A Cross-Linguistic Analysis: Impacts of Relative Clause Structure on Cognition

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Abstract. With a rising amount of second language (L2) learners around the world. The understanding and using of L2 sentence structure is largely influenced by first language (L1) thinking patterns, especially when the two languages belong to different language systems. Previous studies on L1 and L2 focus largely on the differences between verb form and tenses. The test subjects in the present study are required to translate English sentences with relative clauses to Chinese. This experiment found that Chinese native speakers who learn English as L2 often fail to distinguish the structural relationship between the main clause and relative clause when given English sentences with relative clauses.

Keywords: English Relative Clause · Second Language Acquisition · Language and Cognition · First Language Influences

1 Introduction

It is common for Chinese native speakers to have difficulty learning English clauses. Sun Feifei points out one central difference between Chinese and English by comparing their respective syntactic structures [1]. An English sentence with many modifying components presents a syntactically recursive "tree structure" while such a Chinese sentence is a long one formed by short sentences connected by multiple verbs and commas. This linkage reflects the short sentences' progressive semantic relationships.

The mandarin sentences "Li Hua jing-li le zhong-zhong mo-nan, ta yi-jiu na-me le-guan, zhen ling ren jing-tan" has 3 clauses which is divided by commas. The second line shows the meaning of the mandarin sentence. The third line shows the verbs in each clause. The last two lines gives the full Chinese sentence and the full English sentence (see Table 1). As illustrated in Table 1, mandarin uses three short sentences with their respective verbs to carry out a semantic progression; each could stand as a full sentence on its own. Chronologically, the first short sentence provides a precondition or background, leading to the second sentence describing the current state of Hua as a response to that precondition. The third sentence therefore expresses the emotional effect of the precondition and of Hua's subsequent response. In contrast, there is only

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Table 1. Main Clause and Relative Clause of Mandarin and English Sentence [Owner-draw]

Mandarin sentence	Li Hua jing-li le zhong-zhong mo-nan,	ta yi-jiu na-me le-guan,	zhen ling ren jing-tan.
Meaning	Li Hua has undergone all kinds of hardships,	he is still so optimistic,	it is so amazing!
Verbs / Verb phrases	jing-li (have/has undergone)	le-guan (be/is optimistic)	ling jing-tan (be/is amazing)
Full Chinese Sentence	Li Hua has undergone all kinds of hardships, he is still so optimistic, it is so amazing.		
Full English Sentence	Li Hua is still so optimistic, despite all kinds of hardships he went through, which is amazing.		

one verb in the English main clause, i.e., "is" in "Li Hua is still so optimistic," with the rest of the sentence being "branches" to provide further details to the main "tree structure," and each branch cannot stand as a full sentence on its own. Additionally, Zhong Chen, Kyle Grove, and John Hale provides one Chinese sentence to illustrate another difference between English and Chinese with specific regard to relative clause structures [2].

The first line is the full Chinese sentence. The relative clause is marked by [], and the modified noun is marked by the yellow color both in the Chinese sentence and the corresponding English sentence (see Table 2).

Table 2. An Example from "Structural Expectations in Chinese Relative Clause Comprehension" [Owner-draw]

Chinese Sentence (Pinyin)	[yaoqing fuhao de] guanyuan da-le jizhe
Corresponding English words	Invite tycoon DE official hit reporter
English Sentence	'The official who invited the tycoon hit the reporter.'

Table 3. Further Analysis of the Example from Table 2 [Owner-draw]

Chinese sentence	[yaoqing fuhao de]	guanyuan	da-le	jizhe
Meaning	Invite tycoon DE	official	hit	reporter
Elements of the Chinese Sentence	relative clause	Noun (modified)	verb	noun
English sentence	The official	who invited the tycoon	hit	the reporter.
Elements of the English Sentence	Noun (modified)	relative clause	verb	noun

The first line is the full Chinese sentence. The relative clause is marked by [], and the modified noun is marked by the yellow color both in the Chinese sentence and the corresponding English sentence. The third line and the fifth line of the table gives the elements of the sentence's grammar fragments (see Table 3). According to Table 2 and Table 3, In the mandarin sentence, the relative clause, [yaoqing fuhao de], precedes guan yuan, the noun being modified. In contrast, the English relative clause, "who invited the tycoon," comes after the modified noun, the official. Hence, one can easily identify the skeleton of the English sentence, i.e., "The official hit the reporter," even without understanding the meaning of the relative clause. This is due in part to two features: (1) the presence of determiners before nouns, and (2) words like "who" to indicate the following relative clause. Such features are not present in Chinese, which requires the readers' thorough understanding of every single component in the sentence to distinguish which is the main clause and which is the relative clause. This example illustrates that Chinese relative clause commonly exists before the modified noun while in English the modified noun precedes the relative clause.

