

Introduction

Studies on comprehension and production of relative clauses (henceforth RCs) in Mandarin Chinese are abundant (Chang, 1984; Cheng, 1995; Hsiao & Gibson, 2003; Hsu, 2006; Lin & Bever, 2006; Su, 2004; Su, 2006). Some of the studies tackle the problems of resumptive pronouns and gaps in RCs; some of them probe the differences of subject-extracted and object-extracted RCs, as well as the diversities of serial filler-gap dependencies and nested dependencies. Within the studies which investigate the differences of subject-gapped RCs (SRCs) and object-gapped RCs (ORCs), there is a unanimous result; that is, similar to English, SRCs are easier to generate than ORCs in Mandarin, irrespective of the sentential position of the RC. Although Hsiao and Gibson's study (2003) claims that ORCs are easier than SRCs, Lin and Bever (2006) point out that there are some crucial problems of their experimental design, and hence, the result may not represent the truth.

In Hsu's research (2006), children tend to generate SRCs better than ORCs, which is consistent with the result obtained from adults in Lin and Bever's study. According to Hsu, children's performance was worse than adults' performance in both SRC and ORC conditions. In addition, they produced more other types of structures in the ORC condition than in the SRC condition. In order to explain the result, she further points out that production is a planning process of encoding the intention and content into linguistic forms. Since Chinese is a topic-prominent language, the topic is one possibility which causes the differences in getting the target sentence structure at the message planning level. Likewise, the idea that topic construction may affect RC construction is confirmed in some Japanese studies (Kuno, 1973; Portner & Yabushita, 1998) as well as in studies of other languages (Mak et al., 2006). Chen (1996) also proposes that there is a correlation between the topic construction and the relative construction in Mandarin Chinese. As a matter of fact, this idea has been well accepted since decades ago (Jiang, 1991; Tsao, 1979); nevertheless, it has come to our knowledge that no empirical study has been conducted to verify the claim. As far as the correlation between the topic and relative constructions is concerned, the topic type is another issue to be taken into consideration. Scholars examining the topics sometimes adopt different terms to name the same topic types, some of which they categorize into diverse classes (Badan & Gobbo, 2006; Chen, 1996; Chen & Kao, 2000; Huang et al., 2004; Huang & Ting, 2006; Li & Thompson, 1981; Lu, 2000; Pan & Hu, 2002; Paul, 2002; Shi, 2001; Wu & Shi, 2001; Xu, 1985). This makes the empirical study on the ease of relativizing distinct topic types more valuable in that the study can shed some lights on the categorization of topic types.

In the cause of knowing whether the widely believed assumption, that is, the link between the topic and relative constructions, is accurate, this current study aims to investigate that whether the head nouns of RCs are topics or not will influence Chinese children's RC production. Furthermore, in order to roughly

sketch the categorization of topics, we also probe into the relativization discrepancies in distinct topics. This paper is organized as follows: section two shows what has been done in comprehension and production of RCs in Mandarin Chinese, and the definitions of topics, as well as literature on prosody, which marks the existence of a topic. After which methodology is presented, with full details of the participants in the research, and of the materials and procedures used. Results and discussions are then presented, with a thorough description of the RC production. Finally, the conclusions are drawn.

Literature Review

Literature on producing and comprehending RCs in Chinese can be divided into two classes. One involves adults as their subjects (Hsiao & Gibson, 2003; Lin & Bever, 2006), and the other examines mainly on children (Chang, 1984; Cheng, 1995; Hsu, 2006; Su, 2004; Su, 2006). In the literature with regard to adults, Hsiao and Gibson (2003) investigate the sentence processing of RCs. Through a self-paced reading task and observations on parts of an RC, they claim that regardless of singly-embedded RCs or doubly-embedded RCs, ORCs are less complex than corresponding SRCs. Besides, people have less difficulty processing embedded clauses whose word order matches the word order in main clauses. They also propose that their results are predicted by storage resources and canonical word order. In their view, SRCs require more storage because the linear structure of SRCs starts from a verb, which causes people to judge the verb is in an RC and to wait for an object in the RC, a relativizer *de*¹ and a verb of the main clause. By contrast, ORCs need less storage due to the fact that people may only expect to read a verb after reading a subject, to read an object after the verb, and to read a verb from a main clause after reading a relativizer *de*. The constructions of SRCs and ORCs which are extracted from Hsiao and Gibson's study are shown below:

(1) Singly-embedded RCs²

a. SRC

[*e_i Yaoqing fuhao*] *de* *guanyuan_i xinhuaibugui*
 invite tycoon DE official have bad intentions

¹ In Mandarin Chinese, *de* is a relativizer which connects the head noun of a relative clause and the rest part of the relative clause.

² The RCs can also occur in the object position of a main clause, as given below. The processing of this construction would be affected not only by the RC type, viz. SRC and ORC, but also by the word sequence of the entire sentence, which was not involved in Hsiao & Gibson's (2003) study.

a. *Faguan renshi [e_i yaoqing fuhao] de guanyuan_i*
 judge know invite tycoon DE official
 'The judge knew the official who invited the tycoon.'

b. *Faguan renshi [fuhao yaoqing e_i] de guanyuan_i*
 judge know tycoon invite DE official
 'The judge knew the official who the tycoon invited.'

'The official who invited the tycoon has bad intentions.'

b. ORC

[*Fuhao yaoqing e_i*] *de* *guanyuan_i* *xinhuaibugui*
 tycoon invite DE official have bad intentions
 'The official who the tycoon invited has bad intentions.'

(Hsiao & Gibson, 2003: 6)

(2) Doubly-embedded RCs³

a. SRC

[*e_i Yaoqing [e_k goujie faguan] de fuhao_k*] *de* *guanyuan_i*
 invite conspire judge DE tycoon DE official
xinhuaibugui
 have bad intentions
 'The official who invited the tycoon who conspired with the judge has
 bad intentions.'

b. ORC

[[*Fuhao yaoqing e_i*] *de* *faguan_i goujie e_k*] *de* *guanyuan_k*
 tycoon invite DE judge conspire DE official
xinhuaibugui
 have bad intentions
 'The official who the judge who the tycoon invited conspired with has
 bad intentions.'

(Hsiao & Gibson, 2003: 8)

In addition to storage resources, the canonical word order can also predict that ORCs are easier because the structure of ORCs before *de* is SV, which is consistent with the Chinese word order SVO, while the structure of SRCs before *de* is VO.

However, the results obtained by Hsiao and Gibson are far from reliability. Lin and Bever (2006) pinpoint out some critical problems of Hsiao and Gibson's study. Firstly, by just analyzing the region of the first two words within the singly-embedded RCs, we cannot see the filler-gap integrations. Secondly, the first two words in singly-embedded ORCs are same as those of main clauses; therefore, people can process more easily. Thirdly, doubly-embedded SRCs and ORCs contain different dependency types. The former are nested dependencies, which are harder to process, whereas the latter are serial dependencies, which are easier to

³ The doubly-embedded RCs may incorporate different RC types, that is, SRC and ORC; accordingly, there are two more possible doubly-embedded RC examples, which were not discussed in Hsiao & Gibson (2003), as shown below:

- a. [*e_i Yaoqing [faguan e_k goujie] de fuhao_k*] *de* *guanyuan_i* *xinhuaibugui*
 invite judge conspire DE tycoon DE official have bad intentions
 'The official who invited the tycoon with whom the judge conspired has bad intentions.'
- b. [*e_k Goujie [Fuhao yaoqing e_i] de faguan_i*] *de* *guanyuan_k* *xinhuaibugui*
 conspire tycoon invite DE judge DE official have bad intentions
 'The official who conspired with the judge who the tycoon invited has bad intentions.'

process. In Lin and Bever's study, they discover that Chinese is like English in that SRCs are easier than ORCs, and that serial filler-gap dependencies are easier than nested dependencies. Moreover, subject-modifying RCs are easier than object-modifying RCs. They further suggest that Structural Accessibility, and theories of canonical word order and reanalysis can account for the results. Since subject positions are structurally higher, they are easier to access than object positions. In addition, owing to the fact that the NV sequences in ORCs tend to be taken as main clauses during an initial garden path, they require reanalysis, and hence, people need more reading time to process.

