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CFL learners' productions of relative clauses with demonstratives: From theory to empirical research[1]

Abstract: Relative clauses (RCs), with their typological universality and structural complexity, have always been central to inquiries in generative linguistics and language acquisition. Although recent years witness a growing interest in psycholinguistic and acquisition research in Chinese RCs, few studies have attempted to make connections between psycholinguistic theories and Chinese as a second language learning and teaching. This paper tries to bridge the gap and uses an interdisciplinary approach to address the comparative difficulty of Chinese subject and object RCs in their interaction with demonstratives. Chinese L1 and L2 participants completed a written sentence completion task. More productions in a certain type of RC, when observed in both participant groups, were interpreted as evidence of structural preference, and differences between L1 and L2 patterns were analyzed as competence issues. It was found that both groups prefer subject RCs when the structure begins with a demonstrative, and this result corresponds to corpus studies of Chinese RCs as well as findings in previous acquisition research. At the same time, there was no asymmetry between the subject and object RCs produced when the demonstrative follows the RC. A multi-constraint model in which a "perspective" factor (MacWhinney 1977, 1982, MacWhinney and Pleh 1988) and a word order factor simultaneously contribute to production cost can explain the data. Meanwhile, L2 participants' errors were often related to neglecting the obligatory gap within the RC. Pedagogical implications were put forward.

1 The experiment reported in this study was part of a bigger dissertation project referenced as Xu (2009). The original dissertation project was supported by the Language Learning Dissertation Grant in 2008, awarded by Language Learning, the journal, and the 2008 University of Arizona's Social and Behavioral Science Research Institute Small Grant. Data from this particular experiment were recoded in 2012 with the help of a research assistant, enabling me to verify the reliability and statistical significance of the result. The interpretation of the results in this study is not entirely identical to Xu (2009), and this paper is intended for researchers as well as for CFL practitioners. I extend my gratitude to the students, the instructors, and the research program coordinator at the Defense Language Institute. I also thank Dr. Feng-hsi Liu, Dr. Heidi Harley, and Dr. Janet Nicol for their advice, Dr. Brian MacWhinney for communicating with me, and Ms. Jie Cui for her assistance in data coding. My appreciation also goes to two anonymous reviewers' for their valuable suggestions. All errors remain mine.

Keywords: Chinese relative clauses, demonstrative, structural preference, psycholinguistic theory, learner errors

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1 Introduction

A topic that has been central to acquisition studies in English for almost half a century (e.g., Brown 1971, Sheldon 1974) and yet has only recently captured attention from applied linguists of Chinese is the structural complexity and acquisition difficulties in different types of relative clauses, hereafter RCs. RCs are complex noun phrases such as *the boy that loves her* or *the boy that she loves*, with the former referred to as subject RCs (SRs), and the latter object RCs (ORs). SRs and ORs differ in their gap/extraction positions. Studies in Indo-European languages consistently report an SR advantage between the two in processing and acquisition studies (e.g., Ford 1983, King and Just 1991, Keenan and Hawkins 1987, Gass 1979, etc.). But more recent studies suggest that similar claims cannot be easily made for East Asian languages like Korean, Japanese, and Cantonese (Jeon and Kim 2007, Ozeki and Shirai 2007, Yip and Matthews 2007). Because Chinese RCs are typologically unique (Comrie 2008), behavioral research on Chinese RCs can disambiguate the effects from different psycholinguistic motivations by providing cross-linguistic evidence.

At the same time, while the grammatical status of Chinese RCs has long been acknowledged by Chinese linguists (e.g., Li and Thompson 1989), treatment of the structure in Chinese as a foreign language (CFL) teaching materials is not unanimous. For instance, Chinese RCs have been referred to as "verbs, verbal phrases" and "subject-object phrases" serving as attributives in *Integrated Chinese* (Liu et al. 2008: 107), "modifying clauses" in *Interactions* (Wu, Yu, and Zhang 2008: 178), and "Subj.+V. phrases", or "V.+Obj. phrases" in *Chinese Link* (Wu et al. 2008: 178). Aside from the lack of correspondence in terminology between theoretical studies and the practice of teaching, research on CFL learners' difficulties in this area is also under-represented, presumably in part due to the European origin of the notion of "relative clauses". But the fact that RCs are not a construction unique to Chinese is no reason to dismiss their importance. Instead, research on this topic shall not only benefit CFL practices but will also complement the ongoing investigations in theoretical and applied linguistics including language typology, psycholinguistics, and acquisition.

This paper aims to go some way in bridging the gap of RC acquisition between CFL practice and second language acquisition (SLA) research. On the one hand, it carries on the tradition in the current debate on SR/OR asymmetry from a structural and psycholinguistic point of view. On the other, it discusses learners' grammatical competence issues, and puts forward propositions in teaching.

2 Review of literature

Chinese RCs, like their English counterparts, follow the canonical word order of SVO in subordinate clauses, but are head-final like Japanese and Korean RCs. They also interact with demonstrative-classifier (DCl) strings and form different sequences, as illustrated in (1a–d). Following traditions in generative syntax, phrasal boundaries are indicated by brackets. The relativized or extraction position that is realized as a gap is indicated by an underscored space.

(1) a. na-ge [_ xihuan Xiao Na] de nansheng DCl-SR
that-Cl like Xiao Na DE boy
'the boy that likes Xiao Na'

b. na-ge [Xiao Naxihuan _] de nansheng DCl-OR
that-Cl Xiao Nalike DE boy
'the boy that Xiao Na likes'

c. [__ xihuan Xiao Na] de na-ge nansheng SR-DCl
like Xiao Na DE that-Cl boy
'the boy that likes Xiao Na'

d. [Xiao Na xihuan __] de na-ge nansheng OR-DCl
Xiao Na like DE that-Cl boy
'the boy that Xiao Na likes'

Chao (1968) and Hashimoto (1971) referred to the DCl-RC sequence, i.e., (1a–b), as descriptive or non-restrictive RCs, and the RC-DCl sequence, i.e., (1c–d), as restrictive RCs.

In L1 psycholinguistic studies of Chinese RCs, results are controversial. Chen et al. (2010), Kuo and Vasishth (2006), Li et al. (2010), and Lin and Bever (2006) suggested that SRs were read faster in self-paced word-by-word reading tasks and therefore easier, while Chen et al. (2008), Gibson and Wu (2011), and Hsiao and Gibson (2003) stated just the opposite. Studies that found an SR preference proposed a few theoretical explanations, including the Noun Phrase Accessibility Hierarchy (Keenan and Comrie 1977) and the structural frequency account (Hale 2001). On the other hand, Gibson and his colleagues, while claiming an OR

preference, hypothesized that parsing difficulty is measured by the linear distance between the gap and the head noun. In Chinese, such a distance in the OR is shorter than that in the SR (Hsiao and Gibson 2003). A few L1 acquisition studies of Chinese RCs suggested better accuracy in SRs, but results were not always robust (Cheng 1995, Su 2004, Hsu, Hermon, and Zukowski 2009).