According to the differences between Chinese and English, many researchers are interested in using Chinese and English to find the relationship between first languages (L1) and second languages (L2). One fundamental question in this case would be: will L1 influence the learning of L2? Liszka demonstrated ESL (English as a Second Language) learners' mismatch between the selection of verb tenses (i.e. past, present, and present perfect) and the contexts to infer that learners' knowledge about their native language has an influence on their second language learning [3]. The task consists of various environments, including some obligatorily required present perfect verb forms. Therefore, informants need to determine the tense of the contexts and use the correct verb forms to fill in the blanks in six sentences. The L2 informants are advanced English speakers from three native language backgrounds: German, Japanese and Chinese. In the result, the Chinese group alternates between preterit and present forms while the Japanese group and the German group favor preterit use over present use, owing to the influence of their L1 tense structure [3]. Focusing on the Chinese group, Liszka attributes its use of present tense to the Chinese language's lack of a specific grammaticalized feature of present perfect, namely the form of "V+ed". As for the use of preterit, she explains that Chinese encodes the perfective aspect by the V-le suffix, which also expresses the past meaning. This directly contrasts with English representations: the English preterit encodes the tense feature and its associated past meaning without showing the perfective aspect [3]. In conclusion, the influence of L1 tense structure on understanding L2 can be proved from this experiment.

Now the last pillar of our study is constructed through Boroditsky, where it is shown languages have their inherent thinking patterns [4]. More accurately, linguistic metaphors of time in Mandarin (vertical) and English (horizontal) shape their respective native speakers' perception of time. In the experiment, Mandarin native speakers and English native speakers are first presented with either a horizontal or vertical spatial layout of two objects on paper, with a description of such a layout provided by the researcher, which requires the participants' evaluation in TRUE/FALSE. Then, they will determine TRUE/FALSE of a target question about time, a statement that is either

spatiotemporal (contains before/after: "March comes before April") or purely temporal (contains earlier/later: "March comes earlier than April"), with their response time recorded. It is worth mentioning that the experiment was conducted in English in its entirety, including the vertical/horizontal priming statements, the target questions about time, and TRUE/FALSE evaluations. The results show that English's and Mandarin's respective preponderance of horizontal and vertical linguistic metaphors of time (1) makes it faster for English speakers to verify that "March comes earlier than April" after horizontal primes than after vertical primes and (2) faster for Mandarin speakers to verify that "March comes earlier than April" after vertical primes than after horizontal primes [4].Therefore, the results reveal distinct thinking patterns in English and Mandarin through their respective native speakers' perceptions of time. Such a difference in thinking as a result of language could be found in other abstract domains other than time.

In the study of L1 influencing L2, researchers have already pointed out that the intrinsic language thinking patterns of L1 influences L2 learning and using in terms of tenses. However, the syntactic structure, a domain that reflects intrinsic thinking patterns, has not been studied. In the work, based on the distinct thinking patterns and syntactic structure in Chinese and English, our research focuses on whether the thinking pattern in L1 would be carried over to understand relative clauses in L2. The innovation point of our research is that it proves the point that L1's thinking pattern influences L2 learning and using in sentence structure by analyzing the errors in relative clauses translated by English L2 learner.

2 Proposed Study

As demonstrated above on the contrasting structures of relative clauses in Chinese and English, it is hypothesized that: when Chinese native speakers who learn English as L2 are given English sentences with relative clauses, they will fail to distinguish the structural relationship between the main clause and relative clause despite hinting conjunction words such as who, that, or which. Namely, the thinking pattern of Chinese, as illustrated by its sentential structures, is grated onto Chinese L2 learners of English and makes it difficult for them to recognize main clauses and relative clauses.

3 Methods

3.1 Participants and Pilot Tests

Forty Grade Nine Chinese students will be selected for this experiment, as it is the stage when Chinese schools normally introduce the concept of English relative clauses to students. Therefore, all participants have prior experience with English learning, and a pilot test will be conducted to further control the English level of our participants. The pilot test is separated into two sections, a test and a questionnaire. The quick test includes three nouns with a relative clause as their definitions, collected from the Oxford Advanced Learner's Dictionary. For example, the definition for "reporter" is "a person who collects and reports news for newspapers, radio or television [5]." Since those nouns

are selected from the sentences used in the main experiment, this test also ensures that the test subjects will not encounter any difficulty understanding the presented vocabularies. Also, this test helps set the time limit for reading the sentences in the later experiment. The reading time of each sentence will be recorded to calculate the average time it takes for the participants to read each word. Secondly, a questionnaire will be used to collect the participants' latest three English exam grades at school. Those whose test scores are within the average 75%-to-85% range would be eligible for consideration, scores lower than this range would be considered as having trouble comprehending the English sentences in the main experiment. Scores higher than 85% have no reference value.