Research on children's comprehension of RCs in Mandarin Chinese is first conducted by Chang (1984). In this study, an act out task was adopted to test children on four types of RCs (SS, SO, OS and OO)⁴ with animate or inanimate arguments. The results show that RCs in subject position of main clauses (SS and SO) are easier than those in object position of main clauses (OO and OS) irrespective of the animacy of arguments. This corresponds with the results found in Lin and Bever's study (2006), which proposes that nested dependencies are more difficult. Cheng (1995) also employed an act out task to test children on the four types of RCs with animate or inanimate arguments, as well as intransitive or existential verbs. She argues that sentences with intransitive or existential verbs are the easiest to comprehend for children, and sentences with one inanimate argument are easier to comprehend than sentences with only animate arguments.

Su (2006) examines whether Chinese-speaking children use the NVN word order strategy, proposed by Bever (1970), to comprehend the OO RCs. According to her study, younger children (especially 4-year-old children) tend to adopt the NVN word order strategy to comprehend the OO type of RCs and hence misinterpret the sentences when they meet the garden path.⁵ Younger children have more difficulty reanalyzing their initial parsing commitments than adults or older children do.

In studies on children's production of RCs, Su (2004) focuses on the distribution of resumptive pronouns and gaps in five types of relative constructions differing in which position inside the RC the head noun corresponded to. The five positions which head nouns corresponding to are subject, object, preposition-of-object, clausal complement and unextractable subject⁶. She investigates three groups, including younger children (age range from 5;0 to 5;6),

⁴ SS represents SRCs in subject position of main clauses; SO represents ORCs in subject position of main clauses; OS represents SRCs in object position of main clauses; OO represents ORCs in object position of main clauses.

⁵ The linear structure of OO type of relative clauses is $N_1 V_1 [N_2 V_2] de N_3$. N_2 is a garden path since it will be analyzed as the object of the main clause verb at the first parsing, but when V_2 is encountered, a reanalysis is required.

⁶ Unextractable of the subject means that the extraction of the subject of an 'island' is not acceptable.

older children (age range from 5;7 to 6;5) and adults, and discovers a gradual development toward a better grasp of complex structure formation. Furthermore, she suggests that Mandarin-speaking children and adults prefer using a resumptive pronoun nearly 100% of the time.

Hsu (2006) tackles the issue on whether SRCs are easier than ORCs in children's production in Mandarin Chinese. Twenty-three Mandarin-speaking children (age range from 4;0 to 6;5) and ten Mandarin-speaking adults participate in the study. The results show that the adults' performance is better than children's in both SRCs and ORCs. Both the adults and the children produce more expected RC type in the SRCs than in the ORCs. However, the difference between the ORCs and the SRCs is larger for the children than for the adults. Children tend to produce more ungrammatical RCs in ORCs than in SRCs, regardless of the position of the RC. The finding supports Structural Distance Hypothesis⁷, consistent with the conclusion of Lin and Bever (2006).

Nevertheless, due to the fact that the Structural Distance Hypothesis is based on comprehension studies, it cannot explicitly explain the production result. Hsu suggests that the cause of the subject-object asymmetry may come from two sources. One is that children may have more difficulty in suppressing the NP in the object position than in the subject position when the head noun appears later in the production sequence. The other is the concept that involves topics in Chinese and their discourse function. Chinese is a topic-prominent language. Any sentence-initial NPs that are definite or generic can be topics in Chinese. In other words, in SRCs, the subject NP children picked out could be a topic at the same time. By contrast, the NP that must be picked out to form the head of the ORCs is not a topic in the source sentence. That children perform better in SRCs may result from the fact that subject NPs are also topics, which facilitate selection of target NPs.

