

## Research into the Processing Mechanism of English Relative Clause by Chinese English Learners

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### Abstract

*The processing mechanism of relative clause has aroused a fierce discussion among linguists from different countries. Until now, a universal principle about alphabetical languages has been accepted, that is the subject preference. While in other languages, especially Chinese, there are still great controversies. Two major conclusions have been put forward: one is the subject preference and the other is the object preference. Compared with these researches done among native speakers, the number of experiments done by second language learners is much smaller. By implementing a self-paced reading experiment with the Linger software and analyzing the data with the SPSS software, this paper aims to study the processing mechanism of English relative clause by Chinese English learners. Participants enrolled in this experiment are thirty English major students from Dalian University of Technology, whose mother tongue is Chinese and the second language is English. The researcher has collected the experiment data and mainly discussed the differences about accuracy and response time. Results show that the subject preference is still applicable to Chinese English learners, but difference is not as significant as what has been found among native speakers. The writer of this paper has made some discussion by employing several theories put forward by former linguists. The proficiency of the participants' English and the number of the participants could probably have prevented this difference from being obvious.*

**Key words:** relative clause; subject preference; object preference; Chinese English learners

### 1 Introduction

Sentence comprehension research has long been one of the central concerns of linguists, while the processing mechanism of relative clause is a significant branch of it. The major focuses of the present sentence processing discussion in relative clause are the sentence preference in subject relatives versus object relatives and its relevant explanations.

Before discussing the sentence processing preference problem, a brief review about the relative clause structure is needed. Generally speaking, there are mainly two elements that will influence the structure of a relative clause—embeddedness and focus. Embeddedness refers to the situation of the relative clause in the whole sentence and is usually divided into center-embedding and right-branching. Center-embedding means the relative clause is situated at the subject position of the sentence, with the subject of the matrix clause acting as the head noun. While right-branching means that the relative clause is at the object position and its head noun is the object of the whole sentence. Previous evidence shows that a center-embedding relative is easier to process than a right-branching one. As to the focus of a relative clause, it is also known as the head noun of a relative clause. If the focus acts as the subject of the relative clause, the clause could be called a subject-extraction relative clause (SRC). Similarly, a relative clause with the focus acting as its object is called an object-extraction relative clause (ORC). For example,

- E.g.(1) a. The child that played with the babysitter ran to his father and hugged him.  
b. The child that the babysitter played with ran to his father and hugged him.  
c. The father ran to the child that played with the babysitter and hugged him.  
d. The father ran to the child that the babysitter played with and hugged him.

In the above example, from a to d, they are center-embedding SRC, center-embedding ORC, right-branching SRC and right-branching ORC. These differences in the structure of relative clauses have led to the processing preference problem.

For so many years, psycholinguists are devoted into the identification of a universal applicable principle regard to the language processing preference in subject relatives and object relatives. According to the previous research, English subject relatives are easier than object relatives to process (Ford 1983<sup>[11]</sup>; King & Just 1991<sup>[12]</sup>; King & Kutas 1995<sup>[3]</sup>; Muller, et al. 1997<sup>[4]</sup>; Traxler, et al. 2002<sup>[5]</sup>; Gibson, et al. 2005<sup>[6]</sup>). This subject-preference is also proved by some other Indo-European languages like German (Schriefers, Friederici & kuhn, 1995<sup>[7]</sup>; Mecklinger, Schriefers, Steinhauer & Friederici, 1995<sup>[8]</sup>), French (Frauenfelder, Segui & Mehler, 1980<sup>[9]</sup>; Cohen & Mehler 1996<sup>[10]</sup>) and Dutch (Frazier, 1987<sup>[11]</sup>; Mak, Vonk & Schriefers, 2002<sup>[12]</sup>). However, this subject preference has received some challenges from Chinese, first raised by Hsiao and Gibson (2003)<sup>[13]</sup>. Until now, there are still some controversies about this sentence processing preference problem in Chinese.

Different from these experiments done by native speakers, what the writer of this paper wants to do is to study the processing mechanism of English relative clause by Chinese English learners. This is not only an expansion of the study on sentence processing preference in English SRC and ORC for L2 learners, but also will provide some guidance for Chinese English learners and teachers in English SRC and ORC comprehension and learning.

