reading, which was different from the English native controls. The English control group liked the distributive reading. The Chi-square test indicated that Groups 1 and 2 were significantly different from the English speakers in the distributive and

collective readings while interpreting N1 (E1 vs. NE:  $\chi^2 = 18.987$ ,  $\psi$  of the distributive reading =  $0.4 \pm 0.336$ ,  $\psi$  of the collective reading =  $0.633 \pm 0.216$ ; E2 vs. NE:  $\chi^2 = 17.500$ ,  $\psi$  of the distributive reading =  $0.434 \pm 0.331$ ,  $\psi$  of the collective reading =  $0.6 \pm 0.219$ ). With respect to the subjects' interpretations of N2, it was found that Group 2 and our native controls responded differently, but the difference did not reach a significant level.

The Chinese control group's interpretations of QNPs were similar to those of the experimental groups. Compared with the English native controls, they liked the distributive reading less and collective reading more when interpreting N1 (NC vs. NE:  $\chi^2 = 17.443$ ,  $\psi$  of the distributive reading =  $0.4 \pm 0.339$ ,  $\psi$  of the collective reading =  $0.667 \pm 0.298$ ).

Generally speaking, Group 1, Group 2 and the Chinese controls responded to simple passive constructions similarly, preferring the preceding QNP to have a wide scope interpretation. However, our English native controls were more in favor of the ambiguous reading and of the following QNP to have a wide scope interpretation.

### 3.4.2.3 Double Object Constructions

Presented in Table 3-25 are the subjects' responses to double object constructions where a universal QNP preceded an existential QNP:

Table 3-25: Subjects' Interpretations of Double Object Sentences with a Universal QNP Preceding an Existential QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	93.3	86.7	77.8	93.3	3.3	0	0	0	3.3	13.3	22.2	6.7
N2	66.7	56.7	33.3	60.0	30.0	36.7	22.2	40.0	3.3	6.7	44.4	0
Average	80.0	71.7	55.55	76.65	16.65	18.35	11.1	20.0	3.3	10.0	33.3	3.35

As shown above, our experimental groups preferred the distributive reading while interpreting N1 and N2, but the percentages of the distributive reading of N2 were not as high as those of N1. Moreover, Group 1 seemed to have higher percentages of the distributive reading than Group 2. The Chi-square test indicated that the differences between Groups 1 and 2 did not reach a significant level. Compared with the English control group, in response to N1 our experimental groups preferred the distributive reading more and the ambiguous reading less, but the differences were not significant. With regard to N2, Group 1 differed from the English control group in the distributive and ambiguous readings and Group 2 liked the ambiguous reading less than our English native controls (E1 vs. NE:  $\chi^2 = 12.700$ ,  $\psi$  of the distributive reading =  $0.334 \pm 0.298$ ,  $\psi$  of the ambiguous reading =  $0.411 \pm 0.298$ ; E2 vs. NE:  $\chi^2 = 9.736$ ,  $\psi$  of the ambiguous reading =  $0.377 \pm 0.308$ ), according to the Chi-square test and posterior comparisons. The ambiguous readings of our experimental groups were significantly different from that of the English native controls in response to N2.

The Chinese native controls did not show significant differences from the experimental groups in interpreting N1 and N2. Nevertheless, they were less in favor of the ambiguous reading than the English controls in response to N1 (NC vs. NE:  $\chi^2 = 9.731$ ,  $\psi$  of the ambiguous reading =  $0.444 \pm 0.327$ ).

Table 3-26 shows the subjects' interpretations of double object constructions with an existential QNP preceding a universal QNP:



Table 3-26: Subjects' Interpretations of Double Object Sentences with an Existential QNP Preceding a Universal QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	6.7	10.0	11.1	6.7	93.3	80.0	72.2	86.7	0	10.0	16.7	6.7
N2	16.7	0	0	13.3	76.7	90.0	83.3	86.7	6.7	10.0	16.7	0
Average	11.7	5.0	5.55	10.0	85.0	85.0	77.75	86.7	3.35	10.0	16.7	3.35

It was found that Groups 1 and 2 preferred the preceding QNP to have a wide scope interpretation. Compared with Group 2, Group 1 had a higher percentage of the collective reading in response to N1 and a lower percentage of this reading in response to N2. Table 3-26 also shows that Group 1 was less in favor of the ambiguous reading than Group 2. However, the Chi-square test indicated that these differences between the two experimental groups were not significant. The Chi-square also showed that the two experimental groups did not respond significantly differently from the control groups to N1 and N2 ( $\chi^2 < 5.991, p > 0.05$ ).

