Article

Evidence of the Accessibility Hierarchy in Relative Clauses in Chinese as a Second Language*

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Relative clause (RC) structures are productive and complex in Chinese. While second language acquisition studies of RCs in English has a long tradition, it is only in recent years that the Chinese as a second/foreign language researchers started to pay close attention to the comparative difficulties of different types of Chinese RCs for learners. A well-known markedness generalization regarding the RC structure is the Noun Phrase Accessibility Hierarchy (AH), and its implications in second language acquisition have been well-attested in English and other postnominal RCs. This research tests if Chinese as a foreign language learners' production ease of different RC types adheres to the order of the AH, and if such markedness is reflected in RC-forming strategies in learners' interlanguage. Learners in a written sentence combination task produced more target-like subject and direct object RCs than indirect object and object of preposition RCs. Further evidence for a subject RC preference was found in error analysis. Meanwhile, learners used gap and pronoun strategies within the AH constraint, indicating that their interlanguage grammar is comparable to that of natural languages. We conclude that the implicational generalization of the AH holds true in second language (L2) Chinese.

Key words: Chinese relative clauses, gap and pronoun strategy, learner language, Noun Phrase Accessibility Hierarchy, subject preference

1. Introduction

Studies on relative clause (RC) acquisition have a long tradition in English as a second/foreign language studies since Ioup & Kruse (1977), Gass (1979), etc., but the topic of Chinese RC acquisition has only recently drawn researchers' attention (Dai 2010; Packard 2008; Xu 2012). Examples (1a–d) represent Chinese relativization on the following four positions: Subject (SU), Direct Object (DO), Indirect Object (IO), and Object of Preposition (OPrep), in this order.

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(1) a. [$_{NP}$[$_{CP}$—$_i$ 喜歡李四的]那個人$_i$]在北京上學。

       [$_{NP}$[$_{CP}$—$_i$ xihuan Lisi de] na-ge   ren$_i$]   zai Beijing shangxue. – SU

                like   Lisi Rel that-Cl person at   Beijing   study

       'The person who likes Lisi is studying in Beijing now.'

  b. [[李四喜歡__$_i$的]那個人$_i$]在北京上學。

       [$_{NP}$ [$_{CP}$ Lisi xihuan __$_i$ de] na-ge ren$_i$]   zai Beijing shangxue.   – DO

             Lisi like   Rel that-Cl person at   Beijing   study

       'The person that Lisi likes is studying in Beijing now.'

  c. [$_{NP}$[$_{CP}$ 我借給他$_i$書的]那個人$_i$]學習很認真。

       [$_{NP}$ [$_{CP}$ Wo jie-gei ta$_i$ shu de] na-ge ren$_i$]   xuexi hen   renzhen. – IO

             I   lend-to he book Rel that-Cl person study very   serious

       'The person that I lent the book to studies very hard.'

  d. [$_{NP}$[$_{CP}$我向他$_i$問路的]那個人$_i$]非常耐心。

       [$_{NP}$ [$_{CP}$ Wo xiang   ta$_i$ wen-lu de] na-ge   ren$_i$]   feichang naixin. – OPrep

             I   towards he ask-way Rel that-Cl person very   patient

       'The person whom I asked the way of was very patient.'

The relativized head NP *na-ge ren* 'that person' is extracted from within the clause, and is placed outside the CP boundary. In (1a–b), the relativized position is realized as a gap, and the co-indexation relation between the gap and the head NP, also referred to as a filler-gap dependency, is indicated by a subscripted *i*. In (1c–d), the relativized position is occupied by a resumptive pronoun *ta* 'he', also co-indexed with the head. *de* is a relativization marker and is a Complementizer in phrase structure (Aoun & Li 2003).

Although Comrie (2002) entertained the possibility that putative RCs in some East Asian languages may be attributive in nature, such a hypothesis cannot be readily extended to Chinese. Comrie (2002) argues that in Japanese, a *pro* occupies the position where one would normally expect a gap. But since Chinese *pro* is syntactically rare, occurring only as a subject but not as an object (Huang 1989:193) under restricted pragmatic circumstances, the gap in Chinese SU and DO RCs cannot all be analyzed as a *pro*. Syntactic constraints such as Subjacency, the Complex Noun Phrase Constraint, the Sentential Subject Condition, and the Adjunct Condition all have to be observed (Huang et al. 2009; Ning 1993). Cheng & Sybesma (2005) argued that although the semantic relation between the head and the clause in Chinese is not always identical to those in the English type of RCs, there is always an argument or an adjunct variable, or an event variable in Chinese RCs. In addition, Lin's (2008) experiments showed that filler-gap integration is involved in head-final RC structure processing in East Asian languages, distinguishing purported RC structures from other prenominal modifiers. One can therefore conclude that Chinese RCs are indeed relativization structures that involve true filler-gap dependencies.

RC acquisition studies in English as a first (L1) and second language (L2) consistently report that the ranking of acquisition difficulty from SU to OPrep is largely consistent with Keenan & Comrie's (1977) generalization of the Noun Phrase Accessibility Hierarchy (NPAH or AH), a markedness universal in language typology that can be roughly presented as Subject > Object > Indirect Object > Oblique Object > Genitive > Object of Comparison, where '>' means 'more accessible'

or 'easier to relativize' (Keenan & Comrie 1977). Studies showing evidence of the AH patterns in L1 acquisition include Diessel & Tomasello (2000) and Keenan & Hawkins (1987), and those in the second language acquisition (SLA) context include Doughty (1991), Eckman et al. (1988), Gass (1979, 1982), Hamilton (1994), and Izumi (2003). Recently, attention has been drawn to East Asian RCs, and much controversy has been reported on the comparative acquisition difficulties across these extraction types (e.g. Jeon & Kim 2007; Kanno 2007; O'Grady et al. 2003; Ozeki & Shirai 2007; Yip & Matthews 2007). Chinese presents a particularly interesting case for investigation for SLA researchers and psycholinguists, because of the combination of head-final direction and the subject–verb–object (SVO) clausal word order is extremely rare in typology (Dryer 2005; Comrie 2008). The study of acquisition patterns of Chinese RC is therefore particularly useful in testing the validity of different psycholinguistic models (Gibson & Wu 2013) and in evaluating whether natural language constraints such as the AH are observed in learners' interlanguage (IL). To fill in this lacuna, the present study aims to investigate whether there is evidence for the purportedly universal markedness of SU > DO > IO > OPrep in L2 Chinese, and if so, in what way it manifests.

2. Existing literature

2.1 The AH and English L2 studies

Examples of English RCs in the first four extraction positions are shown in (2). Oblique object and Object of Preposition are often used interchangeably in SLA studies (e.g. Gass 1979; Izumi 2003). Only SU, DO, IO, and OPrep RCs are discussed here.

(2) a. $[_{NP}$ the man$_i$ that $[_{CP}$__$_i$ kissed me]]   – SU
     b. $[_{NP}$ the man$_i$ that $[_{CP}$ I kissed __$_i$]]   – DO
     c. $[_{NP}$ the man$_i$ that $[_{CP}$ I gave the book to __$_i$]]   – IO
     d. $[_{NP}$ the man$_i$ that $[_{CP}$ I talk to __$_i$]]   – OPrep

Both Chinese and English have the SVO word order, and while RCs in the two languages differ in head direction, they also differ in the use of gap/pronoun strategies. The AH states that a natural language may use two strategies to achieve relativizaton. Gap is the primary strategy that applies to high, more accessible positions, and if a language has relativization structures at all, a gap must be used in relativizing the SU position. Pronoun is used in low positions and it is also called the resumptive pronoun or pronoun retention strategy. Languages differ in the exact ways in which the gap/pronoun alternates. In English, the gap strategy is used consistently throughout the four positions of SU, DO, IO, OPrep, and in Chinese, a gap is used in the two higher positions, namely the SU and the DO positions, while a pronoun is used in IO and OPrep positions. The AH also states that both RC-forming strategies have to apply on a continuous segment of the hierarchy (with potential overlaps of the two strategies allowed in adjacent positions). The implicational generalization is as follows: if language X can use the gap strategy to form IO RCs, then it must be able to use the gap strategy to relativize the SU and DO positions too. The implication of the pronoun strategy goes in the reverse direction: if a language Y uses resumptive pronouns in IO, it must also use pronouns

in OPrep, Genitive, and Object of Comparison relativization (if relativization in these positions exists at all). This generalization holds true in more than 50 languages, including Chinese and English, in Keenan & Comrie's (1977) observation.