SLA studies of Chinese RCs are scarce. Chen (1999) tested the effect of several factors including gap position, modifying position (whether the complex noun phrase is a subject or an object in the main clause), and animacy of noun phrases, and suggested a preference for SRs over ORs in the DCl-RC sequence, but a reversed pattern in the RC-DCl sequence. But without a more rigid statistical analysis taking all her variables simultaneously into consideration, her results were not exactly conclusive. Packard (2008) used an on-line self-paced reading task to examine CFL learners' processing of Chinese RCs and reported that SRs were read more slowly. Packard's (2008) study marks an important step forward in using psycholinguistic methodologies in SLA inquiries of Chinese RCs, but animacy (Traxler, Morris, and Seely 2002, Lin and Garnsey 2011) may be a potential confound in his materials.

DCl-modified RCs such as (1a–d) were investigated in some recent studies. Ming (2005, 2010) examined the Sinica and the 1-million-word LCMC corpora, and noted that DCl-RC is used more to track an existing referent and the RC is interpreted as "characterization", while RC-DCl is primarily used to introduce a new referent and the RC functions as "identification". Wu et al. (2007) and Wu et al. (2009) observed from the 0.5-million-word Chinese Treebank 5.0 that SRs tend to occur after the DCl, while ORs occur before the DCl. In Wu, Kaiser, and Anderson's (2009) reaction time experiment, the authors argued that the initial DCl plays an overall facilitating role in comprehension, but the reading of DCl-OR can also be slowed down by the semantic clash between the classifier and the unmatched noun phrase (i.e., the subject NP of the RC) immediately following it. In SLA studies, the preference for DCl-SR, i.e., (1a), was confirmed by Chen (1999) in a grammaticality judgment task and a word-ordering task. Xu (2013) compared DCl-absent RCs and the RC-DCl (1c–d) sequence using a listening comprehension task, and reported an SR preference in DCl-absent RCs when both NPs were animate, and an equally low accuracy for SRs and ORs in the RC-DCl sequence.

The above show that research on the topic of processing and acquiring Chinese RCs has increased in volume in recent years, but much is needed to understand their structural complexities and the acquisition difficulties involved for CFL learners. Previous studies either focused on L1 processing or acquisition, or used L2 participants solely without eliciting the same type of data from L1 counterparts. Also, in acquisition studies of RCs, different measures were found to yield divergent results (Prideaux and Baker 1986, Izumi 2003), while most

existing studies of Chinese RCs relied heavily on comprehension tasks. The current project reports a sentence completion written production task. By taking some of the confounding issues mentioned above into consideration, this research can complement the existing literature.

3 A sentence completion task

The present project was conducted to explore the following questions: First, given a DCl-RC or RC-DCl sequence, are SRs or ORs more preferable in learners' production? If an asymmetry is observed, is it due to structural complexity, or does it reflect a lack of competence? And what types of errors do learners make in production?[2]

3.1 Methods

A written sentence completion task was used in this study. Similar sentence completion tasks have a long track record in psycholinguistic studies (Bever, Garrett, and Hurtig 1973) and have, in particular, been used in eliciting relative clause structures in oral production (Hakansson and Hansson 2000). This task has the advantage of ensuring a good rate of successful response (Hamburger and Crain 1982: 271). Production bias observed similarly for L1 and L2 participants reflects inherent structural complexities, while L2 performance that deviates from L1 patterns suggests acquisition difficulty or competence issues.

Participants. Forty-two adult CFL learners in their third semester at the Defense Language Institute participated in the experiment and data from forty of them were analyzed. (See the Coding section for justification.) All were native speakers of English. Because the participants' institution regularly conducts rigid qualifying exams throughout the curriculum and students exiting third semester are required to pass the Defense Language Proficiency Test and receive a score of 2 or above on the Interagency Roundtable Language scale in order to graduate, participants all had approximately the same level of proficiency at the time of the experiment. In addition to L2 participants, 28 adult native Chinese speakers were recruited from mainland China as the control group. Most of the L1 speakers were

2 It is typical in earlier SLA studies that focus on error analysis to differentiate errors with "mistakes", with the former being interpreted as competence and the latter performance issues (Corder 1967). Instead of assuming the dichotomy, I take the position that systematic deviations from L1 patterns are always worth noting, disregarding what they are labeled as.

bilinguals but none had experience living in an English-speaking country or had family ties with English L1 speakers.

Materials. Two lists were created, each with eight sentences in the DCl-RC sequence and eight in the RC-DCl sequence, represented in (2) and (3).

(2) na-ge _____ de nansheng zai Beijing Daxue
that-Cl DE boy at Beijing University
shangxue. (aishang)
study. (fall.in.love.with)
'The boy that _____ studies at Beijing University'

(3) _____ de na-ge nansheng zai Beijing Daxue
DE that-Cl boy at Beijing University
shangxue. (aishang)
study. (fall.in.love.with)
'The boy that _____ studies at Beijing University'

If a sentence with a particular predication occurred as the sequence in (2) in one list, it appeared in sequence (3) in the other list. The 16 test items all had a transitive verb as the prompt in parentheses. Because agentive verbs in the main predicate may be more likely to suggest an animate subject and could predispose participants towards SRs, the main clause predicate is always stative (e.g., *hen you limao* 'very polite') or non-agentive (e.g., *zhu-zai fujin* 'lives nearby'). The prompt verbs were selected based on the following criteria: (a) they had been introduced to the L2 participants in their regular course curriculum; (b) they were prototypically transitive verbs that often take a human object; (c) they were independent verbs and rarely function as a morpheme to form words that were not intended by the experiment. Therefore, verbs such as *da* 'hit' were excluded (because *daqiu* 'play ballgames' might be a frequently used verb-object compound familiar to learners, thus predisposing the item more towards an SR) and *bangzhu* instead of *bang* 'help', *qinglai* instead of *qing* 'invite', *piping* 'criticize' instead of *ma* 'scold', etc. were used. Care was also taken to ensure that those verbs do not normally induce an SR/OR bias in probability. For instance, we are probably more likely to say something like *The person that Xiao Zhang saw is pretty* rather than *The person that saw Xiao Zhang is pretty*. Similar considerations were given to the choice of noun phrases used in the experiment materials.

Test items were interspersed randomly with 24 filler items to divert participants' attention and to discourage potential structural persistence. The filler sentences belonged to a variety of grammatical structures frequently emphasized in CFL curricula including prepositional phrase with *zai*, *ba*-construction, etc., so

that participants were likely to have remained naive to the specific experiment purpose. See Appendix for the experiment materials.