The Chinese control group's interpretations of N1 and N2 were similar to those of Group 1, Group 2, and the English native controls ( $\chi^2 < 5.991, p > 0.05$ ).

Generally speaking, while interpreting QNPs in the double object constructions, the two experimental groups the Chinese native controls responded similarly, preferring the preceding QNP to have a wide scope interpretation.

#### 3.4.2.4 Dative Constructions

Table 3-27 shows the four groups' interpretations of dative sentences where a universal QNP preceded an existential QNP:

Table 3-27: Subjects' Interpretations of Dative Sentences with a Universal QNP Preceding an Existential QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	6.7	13.3	0	6.7	93.3	83.3	88.9	93.3	0	3.3	11.1	0
N2	20.0	13.3	0	13.3	66.7	80.0	83.3	80.0	13.3	6.7	16.7	6.7
Average	13.35	13.3	0	10.0	80.0	81.65	86.1	86.65	6.65	5.0	13.9	3.35

Different from their interpretations of simple actives, simple passives, and double object constructions, Groups 1 and 2 were in favor of the following QNP to have a wide scope interpretation when they interpreted N1 and N2, shown in Table 3-27. The preference for the collective reading in response to a sentence with a universal QNP preceding an existential QNP violates the linearity principle, which claims that the preceding QNP has a wide scope interpretation. The percentage of the collective reading is comparatively higher than the other readings for Groups 1 and 2. According to the Chi-square test, Groups 1 and 2 had similar interpretations of N1 and N2 and their interpretations were also similar to the English control group ( $\chi^2 < 5.991, p > 0.05$ ).

Compared with the other three groups, the Chinese majors had similar interpretations of Chinese QNPs to their interpretations of English QNPs ( $\chi^2 < 5.991, p > 0.05$ ).

Our subjects' responses to the dative sentences with an existential QNP preceding a universal QNP are shown in Table 3-28:

Table 3-28: Subjects' Interpretations of Dative Sentences with an Existential QNP Preceding a Universal QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	53.3	60.0	77.8	66.7	30.0	36.7	0	26.7	16.7	3.3	22.2	6.7
N2	46.7	70.0	72.2	46.7	43.3	20.0	0	26.7	10.0	10.0	27.8	26.7
Average	50.0	65.0	75.0	56.7	36.65	28.35	0	26.7	13.35	6.65	25.0	16.7

Similar to their interpretations of dative constructions with a universal QNP preceding an existential QNP, Groups 1 and 2 preferred the following QNP to have a wide scope interpretation when they interpreted the dative constructions where an existential QNP preceded a universal QNP. As shown in Table 3-28, Group 2 preferred the distributive reading more than Group 1 in response to N1 and N2; nevertheless, the difference was not significant. Compared with our English control group, the experimental groups had higher percentages of the collective reading. According to the Chi-square test and posterior comparisons, Groups 1 and 2 responded significantly differently from the control group in the collective reading (E1 vs. NE in N1:  $\chi^2 = 6.661$ ,  $\psi$  of the collective reading =  $0.3 \pm 0.205$ ; E1 vs. NE in N2:  $\chi^2 = 11.240$ ,  $\psi$  of the collective reading =  $0.433 \pm 0.223$ ; E2 vs. NE in N1:  $\chi^2 = 10.987$ ,  $\psi$  of the collective reading =  $0.367 \pm 0.216$ ).

Similar to Groups 1 and 2, the Chinese control group liked the collective reading more than the English control group in interpreting N1 (NC vs. NE in N1:  $\chi^2 = 6.246$ ,  $\psi$  of the collective reading =  $0.267 \pm 0.260$ ).

In general, in response to dative constructions with QNPs, the experimental groups and the Chinese controls preferred the following QNP to have a wide scope interpretation, which was different from their interpretations of QNPs in simple actives, simple passives, and double object constructions. When the experimental

groups interpreted dative constructions with an existential QNP preceding a universal QNP, they liked the collective reading more than native speakers of English, which might be relevant to the influence of the linearity principle.