## **2 Literature Review**

### **2.1 English subject preference and its explanations**

English subject preference has long been accepted and receives no doubts from any research. To explain why the subject relatives enjoy a preference in sentence comprehension, many psycholinguistics have come up with different theories. Among all these explanations, the difference of the filler-gap distance between subject relatives and object relatives acts as a significant role and is believed to be closely related to the subject-preference. From the above example (1), it could be clearly seen that the distance between the filler and the gap of the object relative is longer than that of the subject relative. This difference has aroused several different theories. Besides these distance-based theories, some other explanations have also been put forward. The writer of this paper will briefly review some of these theories according to the time order below.

**Parallel function account (Sheldon, 1974)**<sup>[14]</sup>. By enrolling a group of children in his experiment, Sheldon came up with this parallel account, in which he argued that the shifting of the role of the filler in the object relative clause has added to the difficulty of its comprehension. If the identical noun phrase has the same function in the relative clause as the matrix clause, the sentence is significantly easier to understand. Take sentence a and sentence b in the above example(1) for example, the filler "child" acts as the subject and the agent of the matrix clause in both sentence a and sentence b. While the difference lays in that in sentence a, "child" still acts as the subject and the agent in the relative clause, which is parallel to the matrix clause. But in sentence b, "child" has shifted to be the object and the patient in the relative clause, which is not parallel to the matrix clause. This difference is viewed to be one of the reasons that lead to the subject preference.

**Accessibility hierarchy hypothesis (Keenan and Comrie, 1977)**<sup>[15]</sup>. The researchers argue here that the difference between subject relatives and object relatives has something to do with the difference between subject and object. Since the relationship between subject and object is studied in the Accessibility Hierarchy, it is also employed in the sentence comprehension study. The accessibility hierarchy is an ordering of the grammatical functions, like subject, direct object, indirect object, and so on. Subjects are highest on the hierarchy, followed by direct objects. This hierarchy arises from the fact that subjects are more predictable and more accessible than objects because lexical predicates almost always require a subject. Based on this fact, the researchers believe that processing a subject relative should be easier than an object one.

**Working memory account (Ford, 1983)**<sup>[16]</sup>. Employing a new technique-the Continuous Lexical Decision Task, Ford did two experiments. Results showed not only that it is harder to process object relatives than subject relatives, but also that parsing complexity is increased at the gap in object relatives and remains increased for the next couple of words. Ford holds the view that object relatives are harder to process because a larger number of predictions have to be maintained in memory compared to subject relatives.

**Perspective-shifting account (Mac Whinney & Pleh, 1988)**<sup>[17]</sup>. In this account, the reader is assumed to start his sentence comprehension from the subject of the matrix clause. In processing a subject relative clause, the reader is allowed to maintain his perspective until the end. In object relatives, however, the reader has to shift his perspective from the subject noun phrase of the matrix clause to the subject in the relative clause, and then shift again back to the matrix clause subject. This makes it much more complex to process an object relative clause.

**Active filler strategy (Clifton & Frazier, 1989)**<sup>[18]</sup>. In this explanation, it is assumed that the reader has the tendency to take the subject of the matrix clause to be the subject of the relative clause. In processing an object relative clause, when the reader finds he has made a mistake, he has to start a new round of processing again. This is much more time consuming and complex, which makes object relatives' comprehension more difficult than that of subject relatives.

**Frequencies of relative clause types (Mitchell, Cuetos, Corley, & Brysbaert, 1995**<sup>[19]</sup>; **Hale, 2001**<sup>[20]</sup>). The main claim here is that since subject relatives tend to occur more frequently than object relatives, processing a subject relative should be much easier. Cross-linguistically, subject relatives are indeed more common than object relatives according to corpus evidence. For example, in the Brown corpus of the English Penn Treebank, the frequency distribution of subject relatives versus object relatives is 86% and 13% (Hale, 2001); in the German NEGRA corpus (Skut, Krenn, Brants, & Uszkoreit, 1997), it is 74% and 26% (Korthals, 2001); and in the Chinese Treebank, 57.5% and 42.5% (Hsiao & Gibson, 2003). As long as this pattern is held, a subject relative advantage could be predicted.