Procedure. Each participant was randomly assigned to one of the two lists. Participants were asked to complete the sentences by first reading the prompt together with the key word in parentheses and then writing down the first response that came to mind, and not to return to previous items when completing the task. For L2 participants, the experiment was conducted in a classroom and the experiment materials were printed out on sheets and distributed. Four sample items with target-like responses were given on the sheet as part of the instruction. Two of them prompted RC structures, and one was answered with an SR while the other answered with an OR. *Pinyin* was available the top of each simplified character. Participants were asked to work silently and independently and were allowed to use dictionaries and ask questions about the meaning of words if they encounter unfamiliar vocabulary, and none did. The task took 40–60 minutes. For L1 participants, experiment materials were sent to them as Microsoft Word files via the Internet and instructions were given either orally or through online computer-mediated communication. L1 participants completed the task in their own time and space by typing their responses into the document, and reported that they took approximately 20 minutes to complete the task.

Plausibility norming survey. Plausibility surveys were conducted prior to the main experiment to ensure that a potential SR or OR response for all test items would generate sentences that describe situations equally natural in the real world, so that bias towards a particular type of structure cannot be attributed to real-life plausibility differences. Eighteen native speakers of Chinese who did not participate in the main experiment completed the survey. Each survey consisted of eight items representing SRs and eight representing ORs. Each version of a sentence (SR or OR) was read by nine native speakers. To reflect the situation which an SR or OR conveyed without causing a bias, the relative pronoun *ta* was used throughout the survey. In addition, to remove the RC structure, the items tested in the survey consisted of pairs of simple sentences. For instance, to test the plausibility for an SR and an OR for the test item shown in (2–3), the survey items were the Chinese translation of (4) and (5), respectively:

(4) A boy fell in love with her. That boy studies at Beijing University. (SR version)
(5) She fell in love with a boy. That boy studies at Beijing University. (OR version)

Those native speakers were asked to rate how likely a situation described in the sentence would occur in the real world on a scale of 1 ("very likely to occur in real life") to 6 ("almost impossible that it would occur"). The 6-point scale design was intentional so as to avoid an absolutely neutral and ambiguous choice such as 3

in a 5-point scale. All the 16 items were matched for their plausibility in the SR and OR versions ($p < 0.05$ in t-test), and the mean ratings for all items in the SR and the OR versions were 2.08 (SD = 0.40) and 1.96 (SD = 0.35).

3.2 Coding criteria

A target-like response to an item like (2) or (3) was either an SR or an OR using the prompt verb as the key verb in the RC. The following were two target-like L2 participants' responses for item (2). (6) was an SR response and (7) an OR response. Only the complex noun phrase containing the RC is shown.

(6) na-ge aishang Xiao Na de nansheng . . . . . .
that-Cl fall.in.love.with Xiao Na DE boy
'the boy that fell in love with Xiao Na'

(7) na-ge wo meimei aishang de nansheng . . . . . .
that-Cl I younger.sister fall.in.love.with DE boy
'the boy that my younger sister fell in love with'

Most responses were classifiable either as SRs or ORs. Minor deviations such as *gen ta lianxi* instead of *lianxi ta* 'contact him' and a few orthographic or lexical errors that were clearly not related to relativization were disregarded. Some L2 learners' responses contained grammatical errors but they were clearly SR or OR attempts. These responses were coded as "RCs with errors". They can be SR or OR with resumptive pronouns or resumptive NPs, or SR/OR with other errors.

Other non-targetlike responses were not distinctively classifiable as SRs or ORs and they were coded into four different types. First, participants sometimes completed the sentence with a verb phrase (VP) with neither a subject nor an object argument. Those are referred to as *Type A* errors. Because all prompt verbs were transitive verbs, such responses are never entirely felicitous, although potentially interpretable. An example from the L1 group is given below.

(8) zhe-ge teyi qinglai de ren shi ge lao-tongxue.
this-Cl deliberately invite DE person BE Cl old-classmate
'The person that (we/I/. . .) specially invited was an old classmate.'

Type B errors refer to "verb only" response in which the participants filled in the blank with only the prompt verb and nothing else. *Type C* were "missing prompt verb" errors, in which case the blank was either left unfilled or filled with some-

thing that did not contain the prompt verb. *Type D* responses were "others", and they can either be (i) grammatical but non-targetlike response in which the participants appeared to have misinterpreted or misused the prompt verb (e.g., *zhe-ge hen3 hao de ren* 'this very good person' as a response for *hen4* 'hate' as a prompt verb) or (ii) ungrammatical non-RC responses.

Responses were first independently coded by the author and a research assistant, who was a doctoral student of linguistics at a major American university and native speaker of Chinese. The RA coded 10% of the data, including four random samples in the L2 group and three in the L1 group. During coding, the raters exercised caution so that responses were classified into (attempted) SRs/ORs categories only when there was certainty regarding the participants' intention. At the same time, we tried not to easily assign any responses to the Type D category unless necessary. Inter-rater reliability for the L1 data was 100% and that for the L2 data was 93.75%. In cases of different coding, discussions were held to dispel ambiguity. The RA then went over a summary of all the errors that the author summarized and the raters reached agreement regarding the assignment of the error categories.

After the initial coding, two L2 participants' data were excluded from further analysis. Responses from one participant all belonged to Type D errors. Consequently, responses from another participant who had the largest number of (i.e., six) non-RC responses and the lowest number of (i.e., eight) target-like responses in the other group were also excluded. The data reported below were from 40 L2 participants and 28 L1 participants.

3.3 Results

Results from L1 participants are reported in Table 1. Aside from target-like responses, there were three instances of non-RC responses. They were all Type A

Table 1: RCs and errors in the L1 group

		DCl-RC		RC-DCl	
		SR	OR	SR	OR
RC responses	Target-like	170	53	113	109
	% of all RCs	76%	24%	51%	49%
	Valid RC observations	223		222	
Non-RC responses		1		2	
Total		224		224	

Table 2: RCs and errors in the L2 group

		DCl-RC		RC-DCl	
		SR	OR	SR	OR
RC responses	Target-like	193	77	154	127
	RCs with errors	6	0	2	5
	% of all RCs	72%	28%	54%	46%
	Valid RC observations	276		288	
Non-RC responses		44		32	
Total		320		320	

errors. L2 participants' responses were summarized in Table 2 and were subcategorized into "target-like RCs", "RCs with errors" and "non-RC responses". In addition to token numbers, the tables show the percentages of classifiable SRs and ORs out of all valid RC observations. Note that "RCs with errors" are considered as "valid RC responses". L2 participants had 44 non-RC responses in the DCl-RC sequence and 32 non-RC responses in the RC-DCl sequence. These non-RC responses belonged to one of the categories from Type A to Type D.

First, consider the results presented in Table 1. L1s were more likely to produce an SR than an OR in the DCl-RC sequence ($\chi^2 = 61.4$, $p < 0.01$) but were no more likely to produce an SR than an OR in the RC-DCl sequence ($\chi^2 = 0.1$, $p = 0.79$): 76% of the 223 valid RC observations in the DCl-RC sequence were SRs, but only 51% of the 222 valid RC observations in the RC-DCl sequence were SRs; this 76% L1 SR rate in the DCl-RC sequence was statistically different from the 51% L1 SR rate in the RC-DCl sequence ($\chi^2 = 30.8$, $p < 0.01$). The probability of an L1 producing an SR instead of an OR was 3.1 times higher in the DCl-RC condition than in the RC-DCl condition, with a 95% confidence interval for this odds ratio of [2.1, 4.6].