### 3.4.2.5 Subject Control Constructions

Table 3-29 shows the subjects' responses to subject control sentences with a universal QNP preceding an existential QNP:

Table 3-29: Subjects' Interpretations of Subject Control Sentences with a Universal QNP Preceding an Existential QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	60.0	63.3	27.8	66.7	20.0	20.0	16.7	20.0	20.0	16.7	55.6	13.3
N2	76.7	83.3	50.0	80.0	13.3	3.3	5.6	20.0	10.0	13.3	44.4	0
Average	68.35	73.3	38.9	73.35	16.65	11.65	11.15	20.0	15.0	15.0	50.0	6.65

In interpreting N1 and N2, Groups 1 and 2 liked the distributive reading. Group 2 preferred the distributive reading more. The Chi-square test indicated that Groups 1 and 2 had similar interpretations of N1 and N2. However, compared with our English control group, Groups 1 and 2 had significantly higher percentages of the distributive reading and lower percentages of the ambiguous reading in response to N1 and N2. According to the Chi-square test and posterior comparisons, Groups 1 and 2 significantly differed from the English native controls in the distributive and ambiguous readings when they interpreted QNPs in N1 (E1 vs. NE:  $\chi^2 = 6.771$ ,  $\psi$  of the distributive reading =  $0.322 \pm 0.297$ ,  $\psi$  of the ambiguous reading =  $0.356 \pm 0.285$ ; E2 vs. NE:  $\chi^2 = 8.356$ ,  $\psi$  of the distributive reading =  $0.355 \pm 0.337$ ,  $\psi$  of the ambiguous reading =  $0.389 \pm 0.243$ ). In response to N2, Group 1 differed from the English native controls in the ambiguous reading and Group 2 preferred the distributive reading more than the English control group (E1 vs. NE:  $\chi^2 = 7.678$ ,  $\psi$

of the ambiguous reading =  $0.344 \pm 0.317$ ; E2 vs. NE:  $\chi^2 = 6.254$ ,  $\psi$  of the distributive reading =  $0.333 \pm 0.332$ ). The above analyses tell us that Group 1's and Group 2's interpretations were similar and that they exhibited less preference for the ambiguous reading than the English control group.

As for the Chinese controls' interpretations of QNPs were similar to those of the experimental groups. However, they preferred the distributive reading more and the ambiguous reading less than the English controls (NC vs. NE in N1:  $\chi^2 = 6.783$ ,  $\psi$  of the distributive reading =  $0.389 \pm 0.384$ ,  $\psi$  of the ambiguous reading =  $0.423 \pm 0.409$ ; NC vs. NE in N2:  $\chi^2 = 9.232$ ,  $\psi$  of the ambiguous reading =  $0.444 \pm 0.327$ ).

Presented in Table 3-30 are the subjects' responses to subject control sentences with an existential QNP preceding a universal QNP:

Table 3-30: Subjects' Interpretations of Subject Control Sentences with an Existential QNP Preceding a Universal QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	0	3.3	0	0	96.7	96.7	83.3	93.3	3.3	0	16.7	6.7
N2	10.0	0	0	13.3	86.7	96.7	61.1	80.0	3.3	3.3	38.9	6.7
Average	5.0	1.65	0	6.65	91.7	96.7	72.2	86.65	3.3	1.65	27.8	6.7

Table 3-30 shows that in response to N1 the two experimental groups had the same interpretations and that in response to N2 Group 2 preferred the collective reading more. The Chi-square test indicated that they had similar interpretations of N1 and N2. The Chi-square also showed that the two experimental groups had similar interpretations to the English control group in interpreting N1, but in response to N2, Group 1 was different from the English native controls in the ambiguous reading (E1 vs. NE:  $\chi^2 = 11.286$ ,  $\psi$  of the ambiguous reading =  $0.356 \pm 0.293$ ) and Group 2 was more in favor of the collective and ambiguous readings than the English native

controls (E2 vs. NE:  $\chi^2 = 10.240$ ,  $\psi$  of the collective reading =  $0.356 \pm 0.293$ ,  $\psi$  of the ambiguous reading =  $0.356 \pm 0.293$ ).

The Chinese native controls did not exhibit significant differences from Groups 1 and 2. Nevertheless, they were less in favor of the ambiguous reading than the English controls in response to N2 (NC vs. NE:  $\chi^2 = 6.323$ ,  $\psi$  of the ambiguous reading =  $0.322 \pm 0.321$ ).

Generally speaking, similar to the interpretations of simple actives, simple passives, and double object constructions, in response to subject control constructions the experimental groups' and the Chinese majors' interpretations supported the linearity principle. The two experimental groups and the Chinese majors liked the preceding QNP to have wide scope interpretations more and liked the ambiguous reading less than native speakers of English.