**Syntactic Prediction Locality Theory, SPLT (Gibson, 1998)**<sup>[21]</sup>. Gibson came up with a new theory of the relationship between the sentence processing mechanism and the available computational resources in the year 1998, namely the Syntactic Prediction Locality Theory. There are two components included: one is the integration cost component and the other is the memory cost associated with keeping track of obligatory syntactic requirements component. Both of the integration cost and the memory cost are heavily influenced by locality. That is to say, the longer the distance between an incoming word and the head to which it attaches, the greater the integration cost; and the longer a predicted category needs to be kept in memory before realization, the greater the memory cost. The longer filler-gap distance of object relatives results in an increasing memory cost with more predicted syntactic categories in memory and an increasing integration cost with longer distance of attachment.

**Dependency Locality Theory, DLT (Gibson, 2000)**<sup>[22]</sup>. The central claim here is that there are mainly two important components of sentence parsing which consume computational resources: one is performing structural integrations, which is connecting a word into the structure for the input thus far; the other is keeping the structure in memory, which includes keeping track of incomplete dependencies. This DLT is a theory of human computational resources in sentence parsing that relies on these two kinds of resource use. It is argued that the longer filler-gap distance of object relative clause makes it harder both to perform the structural integration and to memorize the structure, which contributes to the subject preference.

**Similarity-based interference account (Gordon, et al. 2001)**<sup>[23]</sup>. To study the operation of working memory in language comprehension, Gordon and his partners employed self-paced reading experiment in their research and the reading time and comprehension accuracy were recorded. The results showed a poorer performance in object relatives compared with subject relatives. This is found to be closely related to the mixture of types of noun phrases (names, descriptions, and indexical pronouns) in one sentence. When two noun phrases of the same type appear together, it will influence the comprehension process. Since the distance between the two noun phrases is longer in subject relatives than object relatives, a greater similarity-based interference is observed in object relatives and thus the subject preference is reasonable.

**Canonical word order (MacDonald & Christiansen, 2002)**<sup>[24]</sup>. The main point here is that the word order of subject relatives is identical to the canonical word order, which is Subject-Verb-Object (SVO) in English (see e.g. (1)a. "child played with the babysitter"). While object relatives have a different one, which is Object-Subject-Verb (OSV) (see e.g. (1) b "child the babysitter played with"). In processing the object relatives, the reader has to adjust himself to the new word order and this will add to the difficulty of sentence comprehension, which stops the object relatives from being the faster one compared with the subject relatives.

## 2.2 Controversies in Chinese sentence preference

### 2.2.1 Object preference

Chinese presents an exception to the universal subject-relative preference, which was first raised by Hsiao and Gibson(2003)<sup>[25]</sup>. By employing self-paced reading experiment, Hsiao and Gibson analyzed the reading time of the first two words in the relative clause. The result demonstrated that it took longer in a subject relative than in an object one. Thus they came up with the conclusion that Chinese object relatives are easier to process compared with subject relatives. Hsiao and Gibson attributed this difference to the storage capacity theory. The following example was used in their study.

- E.g. (2) a.邀请富豪的官员心怀不轨但是善于隐藏。  
b.富豪邀请的官员心怀不轨但是善于隐藏。

In the above example(2)a, when the reader first see the word “邀请”, he has to predict the following object, the word“的”and the head noun that the relative clause modifies. This takes up a great storage capacity. While in reading sentence b, the reader only has to predict a verb after the first noun “富豪”since it is parallel to the basic Chinese subject-verb order. This difference in the number of words that are to be predicted by the reader leads to the object relatives’ advantage in Chinese.

This object preference in Chinese is also supported by Chen Baoguo and Ning Aihua ( 2008 )<sup>[26]</sup>. As a complementation to Hsiao and Gibson’s research, Chen and Ning have added another two types of relative clauses into the experiment. They studied the subject relatives and object relatives who modify the object of the matrix clause as well. The example they employed is shown below:

- E.g. (3) a.校长介绍质疑学生的老师给委员会认识。  
b.校长介绍学生质疑的老师给委员会认识。

Chen and Ning also used self-paced reading experiment to test the reading time of different relatives. The results showed that the reader spent longer time in reading a Chinese subject relative clause than an object one, and this difference is more obvious when the relative clause modifies the object of the matrix clause. Besides the storage capacity theory, Chen and Ning also discussed the integration problem. In the above example(3)a, when the reader comes across the verb “介绍”, he is assumed to predict the following noun according to the basic Subject-verb-object order. While another verb “质疑” comes into his eyes, he has to rearrange his original processing process to understand the message. That is to say, it is hard to integrate the verb of the relative clause and the verb of the matrix clause. Whereas in sentence b, this problem does not exist.

