Proceedings of the 22nd North American Conference on Chinese Linguistics (NACCL-22) & the 18th International Conference on Chinese Linguistics (IACL-18). 2010. Vol 1. Clemens, L.E. & C.-M. L. Liu, eds. Harvard University, Cambridge, MA. 31-48.

The Noun Phrase Accessibility Hierarchy in Chinese as a Foreign Language Learnersô Interlanguage[1]

Yi Xu
University of Pittsburgh

Recent studies on the acquisition of putative "relative clauses" (RCs) in East Asian languages have raised the question of whether the Noun Phase Accessibility Hierarchy (NPAH, or AH) (Keenan & Comrie, 1977) is applicable to those languages. In this paper, I report findings from Chinese as a foreign language learners' production data in a sentence combination task. Results from this experiment show that while the NPAH may not accurately predict the acquisition difficulty of different types of Chinese RCs, individual learners' interlanguage in the use of relativization strategies always acts within the constraints of the AH.

1. Introduction

Relative clauses (RCs) are a frequently used and important sentence structure in many languages. In 1977, a generalization of the typology of RCs, referred to as the Noun Phrase Accessibility Hierarchy (NPAH, or AH), was made by Keenan and Comrie. The NPAH is often thought to be predictive of the relative difficulty of different types of RCs in language acquisition, until recent doubts have been raised as to the hierarchy's applicability to East Asian languages. A simplified form of the NPAH can be presented as Subject>Object>Indirect Object>Object of Preposition, whereas ">" means "easier to relativize". English examples of these types of RCs are illustrated below:

(1)a. [$_{NP}$ the mani [$_{CP}$ that [$_{TP}$ __ $_{i}$ kissed me]]] – Subject RC (SU)
b. [$_{NP}$ the mani [$_{CP}$ that [$_{TP}$ I kissed __ $_{i}$]]] – Direct Object RC (DO)
c. [$_{NP}$ the mani [$_{CP}$ that [$_{TP}$ I gave the book to __ $_{i}$]]] – Indirect object RC (IO)
d. [$_{NP}$ the mani [$_{CP}$ that [$_{TP}$ I talk to __$_{i}$]]] —Object of Preposition RC (OPrep)

The relativized item moves from within the TP, leaving a gap, and the gap co-indexes with the relative head N, referred to as the "filler." [2] The AH is generally understood as

[1] This research is supported by a Language Learning Dissertation Grant from Language Learning, the journal, and the Social & Behavioral Science Research Institute Dissertation Grant from the SBSRI, University of Arizona.

an implicational order, where the existence of a level of relativization, e.g. OPrep, means the existence of all other types of relativization higher on the hierarchy. In other words, if language X has Indirect Object relative clauses, then it must also have SU and DO relativization, but it may not necessarily have Object of Preposition relative clauses.

An overwhelming number of acquisition studies in both first and second language (L1 and L2) of the postnominal RCs, i.e., English type of RCs where the head noun occur first, find that acquisition difficulty and orders are often consistent with the AH: learners acquire RC types in more accessible positions (i.e., positions higher on the hierarchy) first, and when different types of RCs were elicited from learners at a particular stage, accuracy rate in learners' production of RCs in more accessible positions is higher (Gass, 1979; 1982; Doughty, 1991; Eckman, Bell, & Nelson, 1988; Hamburger & Crain, 1982; McKee, McDaniel & Snedeker, 1998). To explain such consistency between the behavioral patterns in acquisition and natural language typology, it was proposed that processing ease might be responsible for the AH. However, several recent L2 acquisition studies in East Asian languages, including Japanese, Korean, Cantonese, etc. report findings that are not consistent with the NPAH (Jeon & Kim, 2007; Ozeki & Shirai, 2007; Yip & Matthews, 2007). Previous works on the processing ease and acquisition studies of Chinese RCs also yield controversial findings.

One possibility that was sometimes raised to account for these unsettling results in East Asian language studies is that putative RCs in those languages, as Comrie (2002) argues, might be "attributive clauses" rather than relativizations in nature. We will not delve into this controversy here. Readers are directed to Aoun & Li (2003) and Huang, Li & Li (2009) for a formal linguistic analysis of Chinese RCs. Through literature review and by comparing the syntactic characteristics "attributive clauses" and putative Chinese RCs, Xu (2010) argues against the proposal of treating putative Chinese RCs as "attributive in nature" as Comrie (2002) suggests for languages such as Japanese. Chinese RCs are true relativization structures that normally involve a gap and movement. The current project sets out to examine whether the NPAH can be applicable to L2 Chinese. Could the AH rightfully indicate the relative difficulty of different types of Chinese RCs? Could the NPAH be a meaningful predicator of Chinese as a Foreign Language (CFL) learners' learner language? If there is consistency between observed behavioral facts and the typological markedness observed in natural languages, then such evidence could possibly be taken as support from the behavioral science point of view for the linguistic proposal to analyze Chinese RCs as true relativization structures.

---

[2] According to Chomsky(1977)'s original operator movement analysis, the actual structure in (1a) should be (i).

(i) [NP[The mani] [CP Opi [C that [TP ti kissed me]]].