The underlying motivation for the AH is thought to be a 'psycholinguistic' one (Gass 1979; Keenan & Comrie 1977), and readers are directed to Hawkins' (1999) filler-gap domain theory for one version of explanation. The AH could have two potential implications in language acquisition. For one, since Eckman (1977) proposed that typological markedness could be a possible explanation or a means of predicting learners' interlanguage development, it has been suggested that a reasonable interpretation of what is 'more accessible' is that acquisition ease should follow SU > DO > IO > OPrep, with lower positions that are considered 'more marked' inherently more difficult to acquire than higher or 'more accessible' positions (Eckman 1984, 1991, 1996). This prediction is generally borne out in English RC studies. By testing learners from different L1 groups, Gass (1979) showed that learners' accuracy rates were consistent with the AH, with exceptions in Genitive relativization only. Pavesi (1986) reported that the AH (till the Genitive position) was clearly evident in learner language from participants in both formal and informal learning contexts. A second implication considers markedness in terms of the alternation between the gap and pronoun strategies. There is evidence in SLA studies of postnominal RCs that learners tend to use pronouns, the unmarked strategy, in less accessible positions, even if their native language may allow pronoun deletion in that position. For instance, Gass (1979:336–337) suggested that ESL learners, disregarding their L1 background, accepted pronoun retention to comprehend more complex structures of Genitive and Object of Comparison relativization. Her data showed that learners accepted pronouns in a grammaticality judgment task and made pronoun retention errors in a sentence combination task increasingly more as the position descended from SU > DO > IO. Hyltenstam (1984) investigated the L2 acquisition of Swedish, with participants with Spanish, Finnish, Persian, and Greek L1 backgrounds. Hyltenstam found, despite learners' L1 variations, that all learners used pronouns 'roughly in the order predicted by the NP Accessibility Hierarchy' (Hyltenstam 1984:47). In other words, learners' interlanguage adhered to the AH constraint. According to Hawkins (2007:341), the following is the correct interpretation of the AH's implication in SLA: for learner language at any of the successive stages of development, if the gap strategy is used in a low position, then it must be used in higher positions as well, whereas if a pronoun is used in a high position, it must be used in lower positions. In this paper, I discuss whether the markedness of the AH is reflected in the L2 acquisition of Chinese from these two aspects: one in terms of production ease in or preference for extraction types higher on the hierarchy, and the other in the alternation of gap/pronoun RC-forming strategies in learner language.

2.2 Acquisition studies on Chinese RCs

Psycholinguistic studies of RCs with L1 adult participants generally investigate the comparative difficulty of SU versus DO extractions. In contrast to the robust findings of SU > DO asymmetry in English RCs (Ford 1983; King & Just 1991; Traxler et al. 2002; Wanner & Maratsos 1978), the comparison between SU and DO RCs has been controversial in Chinese L1 processing experiments, which mostly use self-paced reading tasks. Chen et al. (2008), Gibson & Wu (2013), and Hsiao &

Gibson (2003) reported that DO RCs were processed more easily than their SU counterparts, while Vasishth et al. (2013), Li et al. (2010), and Lin & Bever (2006) presented evidence for an SU preference. In L1 children's acquisition of Chinese, Su (2004) used an acting-out, oral description task modeled after Hamburger & Crain (1982) with L1 children and adults. While no significant differences were found in the percentage of RCs or target RCs produced between the SU and DO types, she found that younger children had significantly lower percentage production of OPrep RCs as compared to older children. In a more recent study, Hsu et al. (2009) used a picture elicitation task and found that children were able to orally produce more SU RCs with greater accuracy than DO RCs. While Su's research focused on the resumptive pronoun and gap strategies in relativization, and Hsu et al.'s study showed how L1 children's RC production can be explained by psycholinguistic mechanisms, these studies did not attempt to address how acquisition patterns might be explained by the AH.

In SLA studies, Chen (1999) used a grammaticality acceptance task and a word ordering task to examine a number of variables, including SU and DO extractions, demonstrative-classifier sequence, animacy, and L1 background. She reported that in general, for Chinese L1 adults as well as for Chinese L2 speakers with English and Japanese L1 background, in the demonstrative-classifier-RC sequence, SU is easier, whereas in the RC-demonstrative-classifier sequence, DO is easier. More recently, Packard (2008) used the psycholinguistic technique of self-paced reading tasks to assess the online processing difficulty of L2 Chinese learners, and reported a DO preference. However, in Packard's materials, sentences in the SU and the DO conditions have different lexical items and animate and inanimate arguments were used randomly. Dai (2010) used a sentence combination task to investigate both the extraction type and the RC's modifying positions (that is, whether the head noun acts as a subject or an object in the matrix clause). Interpreting the mean scores, he claimed that for subject-modifying RCs, the order of relative ease was DO > SU > OPrep > IO, while for object-modifying RCs, the ranking from 'easier' to 'more difficult' was SU > DO > IO > OPrep, consistent with the AH. Dai (2010) reported SU and DO relativization to be significantly easier than IO and OPrep overall, and modifying position was not found to be a significant factor. However, a limitation in Dai's study is that he did not differentiate L2 learners with English, Japanese, or Korean L1 backgrounds. As Japanese and Korean RCs differ from English ones in word order and have head-final structures, it is not possible to discuss the potential influence from L1 transfer in Dai's results. Finally, Xu (2013) conducted a listening comprehension multiple-choice task and the prompts were RC-containing complex nouns crossing three variables, namely animacy, SU/DO extraction types, and the presence/absence of a post-RC demonstrative-classifier. She reported that learners performed better in Subject-animate, Object-inanimate RCs, most likely due to the additional semantic cues. For RCs with two animate argument nouns, accuracy in the SU condition was higher than that in the DO condition when there was no classifier modification, but there was no asymmetry between the two conditions when there was a post-RC demonstrative-classifier string.

The above review shows that acquisition studies of Chinese RCs have burgeoned in recent years, but much remains to be explored. Except for the current project, Dai (2010) was the only published study that addresses the relevance of the AH to Chinese RCs in learner language throughout the four positions in (1a–d).

3. Methodology: A sentence combination task

While L2 acquisition studies of English RCs used a variety of tasks including picture-cued listening comprehension (Brown 1971), recall after aural stimulus (Keenan & Hawkins 1987), picture-cued oral production (Doughty 1991), grammaticality judgment (Ioup & Kruse 1977), etc., sentence combination appeared to be the task most often used (in L2 English: Doughty 1991; Eckman et al. 1988; Gass 1979, 1982; Hamilton 1994; Izumi 2003; Tang & Xu 2011; in L2 Japanese: Ozeki & Shirai 2007; Roberts 2000). The current study follows the tradition and uses a sentence combination task to make results comparable. Only RCs in the subject-modifying position were investigated, excluding the variable of modifying position in the matrix clause.

3.1 Participants

Forty-five participants who were native speakers of English participated in the experiment. All were third semester Chinese as a foreign language (CFL) students enrolled in an intensive language program at the Defense Languages Institute (DLI) in the United States. All participants were native speakers of English, ranging from 18 to 36 years of age. Data from 32 of these participants were considered valid for analysis (see justification in the Scoring section). Because the DLI conducts qualifying exams throughout the curriculum and students exiting third semester are required to pass the Defense Language Proficiency Test and receive a score of two or above on the Interagency Roundtable Language Scale in order to graduate, participants had approximately the same level of overall proficiency at the time of the experiment. This task is not necessarily appropriate for native speakers, since the task would hardly present any challenges for native speakers if participants followed instructions. Thus, an L1 control group was not used in any of the previous studies and is not used here.

3.2 Design and materials

Two versions of a written test were created, so that half of the participants completed the first version of the test, while the other half of the participants took the second version of the test. This design was used to allow the counter-balancing of test items in the SU and the DO conditions. The test contained 20 pairs of sentences. The instruction section of the test paper gave examples as to how two sentences in each pair should be combined into one sentence. In combination, the first sentence in a pair was to be changed to a subordinate clause, while information in the second sentence was to be used as the main predicate. The combined result would always be a complex sentence containing an RC in the matrix subject-modifying position. The 20 test items included four items eliciting each of the following types of RCs: SU, DO, ID, OPrep, and Genitive RC. The items were presented in simplified Chinese characters, with *pinyin* at the top of each character (see Appendix A for the test items). Analysis in this paper is restricted to 16 items crossing the first four RC types.[1] The items were randomly ordered. The second sentence always contained a stative verb (e.g. *zhu* 'live', *xihuan* 'like'), a predicate adjective (which is roughly equivalent to a stative verb), or a copula, and the head noun of the target RC was always [+human]. To keep the length of the

subordinate clause (the first sentence in the pair) approximately the same throughout the four conditions, sentential adverbials like *gangcai* ('just now') were added to the first sentence of the pair in the SU and DO conditions.