Another research that supported the Chinese object preference was done by Zhou Tongquan, Zheng Wei, Shu Hua and Yang Yiming in 2010<sup>[27]</sup>. They invited two volunteers who have suffered from aphasia to participate in their experiment. The result they got after conducting three experiments was that Chinese subject relative clause was harder than the object relative clause to process. What’s more, they have found that some change in the characteristics of the subject and object of the relative clause will influence the sentence comprehension process. When the noun phrase that acts as the subject of the relative clause is animate while the object one is inanimate, the sentence comprehension is much easier to be done, no matter it is a subject relative clause or an object relative clause. In order to analyze the research results, they employed the Argument Crossing Hypothesis, which better explained this object preference found among the aphasia patients.

### **2.2.2 Subject preference**

Despite the great influence of Hsiao and Gibson’s research, their experimental materials and design were challenged by Lin and Bever (2006), who argued that some other factors had influenced the experiment results.<sup>[28]</sup> They reviewed the materials used in Hsiao and Gibson’s study, including both the single embeddings and the double embeddings. Hsiao and Gibson demonstrated in their research that object relatives of the single embeddings were read faster in the pre-relativizer region, while Lin and Bever believed that this may be simply because an empty subject needs to be added in subject relatives, which may increase the difficulty of sentence processing. In regard to the double embeddings, Hsiao and Gibson discovered that the reading time of the second and third words combined and the fourth and fifth words separately was longer in subject relatives than object relatives. While Lin and Bever argued that this may be only due to the difference of the distance between the gaps and fillers in the relative clause, not the storage costs announced by Hsiao and Gibson.

What's more, Lin and Bever believed that some of the verbs in the experiment were not carefully selected, which may be ambiguous and caused some syntactic differences. Combining all these factors, Lin and Bever did another self-paced reading experiment, which finally showed that the processing time of subject relatives was shorter than that of object relatives, namely the subject preference. The theory they employed to explain this result was the accessibility hierarchy of the subject and the object.

### 2.3 Studies of relative clause in second language learners

Based on the above review, it could be clearly seen that subject preference is widely accepted in English and is supported by a number of theories, while great differences still exist in Chinese over this issue. Different from these studies done on the native speakers, a number of researches on the acquisition of relative clauses by second language learners have also been done. For example, Grass (1980)<sup>[29]</sup>, Doughty (1991)<sup>[30]</sup> and Hamilton (1994)<sup>[31]</sup> have separately proved in their research that in the acquisition of relative clauses in English as a second language, subject relatives are easier than object relatives both in production and comprehension. Similarly, Sakamoto and Kubota (2000)<sup>[32]</sup> have also proved this subject preference in the processing of Japanese relative clauses by English, Chinese and Indonesian participants. They have found that subject relatives are more frequently used by these nonnative speakers of Japanese and the noun phrases in the subject position of an action verb are easier to relativize than those in the direct object position to them.

This Japanese subject preference is supported by Kanno in 2000, who argued that subject relatives were easier to comprehend and faster to process than object relatives.<sup>[33]</sup> In the year 2007, Kanno did another research on the factors that affect the processing of Japanese relative clauses by L2 learners.<sup>[34]</sup> However, subject preference is not applicable to all the L2 learners. Virginia Yip and Stephen Matthews have done a research in 2007 named *Relative Clauses in Cantonese-English Bilingual Children*, which came to the conclusion that object relatives were produced before subject relatives.<sup>[35]</sup> This is challenge to the language universal. Despite all these studies done on L2 learners, no relevant articles about the processing mechanism of English relative clauses by Chinese English learners have been found. So the researcher of this paper is going to employ some Chinese English learners into this study, trying to find out whether or not the English subject preference is applicable to the Chinese EFL learners and the possible causes.

## 3 Methodology

### 3.1 Participants

Thirty subjects participated in the experiment. All of them are English major students from Dalian University of Technology with an average age of 22. They are all native speakers of Mandarin Chinese using simplified characters and their second language is English.