In general, though, the difference between (1a) and (i) does not concern us, since all structures in (1a-d) involve such an operator and movement to the Spec of CP, and the hierarchy is more concerned with the differences between these different types of RCs.

2. Background

(2a-d) illustrate examples of Chinese relative clauses.

(2) a. [[*e* xihuan Lisi de] na ge ren] zai Beijing shangxue.
e like Lisi DE that CL person at Beijing study.
'The person who likes Lisi is studying in Beijing right now.'

b. [[Lisi xihuan *e* de] na ge ren] zai Beijing shangxue.
Lisi like *e* DE that CL person at Beijing study
'The person that Lisi likes is right now studying in Beijing.'

c. [[Wo jie-gei ta shu de] na ge ren] xuexi hen renzhen.
I lend-to he book DE that CL person study very serious
'The person that I lent the book to studies very hard.'

d. [[Wo xiang ta wen-lu de] na ge ren] feichang naixin.
I toward he ask-way DE that CL person very patient.
'The person whom I asked the way of is very patient.'

The relativization strategies of these examples follow the Noun Phrase Accessibility Hierarchy but are different from the ones used in the English examples in (1a-d).

A more detailed illustration of the NPAH is in need here. The Hierarchy states that there are different relative clause forming strategies. The primary strategy is the gap strategy and an alternative strategy is the resumptive pronoun strategy. The Hierarchy has the following stipulations:

(a) A language must be able to relativize subjects;
(b) Any RC-forming strategy must apply to a continuous segment of the hierarchy;
(c) Strategies that apply at one point of the AH may in principle cease to apply at any lower point (Keenan & Comrie, 1977, p. 67).

The use of the resumptive pronoun strategy has the reverse implicational order than the primary gap strategy: if a resumptive pronoun is used in position X on the hierarchy, the resumptive pronoun must be used in all lower positions that can be relativized at all (Comrie & Keenan, 1979). The hierarchy also allows a possible overlap of the strategies as long as a particular strategy applies to a continuous segment of the hierarchy.

As seen from (2a-d), both the gap strategy (in which there is movement) and base generation with resumptive pronoun strategies are available to derive relative clause structures in Chinese: The gap strategy is used in SU and DO relative clauses, and resumptive pronouns are obligatory in IO and OPrep relativization.

Although there is an increasing number of behavioral studies on Chinese RCs in the recent decades, results remain controversial. Results from both L1 processing, L1 acquisition and L2 acquisition studies of Chinese are inclusive so far. Readers are directed to Lin (2006), Hsiao and Gibson(2003), Kuo and Vasishth (2006) for results in L1 studies comparing the psychological difficulty of Subject versus Object RCs. The existing few L2 studies on Chinese RCs usually only compare Subject versus Object RCs, often with inclusive results, perhaps due to the complications of other variables or issues in design (Chen, 1999; Packard, 2008). Without other types of RCs taken into consideration, these studies often do not look at relativization strategies used by learners.

3. Experiment: Sentence Combination Task

3.1. Methods

3.1.1. Participants

In the current experiment, 45 participants who were native speakers of English participated in the experiment. All were CFL students enrolled in an intensive language program at an institute in North America that specializes in foreign language teaching. Prior to the conduct of the experiment, these participants received language instruction for 4 hours a day on weekdays for 2.5 semesters. Those participants were judged by the institutes' trained professionals to be intermediate-mid to intermediate-high L2 speakers of Chinese by the American Council on the Teaching of Foreign Languages (ACTFL) standard. Participants ranged from 18 to 36 years old. Data from 34 of these participants were analyzed. Justification of inclusion is provided in the Scoring section. Because this experiment does not focus directly on developmental sequence, but aims to investigate the mental representation of learner language (perhaps at a particular stage), data from participants at a unanimous proficiency group is thought to be meaningful enough to indicate acquisition difficulty. From learners' production accuracy and errors, issues regarding learners' (in)competence can be discussed.[3]

3.1.2. Materials and procedure

A Written Sentence Combination Task was used to elicit production. This task was frequently used in second language acquisition (SLA) studies (Gass, 1979; Roberts, 2000; Ozeki & Shirai, 2007). To the author's knowledge, this task has not been used in SLA studies of Chinese RCs.

Each participant was given a written test paper with 20 pairs of sentences and was instructed to combine pairs of sentences in each item, following the examples in the instruction section. (3) provides a test item with a pair of sentences. In the experiment,

[3] A group of 24 L1 participants (native speakers of Chinese) also participated in this experiment, but this procedure was conducted to elicit data to analyze native speakers' preference for other issues such as the demonstrative position in Chinese RCs. Native speakers made no errors in this task and therefore performance of the L1 and L2 group differences will be discussed in this paper.

the items were presented in simplified Chinese characters, with *pinyin*/Romanization at the top of each character.

(3) --- Gangcai wo mama zai zhao yi ge nvren.
Just now I mother PRG look.for one CL woman
'Just now, my mother was looking for a woman.'

--- Na ge nvren xing Li.
That CL girl name Li
'That girl is named Li.'

The targeted answer for (3) is a DO relative clause, i.e., (4), which combines the information in the two statements in (3).