Example (3) provides a test item targeting an SU production in one version of the test, and a target-like response example is given in (4).

(3)   a. 剛才有個女人在找我媽媽。
         Gangcai   you   ge   nüren   zai   zhao   wo   mama.
         just.now   exist   Cl   woman   PRG   look-for   I   mother
         'Just now a woman was looking for my mother.'
     b. 那個女人姓李。
         Na   ge   nüren   xing   Li.
         that   Cl   woman   name   Li
         'That woman is named Li.'
(4)   剛才在找我媽媽的（那個）女人姓李。[2]
     Gangcai   zai   zhao   wo   mama   de   (na-ge)   nüren   xing   Li.
     just.now   PRG   look.for   I   mother   Rel   that-Cl   woman   name   Li
     'The woman that was looking for my mother just now is named Li.'

Since each SU item should have a DO counterpart containing exactly the same lexical items to allow comparisons directly caused by relativized position, in the other version of the test (3) was replaced by (5), an item targeting at DO RC production.

(5)   a. 剛才我媽媽在找一個女人。
         Gangcai   wo   mama   zai   zhao   yi-ge   nüren.
         just.now   I   mother   PRG   look.for   one-Cl   woman
         'Just now, my mother was looking for a woman.'
     b. 那個女人姓李。
         Na-ge   nüren   xing   Li.
         that-Cl   girl   name   Li
         'That girl is named Li.'

Since participants took one version of the test, they would only get either the SU version, for example (3), or the DO version, for example (5), but not both, of an item containing the particular lexical content. IO and OPrep items on the two versions of the test papers were the same.

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[1] Genitive RCs were not analyzed here because their grammaticality is subject to a number of licensing conditions in Chinese (Tang 1981), and the purpose of including them was to collect data to initiate other research.

[2] *Na-ge* can be absent, or be replaced by *yi-ge* (numeral-classifier), or it may occur in pre-RC positions. Because these variations result in SU, DO, IO, or OPrep RCs, they are all considered target-like. The differences between these variations have been discussed in the literature as reflecting distinctions between restrictive and nonrestrictive/descriptive relative clauses (Chao 1968; Del Gobbo 2003).

To ensure that no potential errors should be caused by participants' lack of vocabulary knowledge, an instructor at the DLI reviewed test materials and made sure that vocabulary items in the test were previously introduced in class.

3.3 Procedure

This experiment was administered in a regular class period of 50 minutes. Two DLI teachers and the author of the paper together administered the experiment. In addition to the examples and instructions given on the written sheet, the author gave brief oral instructions before the experiment and provided additional examples of SU, DO, IO, and OPrep RCs, with one example in each condition. The experiment was not timed, but all participants finished the task within 50 minutes. There were no questions about vocabulary or use of reference books, although participants were allowed to use dictionaries and ask questions about the meanings of unfamiliar words.

3.4 Scoring and exclusion criterion

The test was scored based on whether the participants produced the target response. The scoring was either 1 (correct) or 0 (incorrect). The mean score of all the 45 participants who took the task was 6.9, with a standard deviation of 4.9. To ensure that only data from participants who followed task instructions and who exhibited some evidence of RC structure acquisition were used, data exclusion applies to 13 participants who received a score of two or below, that is, one standard deviation below the mean. Among them, eight participants did not follow instructions to combine sentences in the right order, resulting in *miscombination* errors in all or most of the 16 items. Five other participants' responses contained a large number of ungrammatical productions that could not be analyzed as potentially having any RC structures, exhibiting no sign of acquiring the RC structure. These 13 participants' responses were quantitatively and qualitatively different from others, since no other participants made more than three *miscombination* errors, and for the remaining 32 participants there were very few ungrammatical non-RC productions or *miscombination* errors.[3]

Following Ozeki & Shirai (2007), miscombining the sentences in the wrong order is considered an error, regardless of the grammaticality of the production. A potential miscombination error for item (3) is (6), in which the learner used information in the second sentence as the subordinate clause.

(6)　剛才一個姓李的女人在找我媽媽。
　　　Gangcai　yi-ge　xing　Li　de　nüren　zai　zhao　wo　mama.
　　　just.now　one-Cl　name　Li　Rel　woman　PRG　look.for　I　mother
　　　'A woman named Li was looking for my mother just now.'

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[3] The relatively high removal rate can be attributed to the following factors: first, although participants had overall comparable proficiency as judged by DLI instructors, they may have been at different acquisition stages in RC structures. The same situation was noted in Dai (2010), in which only 39 out of 50 intermediate-to-high proficiency Chinese L2 participants' responses were used. Second, since a large proportion of miscombination errors (164 out of 225) were also observed in previous studies on head-final RC structures (Ozeki & Shirai 2007), it is possible that the *miscombined* response was easier than the target-like response due to processing factors in head-final RC languages. See footnote 4.

Miscombination in this experiment most often would result in a subject RC, for example (6), as the relativized NP is always the subject of the second sentence. In some cases where the second sentence contains an intransitive state verb, the miscombined response would have an ambiguous adjectival phrase modification structure, for example *bu-jiang-daoli de keren* 'unreasonable guest/a guest that cannot be reasoned with', which potentially contain a (reduced) subject RC (Aoun & Li 2003:147). In the present study, participants either miscombined almost all of the items or generally followed the combination order. Since an array of potential processing factors unrelated to extraction position or the AH may have led to such *miscombination* errors, the current paper does not go into the details of analyzing the cause of such responses, but focuses on other response types that were clearly relevant to difficulties caused by RC extraction types.[4]

4. Results

4.1 Accuracy measure

Participants' mean scores in the four conditions were 3.69 (SD = 0.88), 3.66 (SD = 0.64), 0.84 (SD = 1.56), and 1.22 (SD = 1.56), respectively. The percentages of accuracies were 92.25%, 91.5%, 21%, and 30.5% in SU, DO, IO, and OPrep conditions, respectively. Figure 1 shows the accuracy rate differences among these conditions. Using one-way analysis of variance (ANOVA) with repeated measures with a Greenhouse-Geisser correction, the mean scores for extraction type were statistically significantly different (F(1.911, 59.234) = 70.685, p < 0.0001). Paired sample comparisons between the following conditions were significant at the .05 level: SU versus IO (p < 0.0001), SU versus OPrep (p < 0.0001), DO versus IO (p < 0.0001), DO versus OPrep (p < 0.0001). The comparisons between SU and DO (p = 1.0) and between IO and OPrep (p = 0.42) were not statistically significant.

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[4] As an anonymous reviewer pointed out, potential factors prompting such *miscombination* errors may include the use of stative verbs in the second sentence, the semantic relation between the two sentences in a pair which sometimes involve a casual relationship, and the tendency of introducing a new referent by RC in the matrix object instead of in the matrix subject position (Fox & Thompson 1990). In this study, participants were given clear oral instructions before the experiment that *miscombinations* would be considered as errors, and there was evidence that most participants were able to overcome these potential tendencies and to produce RCs in the desired target-like form, while eight participants either failed to attend to such experimental instructions or were strongly affected by these potential factors throughout the experiment. Whichever the case, since these processing mechanisms are not relevant to RC gap position, I followed Ozeki & Shirai's (2007) example in reporting them as contributing to an (in)accuracy rate but did not go into details in analyzing the potential causes for such errors. Excluding those eight participants who showed a disparate production pattern from others would allow the analysis to focus on the current research questions. Future research that aims to examine a comprehensive list of interacting processing factors affecting RC production (including the role of RC-modifying position) should take these potential factors into consideration. I am grateful to the reviewers who pointed out these issues.
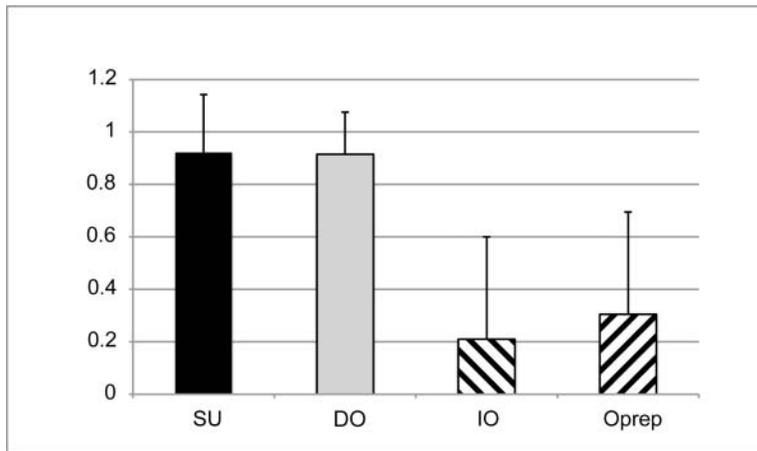
Figure 1: Accuracy rate in the four RC conditions (the error bars indicate standard deviations)