### 3.2 Materials

This experiment has employed a 2×2 factorial design. 24 sets of sentences were constructed, each with four different conditions, including the subject-modifying subject relative(S-SR), the subject-modifying object relative(S-OR), the object-modifying subject relative (O-SR) and the object-modifying object relative (O-OR). All of the noun phrases in the target sentences were animate. For example,

- E.g. (3) a.The|banker|that|irritated|the|lawyer|met|the|priest|and|talked|a|lot.  
 b.The|banker|that|the|lawyer|irritated|met|the|priest|and|talked|a|lot.  
 c.The|priest|met|the|banker|that|irritated|the|lawyer|and|talked|a|lot.  
 d.The|priest|met|the|banker|that|the|lawyer|irritated|and|talked|a|lot.

Besides the 24 sets of target stimulus, 80 fillers of various types were added into the experiment as well, which would be shown to the participants along with the stimulus. Thus, the participants would not be able to analyze what we were trying to test and form a fixed thinking pattern. All these sentences were shown in Standard English. A list of these 24 sets of stimulus could be found in the appendix.

### 3.3 Procedure

The experiment we employed in this study was a self-paced reading experiment, using a moving window display. We ran the experiment by using Doug Rohde's Linger software, which is a widely used software in self-paced reading test both home and abroad. The whole experiment was run on the researcher's laptop. Before starting the experiment, the participants read some instructions and notes about their tasks. Besides, several practice sentences and questions were presented to inform them about the real experiment format. After making sure that no doubts were left, the participants were left undisturbed to finish the experiment.

At the beginning of each trial, there were a series of hyphens marking the length and position of the words in the sentences. The task of the participants was to press the spacebar to view each word. As each time the spacebar was pressed, a new word appeared and the previous one disappeared, until the whole sentence was read by the participants. The time between two presses was accounted as the reading time of the word.

As each sentence finished, a relevant yes or no comprehension question concerning the preceding sentence would come up. Participants were requested to press F key for “yes” or J key for “no”. When an incorrect answer was recognized, participants could see “Oops, wrong answer” on the screen. While no response would be seen if the answer was correct. The participants should read the sentences at a natural speed and make sure that they are careful enough to understand the meaning of the sentence.

After all the participants fulfilled their tasks, the researcher collected the response time data and remove it into an excel form for the use of later SPSS analysis. By using SPSS software, the researcher recorded both the response time of the relative clauses and the accuracy of the answers.

**4 Results**

**4.1 Accuracy**

By using the SPSS software, we have got the question response accuracies for each condition. The correctness percentage of the comprehension questions are recorded in the following table 1.

**Table 1: Comprehension question accuracy**

S-SR	S-OR	O-SR	O-OR
72.13%	68.48%	62.64%	52.50%

Through making a comparison between the data in the above table, it could be easily figured out that the correctness percentage of subject relative is much higher than that of object relative, no matter it is subject modifying or object modifying. What’s more, it could also be seen that the accuracy of the subject modifying relatives is higher than that of the object modifying ones. This is parallel with the results that concluded from the previous experiments done by native English speakers.

**4.2 Latency (Response time)**

Latency is another significant factor that is to be taken into consideration in this experiment. The researcher of this study mainly focused on the response time of six positions in the sentence, beginning from the head noun of the relative clause. Time that spent on each position and its standard deviation are clearly presented in the following table 2.

**Table 2: Response time (millisecond) and standard deviation**

	the		head noun		that		P1		P2		P3	
	mean	Std.	mean	Std.	mean	Std.	mean	Std.	mean	Std.	mean	Std.
S-SR	444	152	670	462	541	313	824	536	504	349	810	591
S-OR	456	150	694	651	557	340	477	260	857	724	845	518
O-SR	469	255	670	418	579	426	742	375	535	285	806	521
O-OR	474	305	706	489	600	374	527	408	816	615	812	547