Next, consider the results presented in Table 2. L2s were more likely to produce an SR than an OR in the DCl-RC sequence ($\chi^2 = 53.9$, $p < 0.01$) but were no more likely to produce an SR than an OR in the RC-DCl sequence ($\chi^2 = 2.01$, $p = 0.16$): 72% of the 276 valid RC observations in the DCl-RC sequence were SRs, but only 54% of the 288 valid RC observations in the RC-DCl sequence were SRs; this 72% L2 SR rate in the DCl-RC sequence was statistically different than the 54% L2 SR rate in the RC-DCl sequence ($\chi^2 = 18.2$, $p < 0.01$). The probability of an L2 producing an SR instead of an OR was 2.2 times higher in the DCl-RC condition than in the RC-DCl condition, with a 95% confidence interval for this odds ratio of [1.5, 3.1].

Table 3: L2 participants' non-target-like responses

Response / Sequence	Resumptive pronoun/NP		RC with other errors		*Type A* VP	*Type B* Verb only	*Type C* Missing prompt verb	*Type D* Others	
	SR	OR	SR	OR				grammatical	ungrammatical
DCl-RC	3	0	3	0	15	18	0	4	7
RC-DCl	1	3	1	2	5	11	4	2	10

L1s and L2s exhibited similar patterns of SR production across the two sequences: the L1 SR rate of 76% and the L2 SR rate of 72% in the DCl-RC condition did not differ from each other ($\chi^2 = 1.1$, $p = 0.30$), and the L1 SR rate of 51% and the L2 SR rate of 54% in the RC-DCl condition did not differ from each other ($\chi^2 = 0.54$, $p = 0.46$).

Target-like productions from the L2 group in the two sequences were then compared to uncover whether learners acquired a particular sequence better than the other as reflected by accuracy rate. Each target-like response (including grammatical SRs and ORs) was assigned a score of 1. The mean score in the DCl-RC condition is 6.75 while that in the RC-DCl condition is 7.025. Paired sample t-tests show that L2 learners' accuracy rate in the two conditions did not differ significantly either over participant or item ($t(1,39) = -1.03$, $p = 0.31$; $t(1,15) = -1.3$, $p = 0.21$).

L2 participants' non-targetlike responses are summarized in Table 3. Those include RC responses with errors as well as non-RC responses. Some errors will be analyzed in detail in section 4.4.

4 Discussion

4.1 A multi-factorial proposal

Since L2 participants exhibited identical patterns with that of native speakers in terms of their structural preference, the SR bias in learners' DCl-RC sequence is not evidence of better acquisition. Nor does the lower percentage of ORs in DCl-RC suggest a deficit in competence. Instead, quantitative difference between SR/

OR responses in the DCl-RC condition indicates underlying structural constraints that make DCl-SR inherently easier than DCl-OR. L2 learners at this stage acquired all the four structures equally well and there was no evidence of an "avoidance" strategy. This result also confirms that the same processes that influence L1 speakers' production also govern L2 behaviors (O'Grady, Lee, and Choo 2003). Below I investigate the underlying mechanisms that L1/L2 participants may rely on in completing the task. Specifically, the speakers' structural preference could be motivated by "perspective" (MacWhinney 1977, 1982, 2005, MacWhinney and Pleh 1988). According to the perspective shift (PS) hypothesis, while both speakers and listeners' perspective is oriented to the sentential subject by default, it is more preferable to maintain the same perspective throughout the whole sentence rather than having to shift perspectives to other arguments. The predictions of the PS were generally borne out for English RCs modifying different positions (MacWhinney 1982). The theory predicates that DCl-SR is less costly than DCl-OR (Brian MacWhinney, personal communication). In (9), a DCl-SR, the perspective is maintained to be that of *na-ge nansheng* 'that boy' throughout the sentence; in (10), a DCl-OR, the perspective starts with *na-ge*, the initial deictic perspective (MacWhinney 2008), and then shifts to the subject of the RC, i.e., *wo meimei* 'my younger sister', and then shifts back to the subject of the main clause, i.e., *nansheng* 'the boy'. (9) is therefore inherently easier than (10).

(9) na-ge aishang Xiao Na de nansheng zai Beijing
that-Cl fall.in.love.with Xiao Na DE boy at Beijing
Daxue shangxue.
University study
'The boy that fell in love with Xiao Na studies at Beijing University.'

(10) na-ge wo meimei aishang de nansheng zai Beijing
that-Cl I younger.sister fall.in.love.with DE boy at Beijing
Daxue shangxue.
University study
'The boy that my younger sister fell in love with studies at Beijing University'

But while the PS lends an advantage to the SR in the DCl-RC sequence, the theory also predicts that SR-DCl should be more favorable than OR-DCl. In (11), an SR-DCl, the perspective is maintained to be that of 'the classmate' throughout, while in (12), an OR-DCl, there is one shift from the subject of the RC, i.e., 'the principal', to the subject of the main clause, i.e., 'the classmate'. (11–12) were both L2 participants' productions.

(11) Wenhou Shantian xiansheng de na-ge tongxue kanqilai
greet Shantian sir DE that-Cl classmate seem
xinqing henhao.
mood very.good
'The classmate that greeted Shantian seems to be in a good mood.'

(12) Xiaozhang wenhou de na-ge tongxue kanqilai xinqing
Principal greet DE that-Cl classmate seem mood
henhao.
very.good
'The classmate that the Principal greeted seems to be in a good mood.'

However, the PS's prediction of an SR advantage in an RC-DCl sequence was not borne out. The lack of bias can be explained if the processing of RCs is multi-factorial, as suggested by Levy (2008: 1166), Reali and Christiansen's (2007: 17–19) in L1 adult processing studies, and by Diessel and Tomasello's (2005: 902) in L1 acquisition research. Though the exact proposals in these studies differ, they all promote the idea that a word-order-based factor as well as some other potential constraints act together to determine the processing and production cost of RCs. The current results suggest that aside from the PS, a Canonical Word Order (CWO) factor may also come into play.

The CWO was proposed by Bever (1970) and Slobin and Bever (1982). The theory suggests that a sequence corresponding to the unmarked word orders in simple sentences in that language is processed and acquired more easily. Thus, an English SR such as *the boy that loves her* is easier than an English OR such as *the boy that she loves*, because the former has a Noun-Verb-Noun (NVN) order, similar to English simple sentence word orders, while the latter has a NNV non-canonical order. This theory is supported cross-linguistically by evidence in SOV languages such as Korean and Japanese (Clancy, Lee, and Zoh 1986). Regarding its relevance to Chinese, Comrie (2008) hypothesized that the resemblance of Chinese OR word order to simple Chinese sentences may be used as a crutch in acquisition, and Packard (2008) also suggested word order as a potential factor responsible for reaction time data in a reading task for L2 Chinese.