4.2 Error types

Non-targetlike responses were considered errors and analyzed in detail. Errors that were purely orthographical in nature (e.g. missing a stroke in character writing) or minor deviations irrelevant to the syntax of relativization (e.g. missing or infelicitous use of perfective aspect marker *le*) were excluded from consideration. All other errors were classified into six major categories, with secondary level classification in some cases. The author and a graduate student in Chinese linguistics first coded all non-targetlike productions independently and then compared results, reaching full agreement regarding the categorization of errors. Those error types and their frequencies are summarized in Table 1. Representative examples are illustrated with gloss and translations below, while Appendix B provides a comprehensive list of errors. Figure 2 visually demonstrates the percentage of errors in these six categories out of all responses in each RC condition.

4.2.1 Pronouns and resumption

The first type of errors, *pronouns and resumption*, includes the misuses of resumptive pronouns, resumptive NPs, and missing pronouns. These errors were related to strategies to co-index the relativized position with the head. *Missing pronoun* applies only to IO and OPrep RCs. There were 84 *missing pronouns* in IO RCs and 42 in OPrep RCs. In (7), *(ta) indicates that the obligatory pronoun was missing in the learner's response and the absence causes ungrammaticality. The participant and the item number are specified in parentheses.

(7)　我媽媽向*(他)問路的那個人是個老太太。(A1:9)
　　　Wo　mama　xiang　*(ta)　wenlu　de　na-ge　ren　shi　ge　lao-taitai.
　　　I　mother　from　(he)　ask.way　Rel　that-Cl　person　BE　Cl　old-lady
　　　'The person that my mother asked the way from is an old lady.'

Table 1: Error types and frequencies

| Type of errors		Subject RC	Object RC	Indirect Obj. RC	Obj. of Prep RC	SUM
Pronouns and Resumption	Missing pronoun	/	/	84	42	126
	Resumptive pronoun		2	/	/	2
	Resumptive NP		1	2	4	7
Type change		/	2	7	13	22
Clause-internal errors	Missing argument	1	1			2
	Missing relativize marker (*de*)	1	2		2	5
	Word order			1	1	2
Non-relative clause Responses	Non-RC grammatical			2	1	3
	Non-RC ungrammatical				4	4
Type-specific errors	Existential presentative *you*	8				8
	Missing prepositional phrase				19	19
	3-argument verb error			3		3
Miscombination		0	3	2	3	8
Total errors		10	11	101	89	211
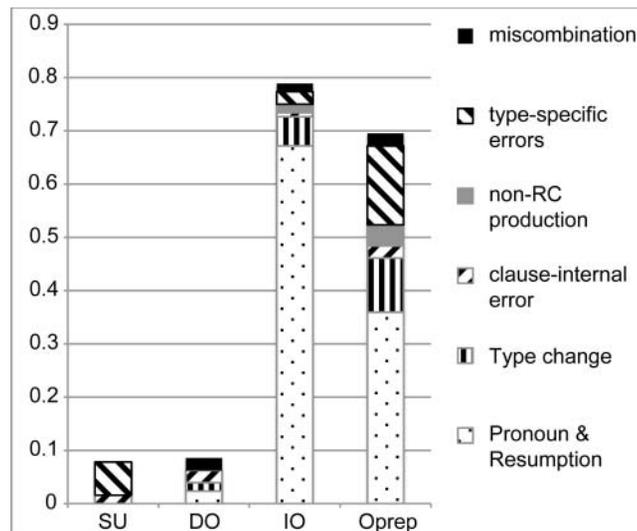
Figure 2: The percentage of six error types out of all responses in the four RC conditions

Resumptive pronoun, or *pronoun retention*, is the use of a pronoun in a position where there should be a gap. Two such errors were identified for DO RCs. (he) indicates that the response was ungrammatical because the pronoun occupied the position where there should be a gap. Brackets and co-indexing subscripts were added in the Romanization presentation to show the dependency relation.

(8)　王先生在屋子裡等(*他)的那個朋友是他的同學。(A11:7)

[$_{NP}$ [$_{CP}$　Wang　xiansheng　zai　wuzi　li　deng　(*ta)$_i$　de]　na-ge　pengyou$_i$]
　　　　　Wang　Mr.　　　at　room　in　wait　he　　Rel　that-Cl　friend
　　　　　shi　ta　de　　　tongxue.
　　　　　BE　he　NOM　classmate

'The person that Mr. Wang was waiting for inside the room was his classmate.'

Resumptive NP, exemplified by (9), is the use of the relativized noun phrase itself in the relativized position. Seven errors of this type were observed in DO (1), IO (2), OPrep RC (4) productions. (Numbers within parentheses are token numbers.) In most cases, there is a copy of the relativized NP inside the RC, for example *yi-ge pengyou* in (9), and a copy of the NP as the RC head outside the clause. An asterisk indicates ungrammaticality.

(9)　*小張給了一個朋友五百塊錢的那個朋友沒有工作。(B7:15)

*[$_{NP}$ [$_{CP}$　Xiao　Zhang　gei-le　　yi-ge　pengyou$_i$　wubai-kuai-qian　de]
　　　　　Xiao　Zhang　give-PERF　one-Cl　friend　　500-dollar　　　Rel
na-ge　　pengyou$_i$　mei-you　gongzuo.
that-Cl　friend　　　not-have　job

'The friend whom Xiao Zhang gave 500 dollars to does not have a job.'

In one case, illustrated in (10), a participant made an error of resumptive NP while missing the head NP outside the clause. Example (10) resembles an internally-headed RC structure, which exists in Korean and arguably in Cantonese in DO relativization (Yip & Matthews 2007).

(10)　*我媽媽向那個人問路的是個老太太。(A9:9)

*[$_{NP}$ [$_{CP}$　Wo　mama　xiang　na-ge　ren$_i$　wenlu　de] __$_i$]　shi　ge　lao-taitai$_i$.
　　　　　I　　mother　from　that-Cl　person　ask.way　Rel　　BE　Cl　old-lady

'The person that my mother asked the way from is an old lady.'

Example (10) is included in this category because, similar to other resumptive NP errors, there is no gap in the relativized position. Internally-headed RCs are thought to be easier and acquired earlier than regular, externally-headed RCs in L1 and L2 acquisition (Jeon & Kim 2007; Yip & Matthews 2007). That is, a potential explanation for (10) is that the learners opted for a structurally easier response over the target-like response.

4.2.2 Type change

The second category of errors is *type change*: two sentences were combined into a matrix sentence containing an RC, but not the targeted type of RC. In all instances of such errors,

participants changed the targeted RC types (DO, IO, and OPrep) into an SU, and there were no cases of a targeted SU being changed into a different type. There were two such errors in the DO condition, seven in the IO condition, and 13 in the OPrep condition. In five of the errors, passive marker *bei* was used in order to maintain the propositional meaning of the sentences. For instance, for the paired prompt shown in (11), instead of producing the targeted OPrep RC equivalent to 'The girl that my brother gave the book to is very happy', some participants produced (12). With the added passive marker, (12) contains a subject RC. The subject position before *bei* is taken by a gap and is co-indexed with *na-ge nühai* 'that girl'.

(11)　我弟弟送了一個女孩一本書。那個女孩很高興。
　　　Wo　didi　　　　　song-le　yi-ge　nühai　yi-ben　shu.
　　　I　younger.brother　give-PERF　one-Cl　girl　one-Cl　book
　　　Na-ge　nühai　hen　gaoxing.
　　　that-Cl　girl　very　happy
　　　'My younger brother gave a book to a girl. That girl is very happy.'