After listing the response time of each position, the researcher started to make a comparison between subject relatives and object relatives through using Oneway ANOVA. First of all, the S-SRs and the S-ORs were studied. The result showed that when the participants read the word “the”,  $F(1) = 0.638, p > 0.05$ , difference was not significant. When it came to the head noun,  $F(1) = 0.164, p > 0.05$ , difference was not significant, either. The same situation also took place at the next position “that”,  $F(1) = 0.208, p > 0.05$ . Then the researcher studied the following position “P1”, result showed that  $F(1) = 62.133, p < 0.05$ , difference was quite significant. And the next position “P2” also saw a significant difference, with  $F(1) = 35.471, p < 0.05$ . At the last position “P3”,  $F(1) = 0.368, p > 0.05$ , difference was tiny. Employing the same method, the researcher studied the O-SRs and the O-ORs as well. Results were quite similar. At the first position “the”,  $F(1) = 0.037, p > 0.05$ , difference was not obvious. Then at the position of the head noun,  $F(1) = 0.583, p > 0.05$ , difference was not obvious, either. The same thing happened to the following position “that”, with  $F(1) = 0.265, p > 0.05$ . Obvious differences began to occur at the next two positions---P1 and P2. The data here were  $F(1) = 28.491, p < 0.05$  and  $F(1) = 31.829, p < 0.05$ . At the last position P3,  $F(1) = 0.016, p > 0.05$ , difference was not significant.

Through the above analysis, we may come to the conclusion that huge differences about the response time only take place at position “P1” and “P2”, while differences at other positions are tiny. However, when we check the stimulus, we may find out that the huge difference took place on position “P1” and “P2” could not be counted as the difference between subject relatives and object relatives. That is because in a subject relative, the word at the “P1” position is a verb. While in an object relative, there is the article “the” on the “P1” position. There is no doubt that the response time of “the” is much shorter than that of a verb and the difference is significant. So in our experiment, no obvious difference about the response time between subject relatives and object relatives were recorded. But no significant difference does not mean no difference. Through watching the above table 2, we can easily find out that the mean response time of each position (except P1 and P2) follows a same law, that is the response time of a subject relative is shorter than that of an object one. This law is applicable both to the subject modifying relatives and the object modifying relatives. So the researcher come up with the conclusion that reading a subject relative is faster than an object one, though the difference is tiny. We tried to find out the factors that stop this difference from being significant and obvious and at last came up with two: One is the proficiency of the participants’ English and the other is the number of participants.

Though all the participants of this experiment are English major students from Dalian University of Technology, most of them still have a long way to go before they could use English fluently and understand all English articles easily. This is believed to influence the result greatly. What’s more, since each participant needs to spend about an hour to finish the experiment, time is quite limited. So we have just enrolled thirty students in our experiment. Maybe this number is not large enough to get an obvious result. It is assumed that a significant difference would be achieved if we could enhance both the quantity and the quality of the participants.

## **5 Discussion**

As we have mentioned at the beginning of this paper, English subject preference is widely accepted and is supported by many experiments done by native English speakers. What we want to do in this study is to see whether this preference is held among Chinese English learners. The final results of our experiment showed that this English subject preference is still applicable to Chinese English learner, proved by both the accuracy of comprehension questions and the response time of relative clauses. To explore why this preference is found among Chinese English learners, the researcher reviewed some theories put forward by previous scholars and divided them into four groups.

### **5.1 Distance-based theories**

The researcher of this paper has already got a brief review about four distance-based theories in the Literature Review part. Each of them explained the English subject preference from its own perspective. After some comparison and discussion, we think these explanations could be classified into three aspects: integration cost, memory cost and similarity interference. Combining our experiment, these three aspects are discussed in detail below.

First of all, the integration cost theory. As Gibson has mentioned in his Dependency Locality Theory, the longer distance between the filler and the gap of an object relative clause makes it harder for the reader to perform the structural integration. See example (3), sentence a and sentence c are subject relatives while sentence b and sentence d are object relatives. When the reader come across the word “banker” in a and c, the verb “irritated” could be found immediately in the later part. While in b and d, the distance between the filler “banker” and its verb “met” is much longer. What’s more, we can see that in sentence b and sentence d, two verbs “irritated” and “met” are just situated side by side, which makes it even harder to connect the head noun with its verb. We believe that this structural integration difficulty is much more obvious among Chinese English learners than the native English speaker.

This is because since day we began to learn English as a child, our teacher had told us that a subject must be followed by a verb and two verbs could not be used side by side. Even though we grow to know that the simple subject-verb-object sentence pattern is only the most basic one in English and some much more complex situations appear as we learn more and more, we still tend to figure out the basic sentence structure during our reading and comprehension. So the longer filler-gap distance in an object relative makes it harder for the second language learners to fulfill the structural integration task. Therefore, the researcher of this paper argues that the integration cost theory could appropriately explain the subject preference among Chinese English learners. Another distance-based theory that the writer wants to mention is the memory cost theory. This is also a pop theory that has been used by many scholars in their researches.