According to the CWO, the processing/production of OR-DCl, but not any others, is assisted by its resemblance to simple Chinese active sentences. (13a–d) show the word orders in the four types of RCs represented in (1a–d). N_S and N_O respectively refer to the subject and object of the RC verb, and $DCl_{S/O}$ indicates whether the DCl modifies the subject or the object N.

(13) a. DCl_S V N_O (de) N_S (DCl-SR)
b. DCl_O N_S V (de) N_O (DCl-OR)
c. V N_O (de) DCl_S N_S (SR-DCl)
d. N_S V (de) DCl_O N_O (OR-DCl)

Structures in (13a–c) all violate the CWO: In (13a), DCl_S is not immediately followed by the N_S that it modifies. In (13b), assuming that the N_S is a proper noun or a personal pronoun, as was the case in participants' responses in this study, DCl-N is generally forbidden unless for the rhetorical effect of emphasis. In (13c), an initial VN_O sequence is only permitted under restricted context that allows *pro*-drop. (13d), on the other hand, follows the basic word order of SVO or NVN in Chinese.

The CWO in OR-DCl can be helpful, because the production of (13d) is "aided by the [participants'] experience with simple sentences, for which many of the same processes are used" (McDonald and Christiansen 2002: 40). However, aside from producing the RC part, as illustrated in (13d), speakers still have to correctly configure the syntactic and semantic relations of the RC head with the rest of the main clause when producing a complete sentence. Thus, as those multi-constraint models point out, the CWO effect does not rule out the relevance of other factors.

Acknowledging this multi-factorial proposal, the CWO and the PS can both contribute to the structural complexity of (14a–d) in the following way:

(14) a. DCL-SR-N: no shift + violation of the CWO
b. DCL-OR-N: two shifts + violation of the CWO
c. SR-DCL-N: no shift + violation of the CWO
d. OR-DCL-N: one shift + conformity to the CWO

Structure in (14d) is thus not necessarily more difficult than (14c), because the PS motivation and the word order mechanism pull in different directions, neutralizing the overall cost comparisons between them.

Results in this study largely correspond to findings in previous behavioral studies. Specifically, the DCl-SR bias over DCl-OR replicates results in Wu, Kaiser, and Anderson's (2009) L1 reaction time data and Chen's (1999) L2 study. The lack of a clear asymmetry between SR and OR in the RC-DCl sequence is not surprising. As mentioned, research so far indicates that DCl-absent SR/OR asymmetries in Chinese are obscure, with some L1 processing studies using sensitive word-by-word reaction time tasks that show no difference between the two (e.g., Kuo and Vasishth 2006), and some other L1 studies reporting controversial results (Lin and Bever 2006, c.f., Hsiao and Gibson 2003). There was also no bias detected

between SR/OR in the RC-DCl sequence in Xu's (2013) L2 study. For subject-modifying RCs like the ones elicited in this study, the PS and the CWO theories make the same predictions for DCl-absent SR/OR comparisons as they make regarding the RC-DCl sequence. Thus, a bias between Chinese SR/OR in DCl-absent and in the RC-DCl sequence is much less robust than the SR/OR asymmetry English, if such a bias exists at all. A multi-constraint model can explain the overall results: while both the CWO and the PS mechanisms are relevant, to what extent they each weigh in the algorithm used to compute SRs and ORs may depend on factors such as the nature of the task, the semantic aspect of the experiment materials, and the proficiency level of the participants.

4.2 Corpus frequencies and other hypotheses

The overall distribution of the four structures also largely conforms to corpus frequencies. That is, the DCl-RC sequence is more likely to be associated with an SR rather than an OR, while an asymmetry is not as evident in the RC-DCl sequence. Both Wu, Kaiser, Anderson's (2009) and Ming and Chen's (2010) confirm that a structure like (1b) is extremely rare while a structure like (1a) is the most frequent in L1 corpora. This further consolidates the present theory that DCl-OR is inherently more complex from the structural and psycholinguistic point of view, and is thus not preferred by L1/L2 speakers in general.

Below I explore if other alternative accounts can be relevant. Some previous L1 comprehension studies suggested a structural frequency account, which claims that comprehension or production ease is determined by one's prior experience and therefore predicable by corpus frequencies (Hale 2001, Levy 2008, etc.). However, as Kuo and Vasishth (2006) argued, distributional frequency alone cannot adequately account for comprehension (or production) ease without an account of where the frequency comes from. More importantly, L2 learners' exposure or experience is significantly different from that of L1 speakers and cannot be predicted by L1 corpus frequencies. Based on information provided by instructors at the L2 participants' institution, DCl-modified RCs are extremely rare in those participants' reading materials. The asymmetry of DCl-SR and DCl-OR in L1 corpus can therefore be interpreted as a "compiled-out consequence" (Kuo and Vasishth, 2006: 17) motivated by the same underlying cause that gave rise to the L1/L2 production bias in this experiment.[3]

3 Ming (2010) provides an alternative explanation for the rarity of DCl-OR from a discourse perspective. He suggests that the DCl-RC sequence is associated with "given information" and humanness, making the head noun in this construction more compatible with a subject role.

While there are several other hypotheses regarding the structural complexity of RCs, we cannot evaluate the applicability of each theory in detail here. Readers are directed to Xu (2012) for a comprehensive review regarding their predictions to Chinese RCs. Aside from the PS and a frequency-based account, the only other potential theory that can predict a DCl-SR > DCl-OR preference is the Noun Phrase Accessibility Hierarchy or the structural distance theory (O'Grady 1997, 1999). Both these theories predicate that the extraction difficulty in RC structures follow the ranking of Subject > Object > Indirect Object > Object of Preposition, etc., whereas > means "more accessible than" or "easier than". Because only SRs and ORs are analyzed here and an asymmetry was found only in the DCl-RC sequence, I do not invoke these theories here.

4.3 Learners' errors

In Type C and Type D errors, participants either missed the key verb, or produced something that cannot be potentially analyzed as having an RC structure. Thus, no further analysis is possible for those errors. There were also six tokens of "RC with other errors" in column 3 and 4 in Table 3, and those responses each had a grammatical error irrelevant to relativization, such as word order errors with prepositional phases or negation, etc. Those responses were not dismissed in coding since they still contained RC structures and were evidence of participants' attempt to construct either an SR or an OR. But since these errors had little to do with relativization, the following discussions focus on Type A, Type B errors, and RC productions with resumptive pronouns/NP errors.

Twenty VP errors were observed, 15 in the DCl-RC sequence. They were often roughly comprehensible, and most such responses contained a full-fledged VP with adverbial phrases that were almost like a complete clause with the exception of a missing subject, e.g., (15). A pronoun is tentatively added in the subject position in the English translation.

Also, since DCl-RC mainly functions as characterization and "characterizing RCs are mainly SRs", DCl-OR is therefore rare (Ming 2010: 336–337). In this experiment, since prompt sentences are provided in isolation without context, and it is unlikely that L2 learners were intuitive enough to know the "characterization" function of DCl-RC, the present results suggest that while discourse and information status factors can be legitimate causes for native speakers' preference for DCl-SR over DCl-OR in corpus, the excessive cost in DCl-OR from perspective shifting should be an additional factor.