(12)　??被我弟弟送了一本書的那個女孩很高興。(A19; B14:11)
　　　??Bei wo didi　　　　　song-le　yi-ben shu de na-ge　nühai hen　gaoxing.
　　　PAS　I　younger.brother give-PERF one-Cl book Rel that-Cl girl　very　happy
　　　'The girl that was given a book (as a present) by my younger brother is very happy.'

Because *bei* passive in Chinese is usually used to express adverse situations and is only felicitous with certain verbs or predicates (e.g. verbs of perception, implications of disposal; Li & Thompson 1989:493–508), these *bei* passives in learners' responses were not appropriate usages. Other *bei* passives observed include *bei jie-gei* 'be loaned (a book) to', *bei gei-le* ('be given'), and *bei mai-le* 'be purchased (a computer) from'. In another case of *RC type change*, the participant maintained the propositional meaning of the prompt by changing the verb *mai* (third tone) 'buy' into *mai* (fourth tone) 'sell' in production.

In seven cases of such *RC type change* errors, there were meaning changes in the proposition of the paired prompt. For instance, a paired item targeted at an OPrep RC is shown in (13). Instead of producing 'The person that my mother asked the way from was an old lady', the participant produced an SU RC, in (14).

(13)　我媽媽向一個人問路。那個人是個老太太。
　　　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.'

(14)　向我媽媽問路的那個人是個老太太。(B20:9)
　　　Xiang　wo　mama　wen-lu　de　na-ge　ren　　shi ge　lao-taitai.
　　　from　I　mother ask-way Rel that-Cl person BE Cl　old-lady
　　　'The person who asked my mother for directions is an old lady.'

In the remaining nine cases of such *RC type change*, the propositional meaning was not affected significantly even though participants did not add the passive marker *bei*. Those errors generally

occurred in item 4, in which the paired prompt was 'Ann was having a meal with a teacher; the teacher speaks French'. Instead of producing the targeted OPrep RC 'The teacher that Ann was having a meal with speaks French', several participants combined the pair into a Subject RC 'The teacher that was having a meal with Ann speaks French'.

4.2.3 Clause-internal errors

The third category of errors is the *clause-internal error*, that is, errors within the relative clause, including *missing argument NPs*, *missing the relative clause marker* de, and *word order errors* within the relative clause. These errors were relevant to the structure of relativization, but other than constituting non-targetlike responses, they did not directly indicate the comparative difficulty across different extraction types. Due to the variety of forms and a range of potential causes, they cannot be analyzed in detail here, but examples are included in Appendix B.

4.2.4 Non-RC productions

A fourth category of errors is *non-relative clause production*, which may be grammatical or not. While grammatical non-RC responses can be interpreted as an avoidance strategy, the four *ungrammatical non-RC production* responses were not subject to structural analysis, since they neither contained the RC marker *de* nor adhered to the SVO clausal word orders. They were also not the focus of our discussion, but it should be noted that ungrammatical RC productions all occurred in the OPrep condition, the lowest position on the AH. Meanwhile, the grammatical avoidance strategies were also only observed in IO and OPrep extractions rather than in SU or DO conditions.

4.2.5 Type-specific errors

The fifth category of errors were type-specific, that is, they were exclusive to particular extraction types, including errors with *existential presentative you* in SU condition, *missing prepositional phrases* in OPrep, and errors with verb conjugation in *three argument verbs*. An example of *missing prepositional phrase* is *wo mama wen lu de na-ge ren* 'the person that my mother asked the way (from)', in which the complete prepositional phrase of *xiang ta* 'from her' was dropped. The other two error types are pertinent to other grammatical areas. In three argument verb errors, learners attempted to use a *ba*-structure or a *gei*-construction for a sentence containing an IO, but failed to produce a grammatical response due to wrong word orders with *ba/gei*. Existential *you* errors will be discussed later.

4.2.6 Miscombination

The last category is *miscombinations*. Aside from the few excluded participants who failed to follow combination order instructions throughout, this error occurred only occasionally in the data: one participant made three simple *miscombination* errors and two reconstructed *miscombinations*, with an example in (15); the other three *miscombination* errors were produced by three different participants.

(15) 我哥哥的電腦是向[那個在電腦公司工作的朋友]買來的。(B3:13)

Wo gege   de   diannao shi xiang [$_{NP}$ na-ge zai diannao gongsi
I   elder.brother POS computer BE from   that-Cl at computer company
gongzuo de   pengyou] mai-lai de.
work   Rel friend   buy   PAR
'My elder brother's computer was bought from the friend who works in a computer
company.'
Target: 'The friend that my elder brother bought the computer from works at a
computer company.'

In (15), the participant combined the two sentences while relativizing the NP 'the friend',
contrary to task instructions. But this participant also changed the subject of the first clause in his/
her production, producing a complex NP containing an RC in a matrix object of preposition
position. The scarcity of this error type in the valid data suggests that their occurrences may be due
to certain clausal relations in particular test items, and several factors unrelated to gap position
(including RC modifying position) may be relevant to this error type. Thus, these responses cannot
be decisively analyzed as evidence of difficulty associated with any particular type of extraction.

5. Discussion

Results in this research will not only shed light on behavioral patterns in learning Chinese as
a second language, but are informative for SLA inquiries in general, since the controversial results
in L2 studies of East Asian language in RC acquisition contrast with the generally consistent find-
ings in English RC acquisition in relation to the AH. Evidence from Chinese may help disambigu-
ate whether the AH markedness effect in acquisition is truly universal or language-specific. In the
following, accuracy in production will first be used as a measure of acquisition ease. In addition,
production errors are analyzed in detail to further reveal learners' difficulty in production. The
analysis of learner errors can also have implications in CFL teaching practices.

5.1 Accuracy as a measure

While structural preference can be reflected in some other areas of behavioral patterns, such
as opting for a more favorable structure while avoiding a more difficult type of extraction, as
we shall see later, I first follow previous studies (Gass 1979; Ozeki & Shirai 2007) to examine
whether the AH is implicative of the accuracy rate in learner production of different RC types. First,
much higher scores in SU and DO conditions than in the IO and OPrep conditions were observed,
indicating that IO and OPrep RCs were more difficult than the SU and DO extractions for Chinese
L2 learners. This result replicates Dai's (2010) findings for Chinese L2s, and is also comparable to
Ozeki & Shirai's (2007) sentence combination experiment result in which they reported an SU =
DO > Oblique pattern. In the present study, the contrast was robust. Interpreting together with the
error type, one can observe that the asymmetry is largely caused by the *missing pronoun* errors
in the two lower positions, with 84 and 42 tokens respectively. Two mechanisms can explain the

prevailing errors. First, if the AH is indeed implicational to the inherent acquisition difficulties, learners' acquisition of IO and OPrep may lag much behind their competence of SU and DO, thus resulting in a low accuracy rate in the two former positions in general. Errors of *missing pronouns* aside, IO and OPrep RCs would still have a lower accuracy rate compared to the other two types, indicating that the markedness of IO/OPrep was attested in other areas beyond using target-like relativization strategies. Second, making connections to EFL/ESL studies, the present results suggest a strong effect of L1 transfer. In English L2 RC acquisition, pronoun retention was a frequently reported error and the transfer of gap/pronoun strategies from L1 to L2 was found (e.g. Gass 1979). In the present study, the learners' L1 was English, in which a gap strategy is consistently used throughout all positions. A potential negative L1 transfer would result in *missing pronoun* errors in IO and OPrep. It is likely that both factors contributed to the low scores in IO and OPrep relativization in the present study.

At the same time, accuracy rates in SU and DO RCs did not differ significantly, giving no evidence of an SU preference. In Ozeki & Shirai's (2007) study, they did not find SU/DO asymmetry either, and the authors interpreted that as inconsistency with the AH. However, Eckman (2007:325) argued that Ozeki & Shirai's data in fact conformed to the hierarchy, in that 'the hierarchy does not exclude grammars in which both SU and DO relatives emerge simultaneously and are acquired before OBL relatives.' Hawkins (2007:341) shares the same interpretation, saying that 'If [. . .] SU, DO, and oblique relatives all arise simultaneously and are equally correct, this is fully compatible with the NPAH.' Therefore, the present result does not contradict the implicational generalization of the hierarchy: mean scores in the SU and DO were equally high in the current experiment. Considering this as a 'ceiling effect', the accuracy result indicates learners had acquired the SU and DO relativization structures equally well at the time of the experiment.