(4) Gangcai wo mama zai zhao de na ge nvren xing Li.
Just.now I mother PRG look.for DE that CL woman name Li.
'The woman that my mother was looking for just now was named Li.'

The 20 test items include 4 items eliciting each of the following types of RCs: SU, DO, ID, OPrep, and Possessive RC in the Object position. Only the first four types of RCs are analyzed here.[4] See Appendix for the test.

The items are randomly ordered and controlled for animacy: sentence (b) always has a stative verb (e.g. 'live', 'like'), or a predicate AdjP (which is roughly equivalent to a stative verb), or a copula, and the head noun of the target RC is [+human]. For sentences eliciting SU and DO RCs, sentential AdjPs like *gangcai* ('just now') are added, as in (3), so that the lengths of the expected productions for all RCs approximately match. The experiment also has a counterbalanced design for SU and DO relatives: each SU relative has a DO relative counterpart. For instance, a counterpart to (3), a DO relative clause, is (5), a Subject relative clause.

(5) --- Gangcai you ge nvren zai zhao wo mama.
just now exist CL women PRG look-for I mother.
'Just now a woman was looking for my mother.'

--- Na ge nvren xing Li.
That CL woman name Li.
'That woman is named Li.'

[4] Possessive RCs were not analyzed in the current study because the grammaticality of relativizing a Possessive RC in an Object position without a resumptive pronoun depends on dialectical differences. The purpose of including Possessive RCs in this experiment was to collect preliminary data to initiate possible future studies in Chinese Possessive RCs.

This experiment was administered in a regular class period of 50 minutes. Two instructors at that institute and the author together administered the experiment. A five-minute practice session with sample items was conducted before the main experiment. While the participants were allowed to do so, they did not raise questions about vocabulary and did not use any reference books.

3.2. Scoring

The test was scored based on whether the participants produced the target sentence, as shown by the example in (4). The scoring was either 1 (correct) or 0 (incorrect). Alternative target-like productions that also received 1 point are grammatical RCs with a demonstrative occurring first (i.e., *na-ge gangcai wo mama zai zhao de nvren*) or without a demonstrative (i.e. *gangcai wo mama zai zhao de nvren*).

Some participants combined pairs of sentences into a sequence that is not target-like by using the first sentence in the pair as the main sentence in their production. (6) is an example of such an error.

(6) Gangcai wo mama zai zhao yi ge xing Li de nvren.
Just now I mother PRG look.for one CL name Li DE woman
'Just now my mother was looking for a woman named Li.'

Such productions often do not yield a production with a relativization structure (when the second sentence in the pair contained a copula or Adj). Following Ozeki and Shirai (2007), such production is considered as a *miscombination* error.

Because seven participants made the error of *miscombination* for almost all the test items, with only one to two target-like productions, their data were excluded from analysis; Another four participants' production data were also excluded because for all test items, they produced sequences that could not be analyzed as a relative clause structure in anyway, or could not use the relativizer *de* throughout the questionnaire. Therefore, data in the following analysis were based on 34 participants' production.

3.3. Results

The scoring for each type of RCs is summarized in Table 1; nine categories of errors were identified and summarized in Table 2.

Table 1 *Scoring of Different Types of RCs*

RC type	Subject RC	Object RC	Indirect Obj.	Obj. of Prep
Score (total)	121	117	27	39
Mean accuracy	88.97%	86.03%	19.85%	28.68%

Note. Three types of responses that differed slightly from the exact "target production" shown in example (7) but were nevertheless counted towards correct responses in Table 1. Those three

types of responses include using yi-ge ("one-Classifier") instead of demonstrative-CL, not using demonstrative-CL, and using demonstrative-CL at the beginning of the RC (forming a demonstrative-first relative clause). For the purpose of this study, all of these are equally considered "target-like productions."

Table 2 *Error Types in Different Types of Relative Clauses*

Type of errors	Subject RC	Object RC	Indirect Obj. RC [a]	Obj. of Prep RC	Total
Pronoun retention	0	2			2
Resumptive NP			3	4	7
Missing pronoun	/	/	90	46	136
Miscombination	3	6	3	6	18
Change into SU RC type	/	4	7	14	25
Preposition missing & Preposition wrong				17+2	19
RC marker *de* missing	1	2			3
Structural errors	11	4	4	6	25
Others		1	4	2	7

[a]There were two cases within IO errors where the errors were counted twice, because the sentences involved both a "missing pronoun" error and a misuse of *gei* "give" or a *ba* (light verb)-construction.

Pronoun retention refers to cases where a pronoun was used in a position where there should be a gap, i.e., in the relativization of SU and DO positions in Chinese. *Missing pronoun* errors are cases where learners failed to a resumptive pronoun in IO and OPrep relative clauses. *Resumptive NP* errors occur only in IO and OPrep relativization in the data. That is, instead of using a resumptive pronoun, learners used the head NP in the position that was being relativized. An example was given in (7), with 'one-CL friend' within the RC as the resumptive NP.

(7) Xiao Zhang gei-le yi ge pengyou wubai-kuai-qian de na-ge pengyou
Xiao Zhang give-PERF 1 CL friend 500-CL-money DE that-CL friend
mei-you gongzuo
not-have job
Intended: The friend whom Xiao Zhang gave 500 dollars to does not have a job.