(15) cong xiao-de-shihou qi hen de na-ge ren
from childhood up hate DE that-Cl person
'the person that (I/he/she . . .) hate from childhood'

VP responses were also the only type of non-target like responses observed in the L1 group, as mentioned earlier in (8), indicating that in some cases it may be marginally acceptable. In fact, they can potentially be analyzed as ORs with a null subject.[4] But there were far more VP responses in the L2 group than in L1s, making this a non-native-like pattern worth attention. Whereas null subject can only occur when its referential value can be recovered in *pro*-drop languages (Jaeggli and Safir 1989, Rizzi 1986, etc.), learners appeared to have overgeneralized the rule of omitting subject.

Note that there were also 18 instances of Type B verb-only errors in the DCl-first sequence and 11 such responses in the DCl-second sequence. While we cannot rule out the possibility that occasionally some learners may simply have filled the prompt verb without trying to construct a syntactically meaningful structure, there was evidence that learners to a large extent were capable of producing target-like responses in this task and they understood the instructions. Therefore, their Type B errors may also be an attempt to construct ORs with a dropped subject. For instance, if placed within the right discourse context, a learner response such as (16) may also be interpretable as an SR.

(16) (. . .) zunzhong de na-ge ren laizi Meiguo.
Respect DE that-Cl person come.from America
'The person that (I/he/she/they . . .) respect comes from America.'

Note that if Type B errors were coded as OR attempts, the overall pattern of DCl-SR>DCl-OR and the lack of clear asymmetry between SR-DCl/OR-DCl for both participant groups is still maintained.

There were also seven resumptive pronoun or resumptive NP errors, exemplified by (17–18). Subscripts indicating co-indexations are added in these examples.

(17) na-ge ren$_i$ xinren dajia de ren$_i$
that-Cl person trust everyone DE person
'the person that trusts everyone'

4 In general, those VPs cannot be analyzed as SRs. Although a phonetically null object is permitted under restricted context too, the null object always has to be bound by a topic that exists in the nearby context (Huang 1984, 1989).

(18) wo hen zunzhong ta_i de na -ge ren_i
I very respect he DE that-Cl person
'The person that I respect a lot'

Resumptive pronouns were frequently reported in both L1 and L2 acquisition studies of English RCs (McKee, McDaniel, and Snedeker 1998, Gass 1979, 1982). In the present study, in the RC-DCl sequence, resumption occurred more often in ORs than in SRs (with three tokens in the former and one in the latter). This result coincides with findings in previous L1 acquisition studies of Chinese (Cheng 1995, Hsu, Hermon, and Zukowski 2009, Su 2004). But in the DCl-RC sequence, resumption errors occurred in attempted SRs in the form of resumptive NPs, as in the case of (17). It is possible that the DCl at the beginning of the sentence prompted a generic NP to immediately follow the classifier (since classifiers are generally followed by generic NPs in simple Chinese sentences), but the *DCl*_____ *de N* sequence still has a preferential bias towards the SR structure due to an advantage in "perspective". This then resulted in some resumptive NP errors in DCl-SR.

The use of resumptive NPs and resumptive pronouns indicate that participants were intuitively aware of the co-indexation or filler-gap relation between the relativized position and the head noun. It has been suggested that a lexical item, which can mark the co-indexation more explicitly than a gap, can help achieve such filler-gap relations when the structural distance between the filler and the gap is too long (Hawkins 1999). Both resumptive pronouns and resumptive NPs were witnessed in the L1 acquisition of Chinese RCs (Hsu, Hermon, and Zukowski 2009), corroborating this hypothesis by showing that learners may need to rely on pronouns or fully-spelled out NPs to realize explicit dependency marking to overcome filler-gap integration difficulty when they have not fully acquired the RC structure. A resumptive NP such as (17) also resembles internally-headed RCs in languages like Korean. According to Jeon and Kim (2007) and Yip and Matthews (2007), internally-headed RCs are acquired earlier than their externally-headed counterparts, further confirming that using resumptive NPs instead of a gap to achieve co-indexation is structurally easier. In this study, L2 participants who still had difficulty constructing a co-indexation relation using the gap strategy may resort to resumptive pronouns or resumptive NPs.

4.4 Pedagogical implications

While L2 participants in this study appeared to have acquired Chinese RCs well in terms of accuracy rate and exhibited a structural preference pattern consistent

with L1 speakers, two aspects of the Chinese RC typology may be worth noting for the practical purposes of teaching. First, the VP, verb-only and the resumptive errors observed in the current study indicate that learners did not consistently notice the requirement of a gap in Chinese RCs. More explicit instruction on the obligatory gap may help discourage such errors. As Packard (2008: 133) pointed out, given the word order difference, helping learners to identify the gap position may be especially beneficial for L2 Chinese learners who are native speakers of languages like English. Currently, examples in CFL textbooks include both SRs (e.g., *zuotian lai de keren* 'the guest that came yesterday') and ORs with a null subject (e.g., *yiqian renshi de pengyou* 'friends that (I/he/she . . .) knew from the past'), and they are equally referred to as "verb or verb phrases [. . .] as attributives" (Liu et al. 2008: 107). However, these phrases in fact involve gaps in different positions and different extraction types. As seen from L2 participants' errors in this experiment, it would be helpful to emphasize the necessity of a gap in Chinese RCs and the different positions (i.e., subject or object) in which it can occur. The seemingly difficult concept of relativization can be made accessible to learners if we use mirrored comparisons between Chinese and English RCs. For instance, the illustration in (19) can show that Chines and English RCs are the same in terms of an SVO word order in subordinate clauses and in the necessity of a gap, and differ minimally in head position.

(19) a. Chinese: SV de O
English: The O that SV
b. Chinese: V(O) de S
English: The S that V(O)

Given that other clause-like attributives exist in Chinese, referring to Chinese RCs as a special type of noun-modifying clauses may capture both the uniqueness of RC structures (in term of its gap necessity, etc.) and its shared features with Chinese attributive clauses.

A second area meriting more attention is the interaction between DCl with RCs. Since most RCs do not co-occur with demonstratives in corpus (Wu, Kaiser, and Anderson 2009), it is reasonable that novice learners should first be exposed to demonstrative-absent RCs. As for DCl-modified RCs, the present study suggests that one sequence is not necessarily more difficult than the other, as seen from learners' target-like productions in both. Different DCl-modified RCs can therefore be differentiated from one another when minimal context is provided to illustrate their respective semantic and discourse functions.

5 Conclusion

In this study, L1 and L2 speakers' productions of Chinese SRs and ORs in two sequences that differ in DCl-modification were examined. L2 participants' choice of structures was similar to that of L1 speakers. Learners did not avoid any particular type of extraction due to lack of competence, suggesting that they have acquired all the four structures equally well at this stage of their acquisition. In the DCl-RC sequence, an SR preference is evident for both L1 and L2 speakers. Meanwhile, a bias is not detectable in the RC-DCl sequence. A multi-constraint model in which a "perspective" and a word order factor both need to be taken into consideration was put forward. Further, learners' failure to notice the obligatory gap in relativization was found to be a systematic error.