3.2 Procedure

The 40 test subjects will be required to read a total of five different sentences, each sentence contains approximately 15 words. According to the pilot test, the time for this main experiment will be set as two words per second. This means that the time limit for each sentence is about eight seconds. Those five sentences have at least eight words and include an attributive clause in various forms, collected from the articles in the Reading Section of College English Test Band Four (CET4). An example would be: "watching movie is something that most teens do alone" [6]. After reading each sentence, the test subjects are required to verbally recall the sentence's main content within about eight seconds. This method will not provide clues like multiple choice questions and will allow much less second thoughts compared to representing through writing. The participants are required to recall these English sentences in Chinese, since recalling in English might be based more on good memory, but recalling in Chinese will require the students to truly understand the sentences. Each recalling will be assessed by four criteria: the vocabulary problem, the confusing subject-predicate structure, the confusion between main and relative clauses, and the lack of or addition to the sentences' meanings.

4 Results and Discussion

Data from 36 participants were available, and 144 pieces of text that were transformed from speech through a voice recognition app were collected. Among the 144 pieces, 87 pieces showed students had misunderstood relative clauses, namely, 60% of the pieces were inconsistent with the original English sentences in meaning. There were four types of problems related to the misunderstanding: vocabulary problems, confusing subject-predicate structure, confusion between main and relative clauses, and lack of or addition to the sentence meaning (see Table 4).

V: vocabulary problem: V1 not all words included V2 all words included but with incorrect ones; V3 all words included with related but not properly used ones
S: confusing subject-predicate structure: S1 with neither clear main clause nor clear relative clause; S2 with unclear relative clause: S3 with unclear main clause
R: Confusion between main and relative clauses
M: Lack of or addition to the sentences' meanings

Table 4. Number of the Problematic Texts for each kind of Problem [Owner-draw]

V	Number (%)	S	Number (%)	R	Number (%)	M	Number (%)
V1	40 (28%)	S1	45 (31%)	R1	52 (36%)	M1	34 (24%)
V2	18 (13%)	S2	29 (20%)	R2	23 (16%)	M2	15 (10.4%)
V3	15 (10%)	S3	8 (6%)	R3	12 (8.3%)		

4.1 Vocabulary Problem

73 pieces of text, namely 51% pieces, have vocabulary problems. 28% of the pieces did not include all the words' meanings. 13% of the pieces included all the words' meanings, but some words' meanings were incorrect. 10% of the pieces include all the words' meanings, some meanings were related but not properly used. Students' limited vocabulary is the main cause for V1 problems. Failing to comprehend meanings of key words will influence their understanding of the whole sentence. V2 issues are often words retention. Students remembered the wrong meaning, or they recognized the word as a similar one, such as recognizing tools as fools. V3 often comes from remembering the wrong meaning of the words, such as in the sentence: "[t]he stuff that is correctly called junk should really carry warning labels", one student's translation is "the stuff is correct, such as rubbish warning labels". It is obvious that the two "correct" have different meanings. The "correctly" in the original sentence means something similar to "accurately", while the latter is closer to the meaning of "right". Based on observation and experience, when Chinese students learn English vocabularies, they often match one-to-one the Chinese meaning and the English word. This learning method may cause confusion when encountering polysemy words, such as, in this case, "correct". The analysis above did not even include issues on parts of speech, but the point here is that: Wrong understanding of words directly led to their misunderstanding of the related sentences.

4.2 Confusing Subject-Verb Structure

82 pieces of text, namely 57% pieces had confusing subject-predicate structures. 20% of pieces had unclear relative clauses, while 6% had unclear main clauses. 31% of pieces had neither clear main clauses nor clear relative clauses. By having a closer analysis of the figures, the errors in the understanding of "subject-verb relation" is highly relevant to comprehending the correlation between main clause and relative clause, as the percentages show a correlating pattern. In this case, mistakes in subject-verb agreements might influence the seeing of main clause and relative clause relationship. According to Jianping Xu, comprehending the subject-verb structure is the most essential part when knowing the sentence, and only then students can grasp the relationship between main and relative clause [7]. The existence of relative clauses can disturb the process of identifying of the subject and the verb, as sometimes it separates the subject from the verb creating difficulties for students to find the main sections of the sentence and understanding the sentence [8]. For example, the original sentence: "[t] he stuff that is correctly called junk