In some cases where DO, IO, or OPrep relative clauses were being elicited, learners produced SU RCs instead, sometimes with the addition of passive marker *bei* in their production and occasionally involving a meaning change. Such errors were categorized as *change into a SU RC type*. There were no cases where targeted Subject RCs were changed into other types of relativization by learners. For instance, a paired-item eliciting an OPrep relative clause was shown in (9a), with the targeted production in (9b). An example of such an error of *change into SU RC type* was given in (10).

(9) a. Wo mama xiang yi-ge ren wen-lu. Na-ge ren shi ge lao taitai.
I mother from one-CL person ask-way. That-CL person BE CL old lady
'My mother asked a person for directions. That person was an old lady.'

b. Wo mama xiang ta wen-lu de na-ge ren shi ge lao taitai.
I mother from her ask-way DE that-CL person BE CL old lady
'The person that my mother asked directions from was an old lady.'

(10) Xiang wo mama wen-lu de ren shi ge lao taitai.
from I mother ask-way DE person BE CL old lady
'The person who asked my mother for directions is an old lady.'

Structural errors are cases of productions without anything that could be potentially analyzed as a relative clause. Other errors include *orthographical errors* and errors with *gei* ('give') and *ba*-structures in targeted IO relativization. The last four types of errors in Table 2 will not be discussed in detail in this paper.

3.4. Discussion

3.4.1. Subject vs. Object RCs

The scores for SU and DO RC productions were higher than the scores of IO and OPrep RCs, indicating that the latter two types of relativization are much harder, consistent with the implicational order that one would assume based on the NPAH.

At the same time, scores of SU versus DO RCs were close, i.e. 121 vs. 117, which did not seem to provide support for the expected the ease of SU relatives. But this was not evidence against the hierarchical difference either; it could be explained in terms of a "ceiling effect", as "the hierarchy does not exclude grammars in which both SU and DO relatives emerge simultaneously and are acquired before [other types of] relatives"

(Eckman, 2007, p. 325). It is possible that these L2 learners of Chinese have acquired similar competence in SU and DO relativization at the time of the experiment.

Additionally, the error of *changing RC type* may indicate that Subject RCs could indeed be easier than other types, since participants tended to produce Subject RCs even when they have to add an additional grammatical element such as the passivizer bei or changed the meaning of the combined sentence.[5]

3.4.2. IO and OPrep RCs

The score for IO relatives is higher than the score for OPrep relative clauses (27 vs. 39). This might be taken to imply that learners have acquired better competence with OPrep than IO relativization, which would be puzzling if one believes that consistency between the hierarchy and acquisition difficulties should be universal.

At the same time, it is noticeable that the most prevalent error in IO relativization is *missing pronoun*, which directly leads to less accuracy with IO RCs. Learners made fewer errors of *missing pronoun* with OPrep RCs. Recall that the NPAH states that both the gap strategy and the resumptive pronouns are legitimate strategies in a language. If one considers the the participants' learner language, or interlanguage (IL) to be an independent language, disregarding how much the IL conforms to the target language, the learners' relativization strategies can be summarized into something that is represented by Table 3. In Table 3, instances of *missing pronoun* were temporarily not considered as an "error" but were instead analyzed as the learners' use of a gap strategy in these positions. Recall that there were also two instances of *pronoun retention* error in Direct Object RCs as seen from Table 2. These were also considered as a relativization strategy instead of an error here. It is obvious from Table 3 that as the position goes lower on the hierarchy, L2 learners tend to rely more on the resumptive pronoun strategy and avoid the gap strategy. That is consistent with the original observation stated by the NPAH, that pronoun retention is more common in lower positions.

Table 3 *Strategies Used for Different Types of RCs*

RC type	Subject RC	Object RC	Indirect Obj.	Obj. of Prep
Gap strategy	119	117	90 (*)	46 (*)
Pronoun strategy	0	2 (*)	27	39

Note. * indicates that using the pronoun strategy for DO and the gap strategy for IO and OPrep RCs are not target-like.

[5] The same type change error was reported in Ozeki and Shirai (2007)'s study, in which almost all (38 out of 40) type change errors involved changing other types of RCs into Subject RCs by passivization, case markers, and verb changes. While noting that this was consistent with the NPAH, Ozeki and Shirai cautioned that the DO/OPrep RC to SU conversion may not be triggered by grammatical relationships but by the animacy of the head noun instead.

3.4.3. Individual data

But it is more important to examine individual learners' use of relativization strategies. Eckman (2007) points out that analysis of whether the L2 acquisition of RCs in a given language is consistent with the NPAH should be best performed when based on individual data, instead of group data (p. 325-326). This is because one cannot assume that the interlanguage of all learners is exactly the same. If individual learners' data adhere to the NPAH, then one has more solid evidence for the applicability of the Hierarchy in the SLA of Chinese.

Again, assuming both gap strategy and the resumptive strategies are candidates of legitimate strategies in a learners' IL, and a few productions with other error types such as *change into SU RC type* were excluded from consideration here, since the alternation of relativization strategies are the focus of analysis here. Individual learners' use of different strategies are summarized in Table 4, with comparable natural language examples cited in Keenan & Comrie (1977) listed.