This study suggests that both structural complexities and grammatical competence issues influence L2 learners' performance. To explore learners' development of mental representations in the first aspect, psycholinguistic models can apply. Several previous works on the acquisition of Chinese RCs are examples of effort in this direction, including Hsu, Hermon, and Zukowski (2009) for L1 children and Packard (2008) for L2 adults. Using an interdisciplinary approach in this study, I also hope to illustrate that formal linguistics plays a role in SLA inquiries, and empirical research may serve to advance theoretical endeavors as well as to inform our teaching.

References

Bever, Thomas G. 1970. The cognitive basis for linguistic structures. In *Cognition and the development of language*, John R. Hayes, and Roger Brown (ed.), 279–362. NY: John Wiley.

Bever, Thomas G., Merrill F. Garrett, and Richard Hurtig. 1973. The interaction of perceptual processes and ambiguous sentences. *Memory and Cognition* 1(3): 277–286.

Brown, H. Douglas. 1971. Children's comprehension of relativized English sentences. *Child Development* 42: 1923–1936.

Chao, Yuen Ren. 1968. *A Grammar of spoken Chinese*. University of California Press, Berkeley & Los Angeles.

Chen, Baoguo, Aihua Ning, Hongyan Bi, and Susan Dunlap. 2008. Chinese subject-relative clauses are more difficult to process than object-relative clauses. *Acta Psychologica* 129: 61–65.

陈纯音[Chen, Chun-Yin]. 1999. 中文关系子句之第二语言习得. [The second language acquisition of Chinese relative clauses]. *The World of Chinese Language*, 94, 59–76.

Chen, Zhong, Qiang Li, Kuei-Lan Kuo, and Shravan Vasishth. 2010. *Processing Chinese relative clauses: Evidence for the universal subject preference* [manuscript]. Available at: http://www.ling.uni-potsdam.de/~vasishth/pdfs/ChenLiKuoVasishthsubmitted.pdf (accessed on 9 June 2012).

Cheng, Sherry Ya-Yin. 1995. *The Acquisition of Relative Clauses in Chinese*. Unpublished MA thesis, National Taiwan Normal University.

Clancy, Patricia M., Hyeonjin Lee, Myeong-han Zoh. 1986. Processing strategies in the acquisition of relative clauses: Universal principles and language-specific realizations. *Cognition* 24: 225–262.

Comrie, Bernard. 2008. Prenominal relative clauses in verb-object languages. *Language and Linguistics* 9(4): 723–733. Accessed on July 9th, 2012 from http://www.ling.sinica.edu.tw/files/publication/j2008_4_02_7177.pdf

Corder, S. Pit. 1967. The significance of learner's errors. *International Review of Applied Linguistics in Language Teaching* 5(4): 161–170.

Diessel, Holger and Michael Tomasello. 2005. A new look at the acquisition of relative clauses. *Language* 81: 882–906.

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*, Mary Hines and William Rutherford (eds.), 129–139. Washington DC: TESOL.

Gibson, Edward and Iris H.-H. Wu. 2011. Processing Chinese relative clauses in context. *Language and Cognitive Processes*. Epub ahead of print 07 March 2011. DOI:10.1080/01690965.2010.536656

Hakansson, Gisela and Kristina Hansson. 2000. Comprehension and production of relative clauses: a comparison between Swedish impaired and unimpaired children. *Journal of Child Language*. 27: 313–333.

Hale, John. 2001. A probabilistic Earley parser as a psycholinguistic model. *Proceedings of the second meeting of the North American Chapter of the Association of Computational Linguistics* (Vol. 2), pp. 159–166. New Brunswick, NJ: Associate for Computational Linguistics.

Hamburger, Henry and Crain Stephen. 1982. Relative acquisition. In Kuczaj Stan A. (ed) *Language development: Syntax and semantics*. Hillsdale, NJ: Lawrence Erlbaum, 245–273.

Hashimoto, Anne Oi-kan. 1971. *Mandarin Syntactic Structures*, Union 8, Princeton University.

Hawkins, John A. 1999. Processing complexity and filler-gap dependencies across grammars. *Language* 75(2): 244–285.

Hsiao, Franny and Gibson, Edward. 2003. Processing relative clauses in Chinese. *Cognition* 3(27): 3–27.

Hsu, Chun-Chieh, Gabriella Hermon, and 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. 1989. Pro-drop in Chinese: a generalized control theory. In *The Null Subject Parameter*, Osvaldo Jaeggli & Kenneth J. Safir (eds.), 185–214. Dordrecht: Kluwer.

Huang, C.-T. James. 1984. On the distribution and reference of empty pronouns. *Linguistic Inquiry* 15: 531–574.

Izumi, Shinichi. 2003. Processing difficulty in comprehension and production of relative clauses by learners of English as a second language. *Language Learning* 53(2): 285–323.

Jaeggli, Osvaldo and Kenneth J. Safir. 1989. The null subject parameter and parametric theory. In *The Null Subject Parameter*, Osvaldo Jaeggli, and Kenneth J. Safir (eds.), 1–44. Dordrecht: Kluwer Academic publishers.

Jeon, K. Seon and 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. and Comrie, Bernard. 1977. Noun phrase accessibility and universal grammar. *Linguistic Inquiry* 8: 63–99.

Keenan, Edward L. and Sarah Hawkins. 1987. The psychological validity of the accessibility hierarchy. In *Universal grammar: Fifteen essays*. Edward L. Keenan (ed.), 60–85. London: Routledge.

King, Jonathan and Marcel Adam Just. 1991. Inidividual differences in syntactic processing: The role of working memory. *Journal of Memory and Language* 30: 580–602.

Kuo, Kueilan and Shravan Vasishth. 2006. *Processing relative clauses: Evidence from Chinese* [manuscript]. Accessed on January 10 2007 from http://www.ling.uni-potsdam.de/~vasishth/vasishth2.html.

Levy, Roger. 2008. Expectation-based syntactic comprehension. *Cognition* 106: 1126–77.

Li, Qiang, Jian Zhang and Wei Yue. 2010. Chinese relative clauses processing in supportive context removing ambiguity. *Studies in literature and language* 1(4): 12–19.

Li, Charles, N. and Sandra A. Thompson. 1989. *Mandarin Chinese: A functional reference grammar*. University of California Press.

Lin, Chien-Jer Charles and Thomas G. Bever. 2006 Subject preference in the processing of relative clauses in Chinese. In *Proceedings of the 25th West Coast Conference on Formal Linguistics*, Donald Baumer, David Montero, and Michael Scanlon (eds.), 254–260. Somerville, MA: Cascadilla Proceedings Project.

Lin, Yowyu and Susan M. Garnsey. 2011. Animacy and the resolution of temporary ambiguity in relative clause comprehension in mandarin. In *Processing and producing head-final structures*, Hiroko Yamashita, Yuki Hirose, and Jerome, L. Packard (eds.), 241–276. London/New York: Springer.