There was no significant difference between means in the IO and the OPrep conditions, and this was again consistent with the AH. Admittedly, there was a numerical tendency that the mean in the latter condition was higher. Upon closer examination, the lower score was caused solely by more *missing pronoun* errors in the IO condition. Explanations are offered in §5.3.

In sum, given an overall pattern of SU/DO > IO/OPrep, CFL learners' acquisition difficulties in different extraction types as measured by response accuracy conformed to the ranking of the AH.

5.2 Production ease of subject RCs

Although the accuracy rate alone does not lend any evidence to a potential asymmetry of SU being easier than DO, preference for the SU structure was found through qualitative analysis of learners' productions in detail. First of all, the error of *changing RC type* indicates that SU could indeed be easier than other types, since this error only occurred in other targeted extraction types. Participants produced SUs even when they had to add grammatical elements such as a passivizer *bei* or change the verb, which were costly from a psycholinguistic perspective. Importantly, type changes never occurred in the other direction, and there was no conversion between other RC types, making the unidirectional change of DO/IO/OPrep→SU a significant pattern. The same type change error was witnessed in several other acquisition studies. For instance, Diessel & Tomasello (2005)

studied L1 children's acquisition of English and German using an oral imitation task, and RC type change was the most frequent error in both languages. In their English study, in 32 instances, DO, IO, OPrep RCs were changed into SUs, while only six tokens of a targeted SU were changed into a DO. In their German study, among a total of 79 cases of conversion, 13 were changing targeted SU productions to DOs, while the remaining 66 went in the direction of DO/IO/OPrep→SU. They interpreted such conversions to be consistent with a filler-gap distance hypothesis (Hawkins 1987; Keenan & Hawkins 1987; O'Grady 1997, 1999), which in turn speaks to the psycholinguistic validity of the AH markedness. Xiao & Lü (2005:263) and Dai et al. (2008:75), in using the same sentence combination task in L2 English, also reported type changes in the direction of DO/OPrep→SU, while they did not mention type changes in the other direction, and Xiao & Lü (2005) interpreted the pattern as evidence for a predominant SU preference. The same conversion to SU RCs was also found in Ozeki & Shirai (2007), in which they reported 32 instances of OBL→SU and five tokens of DO→SU conversion, and only one token of SU→DO, although in their study, the authors attributed the conversion not to structural markedness but to animacy, since they found that the conversion took place mostly when the RC involved an animate head, but not so much when the head noun was inanimate. The present result shows that when both argument NPs are animate, there is a preference of SU over DO in L2 Chinese.

Next, several types of errors did not occur in the SU condition. For instance, the *resumptive pronoun* and *resumptive NP errors* never occurred in the SU condition, showing that learners always relativized the SU using a gap, conforming to the AH universal. These *resumptive* elements occurred increasingly more as the positions descended on the AH. Both resumptive NPs and resumptive pronouns were previously reported in L1 acquisition studies of French (Labelle 1990), and resumptive pronouns were extensively discussed in McKee et al. (1998) as an error in L1 English acquisition. McKee & McDaniel (2001:149) noted that a resumptive pronoun is sometimes accepted by English adults and is a 'saving device' when one finds a filler-gap distance to be too long. Both errors were also reported in previous L1 acquisition studies of Chinese RCs (Hsu et al. 2009; Su 2004) and they both occurred more frequently in targeted DO conditions than in the SU condition. Hsu et al. (2009) reported that L1 adults also occasionally make the resumptive NP errors in the DO condition, but not in the SU condition. These studies show that resumptive errors are not a purely developmental issue, but reflect parsing or structural difficulties when extraction from that position is hard, as McKee & McDaniel (2001) explained. In addition to the error of resumptive NP in the IO condition shown in (9), I gave the relative clause part of another example in the DO condition below in (16).

(16)　*小王在路上撞到了一個小孩的那個小孩。 (B7:14)
　　　*[$_{NP}$[$_{CP}$ Xiao Wang zai lu-shang zhuangdao-le　　yi-ge　xiaohai$_i$ de] na-ge　xiaohai$_i$]
　　　　　　Xiao Wang at　road-up　knock.over-PERF one-Cl child　Rel that-Cl child
　　　'The child that Little Wang knocked over on the street'

Hawkins (1999:260) explained that formal expressions (i.e. resumptive elements) instead of an abstract gap are used in lower positions on the AH (when filler-gap distance is long) to help achieve relativization by explicitly marking the dependency relations. For instance, in processing *Xiaowang*

... *zhuangdao-le __ de na-ge xiaohai* ('the girl that Xiao Wang knocked over'), learners have to assume that a gap existed after the verb 'knock over', and to figure out that the gap, while having an empty phonetic form and abstract semantic content, refers to the head 'that child'. But in (16), it is much easier for one to realize that the resumptive NP 'a child' bears the same information as the head 'that child'. Therefore, resumption is a parsing strategy to achieve extractions that are otherwise hard. This also provides an answer to Hyltenstam's (1984) hypothesis that there is a psycholinguistic explanation as to why pronoun retention is unmarked in less accessible positions. The absence of this error type in SU suggests that extraction from the Subject position is indeed easier, since no help from a phonetically realized item is needed.

Third, an examination of the errors in the SU condition shows that the majority of the errors that learners made in the SU condition were not due to incompetence in establishing a filler-gap relation: eight of the 10 errors in the SU condition were errors with existential *you*. Based on my intuition and judgment from my native speaker informants, several responses, for example (17), while not completely grammatical, were marginally acceptable.

(17) ?剛才有個在找我媽媽的女人姓李。(A4:1)
　　　?Gangcai you ge zai zhao　wo mama de　　nüren　xing　Li.
　　　just.now　exist　Cl　PRG　look.for　I　　mother　Rel　woman　name　Li
　　　'Just now (there was) a woman who was looking for my mother (and she) was named Li.'

This error has something to do with the structures used in the prompt pair in the SU condition, which always contains *you*, similar to (18b). Because indefinite NPs with numerals typically do not occur as topics (Li & Thompson 1989:86, 167–168), (18a) is not entirely grammatical and (18b) is a 'realis descriptive clause' in serial verb construction (Li & Thompson 1989:611–618). In other words, existential *you* licenses the indefinite NP in (18b).

(18) a. ??一個女人在找我媽媽。
　　　　　??Yi-ge　nüren　　zai　zhao　　wo　　mama.
　　　　　one-Cl　woman　PRG　look.for　I　　mother
　　　　　'A woman was looking for my mother.'
　　　b. 有個女人在找我媽媽。
　　　　　You　　ge　nüren　　zai　zhao　　wo　　mama.
　　　　　exist　Cl　woman　PRG　look.for　I　　mother
　　　　　'There was a woman looking for my mother.'

A target-like response should not contain *you* because the second sentence in the pair uses the demonstrative-classifier and the NP relativized is supposed to be definite. While it goes out of the realm of this paper to discuss when RC-modified complex NPs are more acceptable in an existential construction, it is clear that these errors are related to semantic knowledge of the NP's referential features and the existential construction. In all eight instances, these responses contained a gap and a correct word order of RC-de-N, although some productions like *you ge . . . de na ge*

ren with multiple occurrences of the classifiers were more problematic. One can hypothesize that in a situation where the complication of existential *you* is avoided, the accuracy rate of SU could be potentially higher.

In sum, although learners' performance in the SU and the DO conditions did not differ significantly in terms of accuracy rate, the comparative ease and structural preference of SU are reflected in the direction of RC-type conversion, the absence of resumptive elements in the SU condition, and the fact that non-targetlike SU productions most often contained an intact filler-gap phrase structure.[5]

5.3 Pronoun strategies

The most prevalent errors that affected both IO and OPrep conditions were *missing pronoun* errors, and they occurred much more frequently in the former condition. As responses with *missing pronouns* are the manifestation of a gap strategy, learners' IL is in full accordance with the marked-ness hierarchy. As mentioned earlier, Hawkins (2007) explicitly states that if the AH is implica-tional to learner language, resumptive pronouns would emerge earlier in lower positions than in higher ones. In this study, for some learners, resumptive pronouns occurred in OPrep while they had not occurred in IO. Following Eckman's (2007:325–326) suggestion, I analyze learner language in terms of relativization strategies using individual data, summarized in Table 2. Target-like

Table 2: Patterns of pronoun retention in RCs in learners' IL

SU	DO	IO	OPrep	Number of L2 learner	Natural language example
–	(+)	+	+	2	Persian; Genoese
–	–	+	+	5	Chinese (target language)
–	–	–	+	6	Shano[a]
–	–	–	–	16	Japanese; English (L1)
–	–	(+)	(+)	1	?
–	–	–	?	2	

[a]Keenan & Comrie's (1977) observation is that the pronoun strategy is used optionally in relativizing OPrep in Shano.
– : gap strategy; +: pronoun strategy; (+): pronoun retention varies, that is, pronoun/gap optional; ?: lack of data.
Note: Irrelevant errors such as RC internal structural errors and miscombination are excluded from consideration in this table.