Table 4 *Patterns of Pronoun Retention in RCs in Learners' IL*

SU	DO	IO	OPrep	Number of L2 Learner	Natural language comparisons
-	(+)	+	+	2	Persian; Genoese
-	-	+	+	5	Chinese (target language)
-	-	-	+	7	Shano
-	-	-	-	17	Japanese; English (L1)
-	-	(+)	(+)	1	?
-	-	-	?	2	

Note. " –" means that pronouns are not retained in that position when it is being relativized (a gap strategy is used when relativizing an NP in that position); "+" means that a pronoun strategy is used when relativizing an NP in that position. "(+)" means that the retention of the pronoun varies in the learners' production and is optional in the natural language examples. "?" indicates lack of data. Irrelevant errors such as RC internal structural errors and miscombination are excluded from consideration in this table.

Two learners started using the pronoun retention strategy occasionally at the DO position on the hierarchy, and they used the pronoun strategy systematically for IO and OPrep RCs. Seven L2 learners used the gap strategy systematically for the RCs on SU, DO, and IO positions, and they used the pronoun strategy systematically for OPrep RCs.[6] Five participants used relativization strategies that conform to the grammar of the target language, i.e., Chinese: they used the gap strategy on SU and DO positions, and the

[6] Keenan and Comrie (1977)'s observation is that the pronoun strategy is used optionally in relativizing OPrep in Shano, and is used obligatorily in relativizing lower positions, i.e., in Genitive RCs and in Object of Comparison relativization. Still, the pattern of using pronoun retention in relativization in Shano is largely similar to those learners' IL grammar.

pronoun strategy at lower positions. Seventeen L2 learners used the gap strategy to relativize all the four positions. That matches with the grammar of relativization strategies in English. Finally, two learners used the gap strategy systematically for SU, DO, and IO positions, but there is no evidence of their using either the gap or the pronoun strategy for OPrep RCs because they made other errors such as *miscombination*, changing RC type, etc. In sum, although the patterns that participants adopted in using different strategies did not always adhere to the target language form or the native language form, learners were using alternative strategies in a way consistent with the principles dictated by the NPAH. Perhaps one learners' production appeared to be somewhat of an exception. This learner used the gap strategy systematically for SU and DO RCs, but uses the pronoun strategy occasionally for IO and OPrep RCs (This learner used the pronoun strategy in one out of four test items for both types of RCs, and used the gap strategy in three other items.) Still, this learners' IL is not inconsistent with the hierarchy, as the AH does not exclude a grammar that permits flexibility within the two relativization options (gap and pronoun) on two adjacent positions. In sum, detailed analysis of individual learners' interlanguage conforms to the original stipulation of the NPAH: Learners used one particular relativization strategy on a continuous segment on the hierarchy, and the resumptive pronoun strategy has the reverse implicational order as the NPAH. In other words, the NPAH is applicable to the SLA of Chinese, in the sense that L2 Chinese speakers' IL conforms to this generalization based on natural language constraints.

However, if one is to interpret higher accuracy automatically as "less difficulty" or "better competence", it seems that the AH does not always predict the learners' acquisition difficulty: L2 participants achieved higher scores for targeted OPrep than IO relative clauses. To this, the author would like to entertain a possibility that some psycholinguistic factors may have caused the more L2 participants to use the gap strategy in IO position, committing errors of *missing pronouns*. Obviously L1 transfer could be at play, since English uses the gap strategy for relativization in all the four positions, SU, DO, IO and OPrep. The reason that seven of these L2 participants successfully used the pronoun strategy in OPrep position may not be their knowledge of the target language form or a competence to produce OPrep relative clauses in Chinese. Instead, some underlying factors related to language processing could have caused the difference. Section 3.4.5 would discuss such a possibility.

3.4.4. Resumptive NPs and other errors

There were three cases of resumptive NP error with IO relative clauses and four cases with OPrep RCs. While these cases are not counted in the "resumptive pronoun" strategy in Table 3, they do indicate that those learners are also using a non-movement strategy in relativizing these positions. Relativization using a resumptive NP is not referred to as a legitimate relativization strategy by the NPAH, but examples of resumptive NP were reported in the L1 acquisition of Chinese RCs by Chinese children (Hsu, Hermon, & Zukowski, 2009). It is possible that learners were aware of the subordinate relationship

of the relative clause to the main clause, as well as a co-indexing relationship of the relative head to the relativized position. Their use of a non-movement strategy by repeating the head N to achieve the co-indexing relationship could indicate a processing difficulty of doing syntactic extraction or movement.

There were also a few errors associated with three-argument verbs and Prepositional Phrases, indicating that, in some aspect, IO and OPrep relativizations are harder because grammatical production would hinge on acquisition of not only the relativization structure, but also the learners' competence in other aspects of the language. But these are issues of a different nature than the innate difficulty of the relativization structure itself.