Liu, Yuehua, Tao-chung Yao, Nyan-Ping Bi, Liangyan Ge, and Yaohua Shi. 2008. *Integrated Chinese* (Level 1 Part 2) (3rd edition). Boston: Cheng & Tsui.

MacDonald, Maryellen C. and Morten H. Christiansen. 2002. Reassessing working memory: a reply to Just and Carpenter and Waters and Caplan. *Psychological Review* 109(1): 35–54.

MacWhinney, Brian and Csaba Pleh. 1988. The processing of restrictive relative clauses in Hungarian. *Cognition* 29: 95–141.

MacWhinney, Brian. 1977. Starting points. *Language* 53(1): 152–168.

MacWhinney, Brian. 1982. Basic syntactic processes. In: Kuczaj S.A. (ed) *Language development (Vol. 1). Syntax and semantics*. Hillsdale, NJ: Lawrence Erlbaum, 73–136.

MacWhinney, Brian. 2005. The emergence of grammar from perspective. In *The grounding of Cognition: The role of perception and action in memory, language, and thinking*, Diane Pecher, and Rolf A. Zwaan (eds.), 129–223. Mahwah, NJ: Lawrence Erlbaum Associates.

MacWhinney, Brian. 2008. How mental models encode embodied linguistic perspectives. In *Embodiment, Ego-Space, and Action*, Klatzky R, MacWhinney B and Behrmann M (eds.), 369–410. Mahwah: Lawrence Erlbaum.

McKee, Cecile, Dana McDaniel, and Jesse Snedeker. 1998. Relatives children say. *Journal of Psycholinguistic Research* 27(5): 573–596.

Ming, Tao. 2005. A corpus-based study of the order of demonstratives and relative clauses in Mandarin Chinese. In *Proceedings of NACCL* (North American Conference on Chinese Linguistics), Qian Gao (ed.), 354–368. GSIL (Graduate Students in Linguistics) University of Southern California.

Ming, Tao. 2010. The relative position of demonstratives and relative clauses in Mandarin Chinese. In Clement, L.E. & C.-M. L. Liu (eds.), *Proceedings of the 22nd NACCL & the 18th IACL*, pp. 323–340. Harvard University: Cambridge, MA.

Ming, Tao and Liang Chen. 2010. A discourse-pragmatic study of the word order variation in Chinese relative clauses. *Journal of Pragmatics* 42: 168–189.

O'Grady William. 1997. *Syntactic Development*. Chicago: University of Chicago Press.

O'Grady, William. 1999. Toward a new nativism. *Studies in Second Language Acquisition* 21: 621–633.

O'Grady, William, Miseon Lee, and Miho Choo. 2003. A subject-object asymmetry in the acquisition of relative clauses in Korean as a second language. *Studies in Second Language Acquisition* 25: 433–448.

Ozeki, Hiromi and Yasuhiro Shirai. 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 Chinese Language Teachers Association* 43(2): 107–146.

Prideaux, Gary Dean and William J. Baker. 1986. *Strategies and structures: The processing of relative clauses*. Amsterdam: John Benjamins.

Reali, Florencia and Christiansen Morten H. 2007. Processing of relative clause is made easier by frequency of occurrence. *Journal of Memory and Language* 57(1): 1–23.

Rizzi, Luigi. 1986. Null objects in Italian and the theory of pro. *Linguistic Inquiry* 17: 501–557.

Sheldon, Amy. 1974. The role of parallel function in the acquisition of relative clauses in English. *Journal of Verbal Learning and Verbal Behavior* 13: 272–281.

Slobin, Dan I. and Thomas G. Bever. 1982. Children use canonical sentence schemas: A cross-linguistic study of word order and inflections. *Cognition* 12(3): 229–265.

Su, Yi-Ching. 2004. Relatives of Mandarin children [Electronic version]. Paper presented in the 2004 *GALANA*, University of Hawaii at Manoa. Retrieved from http://www.ling.nthu.edu.tw/faculty/ycsu/GALANA2004.pdf

Traxler, Matthew J., Robin K. Morris, and Rachel E. Seely. 2002. Processing subject and object relative clauses: Evidence from eye movements. *Journal of Memory and Language* 47: 69–90.

Wu, Fuyun, Elsi Kaiser, and Elaine Anderson. 2009. The effect of classifiers in predicting Chinese relative clauses. Accessed on June 22, 2012 from http://www-bcf.usc.edu/~emkaiser/WuKaiserAndersen-2009-WECOL-Classifiers.pdf (accessed on 22 June 2012).

Wu, Fuyun, Elsi Kaiser, Todd Haskell, and Elaine Anderson. 2007. Factors in the use of relative clauses in Mandarin: Behavioral and corpus evidence. Paper presented at the Interdisciplinary approaches to relative clauses (REL07). University of Cambridge. Sept. 13–15, 2007.

Wu, Sue-mei, Yueming Yu, and Yanhui Zhang. 2008. *Chinese Link Intermediate Chinese* (Level 2 Part 1). Upper Saddle River, NJ: Pearson Education, Inc.

Xu, Yi. 2009. *The syntax, processing, and second language acquisition of Chinese relative clauses*. Doctoral dissertation. University of Arizona.

Xu, Yi. 2012. On psycholinguistic and acquisition studies of relative clauses: An interdisciplinary and cross-linguistic perspective. *Contemporary Foreign Language Studies* 384/12: 62–85.
Xu, Yi. 2013. Acquisition of Chinese relative clauses at the initial stage. In Istvan Kecskes (ed.), *Research in Chinese as a Second Language* (Trends in Applied Linguistics Series), 216–236. Boston/Berlin: Mouton de Gruyter.
Yan, Margaret Mian, and Jennifer Li-chia Liu. 1997. *Interactions I: A cognitive approach to beginning Chinese*. Bloomington and Indianapolis: Indiana University Press.
Yip, Virginia and Stephen Matthews. 2007. Relative clauses in Cantonese-English bilingual children: Typological challenges and processing motivations. *Studies in Second Language Acquisition* 29: 277–300.

Appendix

Experiment materials
Note. Filler items are not included.

1. 那个_____的人就住在附近。（不喜欢）
2. _____的那个人来自美国。（尊重）
3. 这个_____的人是个老同学。（请来）
4. 那个_____的男人姓王。（等）
5. _____的这个邻居姓李。（照顾）
6. _____的那个同学看起来心情很好。（问候）
7. 那个_____的学生很有礼貌。（帮助）
8. _____的那个人是她最好的朋友。（陪）
9. 那个_____的人在我们公司上班。（接走）
10. 那个_____的男生在北京大学读书。（爱上）
11. _____的这个人是公司的同事。（批评）
12. 那个_____的人和大家关系很好。（信任）
13. _____的这个人三十出头。（喜欢）
14. 那个_____的人姓张。（找）
15. _____的这个人就住在这个楼里。（恨）
16. _____的那个人是一个网络公司的代表。（联系）