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[5] Also, disregarding those learners showing a general failure to follow instructions, the 32 participants never made *miscombination* errors in the SU condition and such errors were observed in all other conditions. As mentioned earlier and shown in Appendix B, *miscombination* always resulted in structures that potentially contained SU relativizations. This pattern may also be related to the relative ease of SU RC production in comparison with DO/IO/OPrep RC (so that target-like responses in the SU condition were more easily pro-duced than in other conditions, despite some potentially influencing factors favoring a *miscombined* response). But since *miscombination* may be a compiled-out result of other interacting factors, this paper does not rely on this particular error type to argue for the SU preference.

responses as well as responses with *missing pronouns* and *resumptive pronouns* were counted. In most cases, natural language examples can be found in Keenan & Comrie's (1977) original study.

Table 2 shows that for each individual learner, there was an increasing reliance on pronoun retention as extraction positions descended on the hierarchy, and in most cases, learners used one particular RC-forming strategy consistently within a particular position. First of all, all learners used the gap strategy in SU positions; two used a pronoun occasionally in the DO position, and used it systematically in relativizing IO and OPrep positions. Optionality on transitional positions (DO in this case) is allowed according to Keenan & Comrie (1977:94). Five participants used RC-forming strategies in a way that is target-like, with gaps in SU and DO, and pronouns in IO and OPrep. Six used gaps consistently in SU, DO, and IO, and pronouns in OPrep. Sixteen learners used the gap strategy in relativizing all four positions, showing a transfer from English. There were also two learners who used gaps systematically for SU, DO, and IO, but there was no evidence of any RC-forming strategies in OPrep, because they made other types of errors for all four items in the OPrep condition. Finally, one L2 learner used gap systematically in SU and DO RCs, and pronoun retention varied in IO and OPrep. While a natural language example identical to this RC-forming strategy alternation was not available in Keenan & Comrie's original article, this learners' IL does not contradict the AH, since the AH does not exclude a grammar that permits flexibility within the two relativization options (gap and pronoun) on two adjacent positions. In sum, learners always used RC-forming strategies in accordance with the AH, although they are not necessarily target-like or L1-like. The same consistency was observed in Hyltenstam (1984).

Because the alternation between pronouns and gaps in relativization is thought to be a psycho-linguistic issue (Gass 1979; Hawkins 1999; McKee & McDaniel 2001), fewer *missing pronoun* errors in OPrep, unlike other error types, cannot be directly taken as evidence of better competence. Instead, it can reflect that OPrep is structurally more difficult, thus prompting participants to rely on explicit dependency marking. As a result of the interaction between several learners' transfer of the gap strategy from their L1 in both IO and OPrep relativization, and an increasing reliance on pronoun retention in OPrep, accuracy rate in OPrep was numerically (but not significantly) higher than that in the IO.

While the increasing use of pronouns suggests that OPrep relativization is the most marked extraction type with a typological and structural criteria, note that once the 'pronoun strategy' error is factored out, numerically there would be more errors in the OPrep condition than in the IO condition, indicating that the OPrep position is less or no more accessible than IO from an acquisitional perspective.

6. Conclusion

Summarizing, positive evidence was found for the implicative power of the AH in L2 Chinese. First, a SU/DO > IO/OPrep pattern was observed in learners' response accuracy. This ranking is fully compatible with the hierarchical order. Meanwhile, the preference of SU over DO was confirmed by qualitative analysis of learners' productions. These findings are consistent with most previous L1 acquisition studies of Chinese RCs, and partially corroborated Dai's (2010) L2 study.

For IO and OPrep relativization, learners had the most problems with using the resumptive pronoun strategy, suggesting a negative L1 transfer from RC-forming strategies in English. The pronoun strategy was used more often in the OPrep than in the IO condition, and this attested to the fact that the AH markedness governs the grammar of learner language, as it does natural languages. From a cross-linguistic perspective, this study provides evidence that despite the distinctive word orders in Chinese RCs, acquisition patterns adhere to the AH.

It is hoped that this study can be useful to both researcher and teacher. From a research perspective, results indicate that Chinese is similar to head-initial languages in having a subject relative clause preference and in following the universal markedness of the AH. For teaching, the summary and analysis of learner errors may be useful. Two issues are worth noting. First, while learners in the present study were quite competent in SU/DO relativization, they had the greatest problem with using pronouns in IO RCs and several types of errors occurred in OPrep relativization. While IO and OPrep RCs are not frequently used in Chinese, for learners who need to develop syntactic sophistication in their production, grammatical awareness of these structures can be beneficial. Second, current CFL textbooks most often introduce the SU and DO relativization structures in the same text. Packard (2008) suggested that in sequencing CFL materials, one might consider instructing less difficult structures first. At the same time, pedagogical intervention studies in English (Doughty 1991; Eckman et al. 1988) indicate that it may be effective to teach learners more marked structures instead of easier ones, because learners who were instructed on relativizing more marked constructions could generalize the grammatical knowledge to less marked structures. At any rate, pedagogy specialists can make informed decisions based on empirical findings in this research.

Several limitations of the study have to be recognized. First, due to practical concerns of participants' vocabulary knowledge, only animate arguments were used in this experiment. The interaction of animacy and the AH is not investigated and the above conclusion applies only to animate RCs. Some previous studies showed that the SU preference over DO relativization is associated with animate head and that inanimate head nouns can help the processing of DO RCs (Mak et al. 2002; Ozeki & Shirai 2007; Traxler et al. 2002). Future research should address whether the AH can still be maintained if the head noun is inanimate. Second, as some studies measuring reading time reported a DO preference, it is possible that different processes are involved in receptive and productive tasks of RCs, as Håkansson & Hansson (2000) pointed out. In fact, several previous studies reported the role of task variation (Izumi 2003; Prideaux & Baker 1986; Tang & Xu 2011). Although sentence combination as a traditional production task has been successfully used, Juffs (2007) encouraged the use of a combination of offline and online techniques to investigate RC processing and acquisition. This project also involved participants in one proficiency group only, and while we can reveal the IL patterns of CFL learners at this particular stage, one can discuss developmental issues and acquisition orders more directly when several proficiency groups are included. The high data exclusion rate due to participants' varying competence in RC production and in following combination order instruction is also one issue that future research should circumvent. Despite these weaknesses, the current study can inspire more comprehensive and compelling studies in the L2 acquisition of Chinese RCs in the future.

Appendix A
Sentence combination task
合成句子

Following the examples, combine each pair of the sentences into one.
請按照例子，把兩句話合成一句話。

Example:　(a)　有個朋友送了我一束花。那個朋友是美國人。→
　　　　　　　送了我一束花的那個朋友是美國人。
　　　　(b)　小王昨天遇見一個女生。那個女生很漂亮。→
　　　　　　　小王昨天遇見的那個女生很漂亮。
　　　　(c)　昨天晚上王先生跟一個女孩子跳舞。那個小姐是我的同學。→
　　　　　　　昨天晚上王先生跟她跳舞的那個女孩子是我的同學。
　　　　(d)　有個朋友送了我一件禮物。那個朋友對大家都很友好。→
　　　　　　　送了我一件禮物的那個朋友對大家都很友好。

Exercises:

(1)	剛才有個女人在找我媽媽。那個女人姓李。	(SU)
(2)	王經理賠了一個客人三百美金。那個客人很不講道理。	(IO)
(3)	張力一直鼓勵一個同學。那個同學和他在一個班上學中文。	(DO)
(4)	安妮和一位老師在吃飯。那位老師會說法語。	(OPrep)
(5)	昨天小王幫了一個美國學生。那個美國學生是班上新來的同學。	(DO)
(6)	壞人打傷了一個女人的丈夫。那個女人非常擔心。	(Genitive)
(7)	王先生在屋子裡等一個朋友。那個朋友是他中學同學。	(DO)
(8)	小李在路上問候了一個人。那個人以前也在這個學校讀書。	(DO)
(9)	我媽媽向一個人問路。那個人是個老太太。	(OPrep)
(10)	壞人搶了一個男人的錢包。那個男人非常生氣。	(Genitive)
(11)	我弟弟送了一個女孩一本書。那個女孩很高興。	(IO)
(12)	小偷偷了一個同學的電腦。那個同學很不高興。	(Genitive)
(13)	我哥哥向一個朋友買了一台電腦。那個朋友在電腦公司工作。	(OPrep)
(14)	有個小孩在路上撞倒了小王。那個小孩很小還不太會走路。	(SU)
(15)	小張給了一個朋友五百塊錢。那個朋友沒有工作。	(IO)
(16)	我哥哥借給了一個人一本中文書。那個人想瞭解中文文化。	(IO)
(17)	我向一位老師請教了這個問題。那位老師對學生特別好。	(OPrep)
(18)	小林弄壞了一個孩子的玩具。那個孩子很不開心。	(Genitive)
(19)	有個朋友每個週末都陪小李。那個朋友和他關係特別好。	(SU)
(20)	有個同學昨天拜訪了小張。那個同學對人很熱情。	(SU)

Note: Indication of relative clause types such as SU, DO in parentheses is not included in the test sheet given to participants.

Appendix B
Error summary

The number of observed tokens is indicated in parentheses. Each error is marked for participant and item number, as well as the target condition that it occurred in. Brackets are used to indicate non-target-like features aside from the major error in learners' production.

Examples of *missing pronoun*, *missing prepositional phrase*, and *three-argument verb* errors are not included, either due to a large number of occurrences or irrelevance to the relativization structure.

1. Pronouns and Resumptions
Missing pronouns (126)

Resumptive Pronoun (2)
王先生在屋子裡等他的那個朋友是他中學同學。(A11:7; DO condition)
小李在路上問候了他的那個人以前也在這個學校讀書。(A15:8; DO condition)

Resumptive NPs (7)
DO condition:
小王在路上撞到了一個小孩的那個小孩很小還不太會走路。(B7:14)

IO condition:
小張給了一個朋友五百塊錢的那個朋友沒有工作。(B7:15)
我哥哥借給了一個人一本中文書的那個人想瞭解中文文化。(B7:16)

OPrep condition:
我媽媽向那個人問路的是個老太太。(A9:9) [internally-headed RC structure]
安妮和一位老師在吃飯的那位老師會說法語。(A14; B22:4)
我向一位老師請教了這個問題的那位老師對學生特別好。(B7:17)

2. RC Type Change (22):
DO→SU (2):
在路上撞到了小王的小孩很小還不太會走路。(B20:14)
昨天拜訪小張的同學對人很熱情。(B20:20)

IO→SU (7):
送了我弟弟一本書的女孩很高興。(B20:11)
給了小張五百塊錢的那個朋友沒有工作。(B20:15)
借給了我哥哥一本中文書的人想瞭解中文文化。(B20:16)
被我弟弟送了一本書的那個女孩很高興。(A19; B14:11) [*bei* passive]
被小張給了五百塊錢的那個朋友沒有工作。(B21:15) [*bei* passive]
被我哥哥借給一本中文書的那個人想瞭解中國文化。(B21:16) [*bei* passive]

OPREP→SU (13):
和安妮在吃飯的那個老師會說法語。(A6; A15; B13; B17:4)
跟安妮在吃飯的那個老師會說法語。(A9; A17; B3:4) [preposition change]
吃飯和安妮的那位老師會說法語。(B2:4) [wrong word order in prepositional phrase]
那位跟安妮一起吃飯的老師會說法語。(B21:4)
賣了我哥一台電腦的那個朋友在一家電腦公司工作。(B22:13) [verb change]
被我哥哥買了一台電腦的那個朋友在電腦公司工作。(B14:13) [*bei* passive]
向我媽媽問路的那個人是個老太太。(B20:9)
請教了我這個問題向的老師對學生特別好。(B20:17) [ungrammatical word order with preposition]

3. Clause-internal errors
Missing relative clause marker *de* (5):
昨天小王幫了美國學生是班上新來的同學。(A1:5; DO condition)
我哥哥向他買了一台電腦那個朋友在電腦公司工作。(A6:14; OPrep condition)
我向他請教了這個問題那位老師對學生特別好。(A6:17; OPrep condition)

昨天拜訪了小張那個同學對人很熱情。(A6:20; SU condition)
我媽媽在找那個女人姓李。(B22:1; DO condition)

Missing Argument (2):
小李和那個每個週末陪的朋友的關係特別好。(B16:19; DO condition) [missing pronoun in SU position]
一直鼓勵的那個張同學和他在一個班上學中文。(B7:3; SU condition) [missing NP in DO position]

Word order error within the relative clause (2):
三百美金王經理陪的哪[sic]個客人很不講道理。(B14:2) [IO condition]
買了我一台電腦向的朋友在電腦公司工作。(B20:13) [missing NP *gege* 'brother'; OPrep condition]

4. Non-RC responses
Grammatical (3):
我弟弟送了一個女孩一本書,讓那個女孩很高興。(B22:11; OPrep condition)
小張給了一個朋友五百塊錢,因為那個朋友沒有工作。(B22:15; IO condition)
那位老師對學生特別好,我向他請教了這個問題。(B22:17; IO condition)

Ungrammatical (4):
我哥哥問那個朋友在電腦公司工作買了一台電腦。(B6:13; OPrep condition)
我請教了這個問題向那位老師對學生特別好。(B6:17; OPprep condition)
安妮在吃飯和那位老師會說法語。(B8:4; Oprep condition)
安妮和他的那位老師會說法語在吃飯。(B12:4; Oprep condition)

5. Type-specific errors
Existential presentative *you* (All in SU condition)
剛才有個在找我媽媽的女人姓李。(A4:1)
有個路上撞到了小王的小孩很小還不太會走路。(A4:14)
有個每個週末都陪小李的朋友和他關係特別好。(A4:19)
有個昨天拜訪了小張的一個同學對人很熱情。(A4:20)
有個一直鼓勵張力的那個同學和他在一個班上學中文。(B1:3; B4:3)
昨天有個幫了小王的那個美國學生是班上新來的同學。(B1:5)
有個在屋子裡等王先生的那個朋友是他中學同學。(B1:7)

Three-argument verb errors (3)
Missing prepositional phrase (19)

6. Miscombination errors (8)
Reconstructed miscombination:
我哥哥的電腦是向那個在電腦公司工作的朋友買來的。(B3:13, OPrep condition)
我哥哥的中文書借給那個想瞭解中國[sic]文化的人。(B3:16, IO condition)

Miscombination:
安妮跟那位會說法語的老師在一塊吃著飯。(A23:4; OPrep condition) [preposition change]
安妮和一位會說法語的老師在吃飯。(B16:4; Oprep condition)
王經理賠了那個很不講道理的客人三百美金。(B3: 2; IO condition)
剛才我媽媽在找那個姓李的女人。(B3:1; B7: 1; DO condition)
小李每個週末都陪那個和他關係特別好的朋友。(B3:19; DO condition)

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中文作爲第二語言中的名詞短語可及性遞進階

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關係子句在中文裡是一種常見且複雜的結構。雖然在對英語作爲第二語言學習的研究中，關係子句的討論已經有很多，直至最近幾年研究者們才開始注意中文關係子句習得的問題。很多已有的英語類的研究發現，「名詞短語可及性遞進階」這一起源於語言類型學標誌性的假說常常可以預測或者解釋哪一種類型的子句對學習者來說更難習得。本項目測試了這種由易到難的遞進階和標誌性在中文作第二語言的學習過程中是否有所體現。通過讓學習者完成句子連接的任務，研究指出對學習者來說，主語關係子句是最容易的，其次是賓語關係子句。另外學習者對空位和代詞的使用，也表明學習者的中介語語法符合這個「可及性遞進階」對人類自然語言的總結。實驗說明「可及性遞進階」不僅適用於中心名詞在前的英語等語言，也適用於中文作爲第二語言的學習。

關鍵詞：中文關係子句，學習者中介語，名詞短語可及性遞進階，主語優勢，空位和代詞