3.4.5. Learnersô relativization strategies and psycholinguistic motivations

As was mentioned earlier, linguists believe that psychological motivations could have been responsible for both the hierarchy in natural languages, and its implication in SLA. Keenan & Comrie (1977) themselves discussed possibilities from the processing perspective to explain the AH, and numerous L1 processing studies in Indo-European languages find that processing ease is consistent with the NPAH (Ford, 1983; Gibson, Desmet, Grodner, Watson, & Ko, 2005; Keenan & Hawkins, S., 1987). In previous SLA studies that examined the relative difficulty of SU versus DO relative clauses in English, researchers also discussed the relevance of psycholinguistic factors in learner production (Hamilton, 1994; Izumi, 2003, etc.). In this section, a connection would be made between a psycholinguistic theory, namely the Filler-Gap Domain Theory (FGD) and the alternation of relativization strategies that one observes in natural languages and in the current L2 data.

The FGD was proposed by Hawkins (1999) primarily to account for the behavioral effects in L1 processing studies. A FGD is the set of minimum number of nodes on a syntactic tree structure required to establish a filler-gap relation or a particular type of relativization structure (Hawkins, 1999, p.248). The human processor prefers smaller FGDs. For instance, the minimum number of nodes required for establishing a Subject-extraction relative clause is five, including a V node for the verb, VP as the maximum projection, CP or S for the relative clause, head N, and maximum projection NP (with an embedded CP). Note that Object N and Object NP projection nodes are not necessary for Subject relativization (since the verb within the RC could be intransitive). On the other hand, the number of nodes required to establish an Object RC is seven, as Object RCs need two more nodes: Subject N (NS) and NPS to establish a filler-gap relation. Hawkins(1999) illustrates that different number of nodes are needed for relativization at different positions, and the minimum FGD are are summarized below:

(11) Subject RC= 5 {N, NP, V, VP, CP}
Object RC =7 {N, NP, N_S, NP_S, S, V, VP}
Indirect Object RC=9 {N, NP, N_S, NP_S, S, V, VP, N_o, NP_o}
Object of Preposition RC =9 {N, NP, N_S, NP_S, S, V, VP, P, PP}
(Adapted from Hawkins, 1999, p. 255)

Such a relative ranking of positions remains the same regardless of the linear ordering of the syntactic elements, i.e., whether relative clauses in that particular language are head-initial or head final, the rankings will be maintained.

The FGD can explain why it is "easier" to relativize a position that is higher on the hierarchy, despite language differences. It can also explain the continuous use of the gap strategy on a segment on the hierarchy, and the reverse implications of the alternative, resumptive pronoun strategy. Hawkins reasons that a resumptive pronoun can make the processing easier because it more explicitly marks the head's role in the relative clause, and an empty category does not need to be inferred from context (p. 257-258). Therefore, when the structural distance between the potential filler-gap is too much (i.e., when the relativized position is lower on the hierarchy), the language may use this alternative strategy for relativization, namely by base-generating a resumptive pronoun. Meanwhile, gaps are still preferred in higher positions because of the advantage in the "economy of expression" (Hawkins, 1999, p. 250-260).

It is conceivable that such an alternation between the gap and the pronoun strategies is not on applicable to L1 processing, but to L2 speakers' processing too. That is why learners tended to rely more on the pronoun strategy as the relativized position goes lower on the hierarchy. Recall that seven participants consistently used the gap strategy for SU, DO and IO positions. Those seven learners did not acquire relativization at the IO position. At the same time, it might be reasonable to suspect that those L2 participants, despite their use of resumptive pronouns in targeted OPrep RC production and hence higher scores for OPrep RC, were not really competent of OPrep relativization either. It may simply be that in those L2 learners' interlanguage grammar, the alternation between the gap and the resumptive pronoun strategy took place in the OPrep position. In other words, L2 Chinese learners used resumptive pronouns in the OPrep RCs, possibly because extraction to establish a filler-gap relation becomes harder in this lower position, not because their innate knowledge of the target language grammar

Still, some comments need to be made regarding Hawkins' stipulation of the FGD, because in (11), the IO and the OPrep relativization involve the same number of nodes. Hawkins does not explain why a difference in OPrep and IO still exist even though the numbers of nodes for these two RC structures are the same, given his definition of the FGD.[7] It is perhaps possible that Hawkins' detailed definition of the minimum FGD

[7] Hawkins (1999)' illustration of FGD includes discussions of several other types of RCs that are lower on the hierarchy than OPrep; those include relativization on a genitive within a Subject NP

might need modification. For instance, some maximum projections could be inherently harder to process than others. Whatever the details may be, the FGD theory does provide some rationale to explain why natural language constraints would be observed in L1 processing researches, and it would not be a surprise that the same processing factor, rather than anything related to competence, would have prompted some L2 participants in this current experiment to use a resumptive pronoun to relativize an OPrep position. It could be argued that universal processing factors that stem from the innate difficulty of the structure, rather than issues in acquisition, could be the underlying factor affecting L2 learners' performance, and perhaps higher score in some SLA studies should not be taken directly as evidence of "competence" without considering other interacting factors.

4. Conclusion

There is evidence from this experiment that Indirect Object and Object of Preposition Relative Clauses are indeed harder than Subject and Object RCs. This could be due to either the learners' transferring relativization strategies in their L1 (English), or the fact that relativization in these positions is inherently more difficult, with the involvement of more terminal nodes in those structures, as the FGD suggests.