should really carry warning labels." One student recalls this sentence as: "the stuff is correct, such as junk warning labels". The main clause of this sentence is: "the stuff should really carry warning labels", where the relative clause is: "that is correctly called junk". The relative clause separated the subject "the stuff" from the verb "should", this made the student confuse and though that "is" (the verb for the relative clause) is the verb for the main clause. This failing to identify the correct subject and verb of the main clause eventually caused a wrong understanding of the entire sentence.

4.3 Confusion Between Main and Relative Clauses

There was confusion between main and relative clauses in 87 pieces of text, namely 60% of the pieces. 16% of pieces were lack of main clauses or relative clauses. 36% of pieces messed up main clauses and relative clauses. Many students' recalling shows an interesting phenomenon, the Chinese answers' word order matched perfectly with the word order of the original English sentence. It is believed that the students remembered the English sentence and translated each word one-by-one in their minds. This is because the students are not aware of the difference between relative clauses and main clauses. In their understanding, sentences with relative clauses are no different to sentences that does not have relative clauses. The grammar concept "relative clause" does not mean anything special in their minds. The way of recalling or translating all sentences, including the ones with relative clauses, is match the Chinese word to the English word, word by word from left to right. Students do not realize that the meaning and information in the relative clause is subordinate to the subject in the main clause. English and Chinese are two very distinct language systems, especially when considering relative clauses. English relative clauses appear on the right side of the head noun, knowing as Right Branching Direction, whereas Chinese is the opposite of Left Branching Direction [9, 10]. As the two languages belongs to different principles of branching directions, this "word-by-word" method of recalling is not applicable to Chinese and English understanding and translation. There was a sentence, "we need restructured online classes in which students can have a learning experience…" One student understood as "we need to restructure online classes and which students have a learning experience (in constructing online classes)".

4.4 Lack of or Addition to the Sentences' Meanings

10% of pieces had incomplete meanings of the original sentences, while 24% of pieces added meanings to the original sentences. It is obvious that the most problems in mis-understanding were due to confusion between main and relative clauses and confusing subject-predicate structure. About this problem, it is found that the recalled sentences include the key words and parts from the original English sentence, but the recalled sentences' meanings are different to the original sentence. It is speculated that it is either because the students' vocabulary or syntax knowledge were not good enough to understand the sentences, or because of the issue mentioned in Sect. 4.3. Therefore, they made up another story by connecting the key words they got from the original sentence. For example, the original sentence is: "there are plenty of recipes, how-to videos and cooking classes available to anyone who has a computer, smart phone or television."

The student's recalling is: "their plenty of recipes on how to make healthy foods, people who has computers or smart phones can research recipes." The recalling sentence have "plenty of recipes", "how to make", "people/anyone who has", "computer", "smart phones", these are also key sections in the original sentence, but the meaning of the two sentences are vastly different. The student added information that was not included in the original sentence, such as "healthy foods" and "their…recipes". At the same time, the student lacks important information such as: "cooking classes" and "available to". Probably due to similar reasons mentioned in 4.3, the students remembered and translated the English sentence each word one-by-one in their minds, without considering the difference between relative clause and main clause. They recalled according to their memories, but their memories did not help them memorize the whole sentence. It turns out that the students only remember some key sections of the original sentence, but they realized that those key words do not make sense on their own, so they connected them by making up something new.

5 Conclusion

Admittedly, this design has several limitations that could be significantly enhanced if provided with better equipment. The sample was collected through one teacher's contacts in several local schools. A more compelling result could be acquired if adopted an online evaluation that was distributed to more populations. Secondly, the problems associated with the students' understanding of English sentences depended entirely on the researchers' subjective assessment of their translation. Hence, it is difficult to know whether the analysis is correct, granted that it is possible for the participants to have understood the sentences perfectly but they failed to translate them in a way conformed to Chinese syntactical/semantic structures. It is worth mentioning that the participants are limited in number and relatively similar in age and experience, making it difficult to support deeper investigation of other factors that influence second language learning. Future research can gravitate towards two directions. One is from the perspective of cognitive development, focusing on whether learners of different ages and experiences will have significant differences in learning attributive clauses; The other is from the perspective of psycholinguistics, focusing on whether ESL learners will encounter other similar difficulties when learning English syntax, since relative clauses are only one of many problems ESL learners will face when learning English.

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