It is argued that a longer filler-gap distance means the reader has to keep more things in memory, including the sentence structure, the predictions, as well as the syntactic categories. Through analyzing the two types of relatives in example (3), we could find this memory cost theory quite reasonable. In processing sentence a and sentence c, we only have to predict a predicate when we see the head noun “banker”, and when the verb “irritated” comes out, we predict the object “lawyer”. But in processing sentence b and sentence d, things get to be much more complex. The reader has to keep the phrase “the lawyer irritated” in memory until the predicted predicate “met” comes out. This has increased the memory cost. To a second language learner, keeping more things in memory will undoubtedly influence the sentence comprehension process and slow down the speed. The last distance-based theory that the researcher studied is the similarity interference theory. Gordon and his partners’ Similarity-based Interference Account attributed the English subject preference to the mixture of the same type of noun phrases in an object relative clause. They argued that two noun phrases of the same type in one sentence would influence the reader’s comprehension process. For example, in example (3), “banker” and “lawyer” are from the same group. But personally, I do not quite support this account. In Chinese relatives, the distance between two noun phrases of the same type is found to be longer in a subject relative than an object one, which is opposite to the English situation. If this account is applicable, then Chinese subject relatives would be harder to process than object ones. But no accurate result about Chinese preference has been found yet. So the researcher would not employ this account in the explanation of the English preference among Chinese English learners.

## **5.2 Universality-based theories**

As we have reviewed in the early part of this paper, some of the theories about the English preference are based on certain universal feature of the language. Scholars believe that the universality of language could explain the language preference to some extent. The researcher of this paper mainly studied two of them: the Canonical Word Order and the Accessibility Hierarchy Hypothesis.

First, the Canonical Word Order. MacDonald and Christiansen argued in their study that the canonical word order was a key factor that led to the final English preference. In their opinion, since the basic word order in English is S-V-O, a relative clause with the same order is easier for the reader to understand. For example, in our example (3), the word order of subject relatives is S-V-O (“the banker irritated the lawyer”), parallel with the canonical English word order. While this order turns to be an O-S-V one in the object relatives (“the banker the lawyer irritated”). The change of the word order makes it more time consuming in the sentence comprehension process. The researcher also agrees with this opinion. What the writer of this paper wants to mention is that the canonical word order of Chinese is also S-V-O. The S-V-O word order is more frequently used in our daily life. For example, we often tend to say “我写完作业了。” rather than “作业被我写完了。”. Influenced by both the English canonical word order and the Chinese canonical word order, an S-V-O order is deeply rooted in a Chinese English learner’s heart. So when it comes to the processing of an English relative clause, the one with this order, namely the subject relative, would enjoy a preference undoubtedly.

The other universality-based theory that the writer studied is the Accessibility Hierarchy Hypothesis, put forward by Keenan and Comrie. They argued in their paper that since subject is higher on the accessibility hierarchy than object, subject relatives must be easier than object ones to process. But the researcher doubts about this. The researcher believes that the accessibility of a subject is not perfectly equal to that of a subject relative. Otherwise, Chinese subject relatives are absolutely easier than object relatives to process since the accessibility of subject is also higher than object in Chinese. But the fact is that there are still controversies in the Chinese preference. So the writer of this paper does not enroll the Accessibility Hierarchy Hypothesis in explaining the subject preference among Chinese English learners.

## **5.3 Role-shifting based theories**

To explain the subject preference in English, some scholars have noticed that certain shift would happen to the role of the head noun in an object relative, while no such phenomenon was recorded in a subject one. The writer of this paper would like to make some discussion about it below.

First of all, the writer wants to mention the Parallel Function Account came up by Sheldon. He argued in his paper that the shifting of the role of the head noun in an object relative made it harder to process. For example, in the above example (3), the head noun “banker” acts as the subject of the matrix clause in all of the four sentences. But in sentence b and sentence d, it shifts to be the object in the relative clause while holds to the subject in the relative clause in sentence a and sentence c.