L2 learners can produce Direct Object and Subject relative clause with similar accuracy. This can be interpreted as a ceiling effect; on the other hand, evidence such as *change into SU RC type* errors may indicate that Subject RCs could be easier in terms of less processing cost.

To address our first research question: Can the NPAH predict the relative difficulty of different types of RCs? If accuracy rate is taken as an indicator of production ease, then the AH could not serve as such a predictor. While such consistency of the relative accuracy rate and the AH was found in English as a second language studies, this could be largely due to the fact that English RCs use the gap strategy throughout the four positions under examination, and therefore processing difficulty, which results in the markedness described in the AH, would have triggered learners to progressively rely more on resumptive pronoun strategies in lower positions, resulting in less accuracy in those less accessible positions. At the same time, if accuracy rate could be taken in some sense as indicators of "less difficulty in acquisition", results in this study could only be considered relevant to CFL learners whose first language is English. Since a large proportion of the errors that surfaced in this study are related to relativization strategies (i.e., using a gap or a pronoun, extraction or base-generation), the L1-L2 differences certainly plays an important role in learner production.

(Gen-SU), Gen-DO, Gen-IO, and Gen-Object of Preposition, and the minimum FGD in those RCs are 9, 11, 13, 13 nodes, respectively (p.255). Other types of RCs are not investigated here, and although the minimum FGD is the same for some positions that are adjacent to each other, the FGD theory in general is capable of explaining language facts beyond the four types of RCs discussed in this paper.

However, one must interpret the "applicability" of the NPAH in SLA in the right way: The NPAH was not originally formulated as a predicator of acquisition difficulty or acquisition order. The reportedly consistency between English L1/L2 speakers' earlier acquisition or better performance of RC types higher on the hierarchy could be, except for the fact that they are both affected by processing difficulties to some extent, coincidental. What should be of real interest to SLA researchers is whether learners' interlanguage, of L2 English or Chinese, adheres to the same constraints described by the NPAH. In the current study, both group and individual data do indicate that learners' interlanguage adheres to this natural language constraints: Learners used the gap strategy as the primary strategy, starting at the highest position (i.e., Subject), and used that strategy on a continuous segment on the hierarchy; and they used pronoun coindexation as an alternative strategy at lower positions, also on a continuous segment on the hierarchy. In that sense, L2 Chinese speakers' learner language exhibits patterns consistent with the AH. To put it another way, evidence from this study shows that the "rule" of NPAH is indeed in effect in L2 Chinese. It is interesting that learners should all use the two relativization strategies continuously on the AH, and perhaps this in turn could lend support for the linguistic analysis of treating putative Chinese RCs as true relativization structures instead of "attributive" or "noun-modifying" clauses.

References

Aoun, Joseph. & Yen-hui Audrey Li. 2003. Essays on the representational and derivational nature of grammar: The diversity of wh-constructions. Cambridge, Mass: MIT.

Chen, Chunyin. 1999. The second language acquisition of Chinese relative clauses. The World of Chinese Language 94. 59-76.

Comrie, Bernard & Edward L. Keenan. 1979. Noun phrase accessibility revisited. Language 55. 649-664.

Comrie, Bernard. 2002. The case of relative clauses. In Anna G Ramat (ed.), Typology and second language acquisition, 19-37. Berlin: Mouton de Gruyter.

Doughty, Catherine. 1991. Second language instruction does make a difference: Evidence from an empirical study of SL relativization. Studies in Second Language Acquisition 13. 431-469.

Eckman, Fred R. 2007. Hypotheses and methods in second language acquisition: testing the noun phrase accessibility hierarchy on relative clauses. Studies in Second Language Acquisition 29. 321-327.

Eckman, Fred R., Lawrence Bell & Diane Nelson. 1988. On the generalization of relative clause instruction in the acquisition of English as a second language. Applied Linguistics 9. 1-20.

Ford, Marily. 1983. A method for obtaining measures of local parsing complexity throughout sentences. Journal of Verbal Learning and Verbal Behavior 22. 203-218.

Gass, Susan M. 1979. Language transfer and universal grammatical relations. Language Learning 29. 327-344.

Gass, Susan M. 1982. From theory to practice. In On TESOL '81: Selected papers of the fifteenth annual Conference of Teachers of English to Speakers of Other Languages, edited by Mary Hines & William Rutherford, 129-139. Washington DC: TESOL.

Gibson, Edward, Timothy Desmet, Daniel Grodner, Duane Watson & Kara Ko. 2005. Reading relative clauses in English. Cognitive Linguistics 16. 313-353.

Hamburger, Henry & Stephen Crain. 1982. Relative acquisition. In Language development: Syntax and semantics, Kuczaj, Stan (ed.), II. Hillsdale, NJ: Lawrence Erlbaum.

Hamilton, Robert L. 1994. Is implicational generalization unidirectional and maximal? Evidence from relativization instruction in a second language. Language Learning, 44(1), 123-157.

Hawkins, John A. 1999. Processing complexity and filler-gap dependencies across grammars. Language 75, 244-285.

Hsiao, Franny, & Edward Gibson. 2003. Processing relative clauses in Chinese. Cognition 90(1). 3-27.