### 3.4.2.6 Object Control Constructions

Shown in Table 3-31 are the four groups' interpretations of object control constructions with a universal QNP preceding an existential QNP:

Table 3-31: Subjects' Interpretations of Object Control Sentences with a Universal QNP Preceding an Existential QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	53.3	60.0	11.1	46.7	33.3	26.7	38.9	40.0	13.3	13.3	50.0	13.3
N2	46.7	50.0	16.7	40.0	36.7	33.3	38.9	46.7	16.7	16.7	44.4	13.3
Average	50.0	55.5	13.9	43.35	35.0	30.0	38.9	43.35	15.0	15.0	47.2	13.3

In interpreting N1 and N2, Groups 1 and 2 preferred the distributive reading. Interestingly, there were also about thirty percent of subjects of each group choosing the collective reading when they interpreted N1 and N2, which implied that these

sentences had ambiguous property for the experimental groups. The Chi-square test indicated that Groups 1 and 2 had similar interpretations of N1 and N2. The Chi-square test also showed that the two experimental groups did not differ in the readings of N2 from the English native controls, but differed significantly from the control group in interpreting N1 (E1 vs. NE:  $\chi^2 = 11.031$ ; E2 vs. NE:  $\chi^2 = 12.576$ ). According to posterior comparisons, in response to N1 Groups 1 and 2 differed from the English controls in the distributive and ambiguous readings (E1 vs. NE:  $\psi$  of the distributive reading =  $0.422 \pm 0.288$ ,  $\psi$  of the ambiguous reading =  $0.367 \pm 0.326$ ; E2 vs. NE:  $\psi$  of the distributive reading =  $0.489 \pm 0.284$ ,  $\psi$  of the ambiguous reading =  $0.367 \pm 0.326$ ). The experimental groups preferred the preceding QNP to have a wide scope interpretation more and the ambiguous reading less than the English control group.

The Chinese majors' interpretations of QNPs were similar to those of Groups 1 and 2. Compared with the English controls, they liked the distributive reading more in interpreting N1 (NC vs. NE:  $\chi^2 = 7.095$ ,  $\psi$  of the distributive reading =  $0.356 \pm 0.350$ ).

Presented in Table 3-32 are the subjects' interpretations of object control constructions with an existential QNP preceding a universal QNP:

Table 3-32: Subjects' Interpretations of Object Control Sentences with an Existential QNP Preceding a Universal QNP (in percentages)

Reading Group Item	Distributive				Collective				Both			
	E1	E2	NE	NC	E1	E2	NE	NC	E1	E2	NE	NC
N1	20.0	3.3	0	0	66.7	66.7	55.6	86.7	13.3	30.0	44.4	13.3
N2	10.0	6.7	0	0	90.0	90.0	61.1	100	0	3.3	38.9	0
Average	15.0	5.0	0	0	78.35	78.35	58.35	93.35	6.65	16.65	41.65	6.65

Table 3-32 shows that in interpreting N1 and N2, Groups 1 and 2 preferred the collective reading, as predicted by the linearity principle. In response to N1, Group 1 preferred the distributive reading more and liked the ambiguous reading less than Group 2. According to the Chi-square test, the percentage differences between Group 1 and Group 2 was not significant in response to N1 and N2. The Chi-square test also indicated that the experimental groups did not differ from the English native controls in interpreting N1 but differed significantly in the ambiguous reading in interpreting N2 (E1 vs. NE:  $\chi^2 = 14.653$ ,  $\psi$  of the ambiguous reading =  $0.389 \pm 0.282$ ; E2 vs. NE:  $\chi^2 = 10.919$ ,  $\psi$  of the ambiguous reading =  $0.356 \pm 0.293$ ).

Similar to the experimental groups' interpretations of QNPs in the object control constructions, the Chinese majors differed from the English controls in interpreting N2 (NC vs. NE:  $\chi^2 = 7.404$ ,  $\psi$  of the collective reading =  $0.389 \pm 0.281$ ,  $\psi$  of the ambiguous reading =  $0.389 \pm 0.321$ ).

To sum up, similar to their interpretations of simple actives, simple passives, double object constructions, and subject control constructions, Group 1's, Group 2's, and the Chinese control group's preference for the preceding QNP to have a wide scope interpretation in object control constructions supported the linearity principle.

### **3.5 Summary of Chapter Three**

In this chapter, I have reported the subjects, methodologies and materials, procedures, and the results of the present experiment. From the description of the results in the problem-solving task, it was found that Groups 1 and 2 had similar interpretations of all the test sentences and that in most situations the linearity was obeyed by the experimental groups except in the dative constructions. Moreover, the percentages of English speakers' ambiguous reading in all situations were higher than those of Groups 1 and 2's, which supports Lee's (1991) claim that English exhibits



scope ambiguity more freely than Chinese. In the picture-selection task, we can also see the similar findings to the problem-solving task. In the next chapter, I will further discuss these findings.