This shifting of the role has made the processing of an object relative much more time consuming and complex. Similarly, Mac Whinney and Pleh came up with a theory named Perspective-shifting Account, which pointed out that the reader of an object relative had to shift his perspective during the reading process while no such needs were needed if the target sentence was a subject one. For example, in the above example (3), the reader has to shift his perspective from “the banker” to “the lawyer” and then shift back to “the banker” again when he reads sentence b and sentence d. While in reading sentence a and sentence c, his perspective could always be “the banker”. This shifting of the perspective is also time consuming and complex. The writer of this paper is convinced that both the shifting of the role of the head noun and the shifting of the perspective have added to the processing complexity for Chinese English learners. When the participant’s English is not proficient enough, he will spend more time in this shifting process to comprehend the sentence. So the researcher of this study argues that these shifting of the perspective and the shifting of the role of the head noun arouse greater difference about the comprehension process between subject relatives and object relatives among Chinese English learners, leading to the final subject preference.

Another role-shifting based theory that the author wants to mention is the Active Filler Strategy put forward by Clifton and Frazier. They argued that in comprehending an English sentence, the participants tend to take the subject of the matrix clause as the subject of the relative clause. But the question is that the subject of the matrix clause is not the subject of the relative clause in an object relative. So in reading an object relative, the reader would find himself making a mistake when he comes across the real subject of the relative clause. At this time, he has to reprocess the sentence again. For example, in the above example(3), if a participant takes the head noun “banker” as the subject of the relative clause when he reads sentence b and sentence d, he will get confused when he meets the word “lawyer”. What he has to do is to give up the previous comprehending process and start a new one. This is quite time consuming. But the writer of this paper argues that this account should not be enrolled in the explanation of our experiment results. Through checking some Chinese relative clauses, the writer have found out that the Chinese relative clauses are quite different from the English ones, with the relatives on the left side of the head noun. That is to say, the reader of a Chinese relative clause will read the relative clause before the head noun. So if this active filler strategy do exist, the reader is more likely to take the subject of the relative clause to be the subject of the matrix clause. This is just the opposite of the English condition. Influenced by the mother tongue, the researcher doubts whether or not the participants would assume the subject of the matrix clause to be the subject of the relative clause as native English speakers do. So this Active Filler Strategy is not applicable in our study.

#### **5.4 Frequency-based theory**

As we have reviewed in the early part of this paper, some scholars have attributed the subject preference to the high frequency of subject relatives compared with object relatives. Through checking some language corpus, evidence was found that subject relatives are more frequently encountered than object relatives. So it is argued that subject relatives are easier for participants to process since they are more “familiar with” this type of relative clauses than object ones. The writer of this paper is also convinced of the famous saying “Practice makes perfect”. The more subject relatives one reads, the easier he will find to process it. What the writer wants to say here is that this frequency-based theory is also applicable to Chinese English learners. According to the research done by Zhou Tongquan in 2009, a higher frequency of Chinese subject relatives was found in the Lancaster Corpus of Mandarin Chinese (LCMC). That is to say, Chinese people also encounter more subject relatives than object relatives in their daily life as the native English speakers do. Influenced by both the mother tongue and the English language, a Chinese English learner is more likely to find a subject relative clause easier to process. From this perspective, the subject preference among Chinese English learners is quite reasonable.

#### **6 Conclusion**

By implementing a self-paced reading experiment with Linger software and analyzing the experiment data with SPSS, the researcher of this paper came to the conclusion that the English subject preference is applicable to Chinese English learners. Results show that Chinese English learners spend less time in reading English subject relative clauses compared with object ones. To explore why this English subject preference is found among Chinese English learners, the writer of this paper has reviewed some theories raised by previous scholars. Through some comparison and discussion, the researcher reckons that the integration and memory cost, the canonical word order, the parallel function and the frequency of relative types could explain this phenomenon well. However, though subject relatives are found to be processed faster than object relatives in our experiment, the difference is not obvious.

The researcher believes that both the English standard and the number of our participants have prevented this difference from being obvious. It is assumed that an increase in the participants' number and their English proficiency will greatly enlarge the difference and make the subject preference more obvious. However, since time and material are limited, this is not achieved in our experiment. More work is needed to be done by later researchers. The writer of this paper sincerely hopes that this experiment will provide some help for later researchers and arouse some ideas about English learning among Chinese students.

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