Hsu, C.-C. Natalie, Gabriella Hermon & Andrea Zukowski. 2009. Young children's production of head-final relative clauses: Elicited production data from Chinese children. Journal of East Asian Linguistics 18. 323-360.

Huang, C.-T. James, Audrey Y.-H. Li & Yafei Li. 2009. The syntax of Chinese. London: Cambridge University Press.

Izumi, Shinichi. 2003. Processing difficulty in comprehension and production of relative clauses by learners of English as a second language. Language Learning 58(2). 285-323.

Jeon, K. Seon & Hae-Young Kim. 2007. Development of relativization in Korean as a foreign language: The noun phrase accessibility hierarchy in head-internal and head-external relative clauses. Studies in Second Language Acquisition 29. 253-276.

Keenan, Edward L. & Bernard Comrie. 1977. Noun phrase accessibility and universal grammar. Linguistic Inquiry 8. 63-99.

Keenan, Edward. L. & Sarah Hawkins. 1987. The psychological validity of the accessibility hierarchy. In Edward L. Keenan (ed.), Universal grammar: 15 essays, 60-85. London: Croom Helm.

Kuo, Kuei-Lan & Shravan Vasishth. 2006. Processing relative clauses: Evidence from Chinese. http://www.ling.uni-potsdam.de/~vasishth/vasishth2.html. (10 January, 2007.)

Lin, C.-J. Charles. 2006. Grammar and parsing: a typological investigation of relative-clause processing. Tucson, AZ: University of Arizona dissertation.

McKee, Cecile, Dana McDaniel & Jesse Snedeker. 1998. Relatives children say. Journal of Psycholinguistic Research 27. 573-596.

Ozeki, Hiromi, & Shirai, Yasuhiro. 2007. Does the noun phrase accessibility hierarchy predict the difficulty order in the acquisition of Japanese relative clauses? Studies in Second Language Acquisition 29. 169-196.

Packard, Jerome L. 2008. Relative clause processing in L2 speakers of Mandarin and English. Journal of the Chinese Language Teachers Association 43. 107-146.

Roberts, Michael A. 2000. Implicational markedness and the acquisition of relativization by adult learners of Japanese as a foreign language. Manoa, HI: University of Hawaii at Manoa dissertation.

Xu, Yi. 2010. The syntax, processing, and second language acquisition of Chinese relative clauses. Tucson, AZ: University of Arizona dissertation.

Yip, Virginia & Stephen Matthews. 2007. Relative clauses in Cantonese-English bilingual children: Typological challenges and processing motivations. Studies in Second Language Acquisition 29(2). 277-300.

Appendix

Sentence Combination Task Survey Sheet

(Indication of relative clause types such as SU, DO in brackets was added for the convenience of the readers of this paper.)

Combine Sentences 合成句子

Following the examples, combine each pair of the sentences into one.
请按照例子，把两句话合成一句话。

Example: (a) 一个朋友送了我一束花。那个朋友是美国人。→
送了我一束花的那个朋友是美国人。
(b) 小王昨天遇见一个女生。那个女生很漂亮。➔
小王昨天遇见的那个女生很漂亮。
(c) 昨天晚上王先生跟一个女孩子跳舞。那个小姐是我的同学。→
昨天晚上王先生跟她跳舞的那个女孩子是我的同学。
有个朋友送了我一件礼物。那个朋友对大家都很友好。→
送了我一件礼物的那个朋友对大家都很友好。

Exercises:

(1) 刚才有个女人在找我妈妈。那个女人姓李。 (SU)
(2) 王经理赔了一个客人三百美金。那个客人很不讲道理。 (IO)
(3) 张力一直鼓励一个同学。那个同学和他在一个班上学中文。 (DO)
(4) 安妮和一位老师在吃饭。那位老师会说法语。 (OPrep)
(5) 昨天小王帮了一个美国学生。那个美国学生是班上新来的同学。 (DO)
(6) 坏人打伤了一个女人的丈夫。那个女人非常担心。 (Poss)
(7) 王先生在屋子里等一个朋友。那个朋友是他中学同学。 (DO)
(8) 小李在路上问候了一个人。那个人以前也在这个学校读书。 (DO)
(9) 我妈妈向一个人问路。那个人是个老太太。 (OPrep)
(10) 坏人抢了一个男人的钱包。那个男人非常生气。 (Poss)
(11) 我弟弟送了一个女孩一本书。那个女孩很高兴。 (IO)
(12) 小偷偷了一个同学的电脑。那个同学很不高兴。 (Poss)
(13) 我哥哥向一个朋友买了一台电脑。那个朋友在电脑公司工作。 (OPrep)
(14) 有个小孩在路上撞倒了小王。那个小孩很小还不太会走路。 (SU)
(15) 小张给了一个朋友五百块钱。那个朋友没有工作。 (IO)
(16) 我哥哥借给了一个人一本中文书。那个人想了解中文文化。 (IO)
(17) 我向一位老师请教了这个问题。那位老师对学生特别好。 (OPrep)
(18) 小林弄坏了一个孩子的玩具。那个孩子很不开心。 (Poss)
(19) 有个朋友每个周末都陪小李。那个朋友和他关系特别好。 (SU)
(20) 有个同学昨天拜访了小张。那个同学对人很热情。 (SU)