The correlation between the topic construction and the relative construction has long been observed in the literature in other languages. Mak et al. (2006) provide extensive discussions of the effects of topichood on RC processing in Dutch. In their study, the choice for an analysis of the RC is based on the interplay of animacy with topichood and verb semantics. It is also claimed in Kuno (1973) that the head noun of an RC which is derived from a topic construction in Japanese is a topic (NP-*wa*) but not an ordinary NP. Similarly, Portner and Yabushita (1998) argue that in Japanese, a discourse entity which is also a topic can be most readily picked out with its information to form an RC. In Japanese, there is a morphological topic marker '*wa*' after the topic NP, whereas in Chinese, there is no such a morphological topic marker, which brings hot debates on the definition of 'topic'.

⁷ According to the structural distance hypothesis, the distance of the head nouns and its gaps in SRCs in Mandarin Chinese is shorter than that of the head nouns and its gaps in ORCs.

Li and Thompson (1981) claim that a morphological topic marker is not needed in Chinese because the topics in Chinese must be definite or generic, and they can construct the spatial and temporal frame. There are two features of topics. One is that topics must occupy the sentence initial position. The other is that pause particles can be inserted after topics in order to separate topics from comments although the pause particles are not a necessity. Subjects are different from topics in that a subject of a sentence has some behavioral or existential relationship with the verb of the sentence. Li and Thompson show four possible patterns consisting of topics and/or subjects, as shown below⁸:

- (3) Sentences with a topic NP and a subject NP
Na zhi gou wo yijing kan guo le
 that CL dog I already see EXP CRS
 ‘That dog, I have already seen.’ (Li & Thompson, 1981: 88)
- (4) Sentences with a topic and subject NP
Wo xihuan chi pingguo
 I like eat apple
 ‘I like to eat apples.’ (Li & Thompson, 1981: 88)
- (5) Sentences with a topic but without a subject
Na ben shu chuban le
 that CL book publish CRS
 ‘That book has been published.’ (Li & Thompson, 1981: 88)
- (6) Sentences without a topic and without a subject (Sentence B)
 A: *Ni kan guo Lisi meiyou?*
 you see EXP Lisi have-not
 ‘Have you seen Lisi?’
 B: *Mei kan guo.*
 not see EXP
 ‘Not yet.’ (Li & Thompson, 1981: 90)

They also suggest that in double-subject sentences, the first subject is in fact a topic, and the second subject remains as a subject. This kind of sentence belongs to the ‘topic-comment’ structure. The relationship between topics and subjects is whole-part relationship. Topics represent ‘whole’, and subjects represent ‘part’. Here are some examples:

- (7) *Xiang bizi chang*
 elephant trunk long
 ‘Elephants, trunks are long.’ (Li & Thompson, 1981: 92)
- (8) *Zhangsan nüpengyou duo*
 Zhangsan girlfriend many
 ‘Zhangsan have many girlfriends.’ (Li & Thompson, 1981: 92)

⁸ Bold words are topics, whereas underlined words are subjects.

- (9) *Wu ge pingguo liangge huai le*
 five CL apple two rotten EXP
 'Of five apples, two are rotten.' (Li & Thompson, 1981: 92)

In addition, spatial and temporal phrases should be regarded as topics.

- (10) *Zuotian xue xia de hen jin*
 yesterday snow fall CSC very heavily
 'Yesterday, it snowed heavily.' (Li & Thompson, 1981: 94)

- (11) *Na nian ta hen jinzhang*
 that year he very nervous
 'That year, he was very nervous.' (Li & Thompson, 1981: 95)

Chen and Kao (2000) tend to define topics as the way Li and Thompson (1981) did. Topics are divided into five types: the first subject in a double-subject sentence, the initial NP extracted from the subject or object in a sentence, the initial NP co-indexing with the resumptive pronoun in a sentence, aboutness topic, and the initial NP of a sentence without a subject. They believe that when topics are subjects, the topics are unmarked and are not prominent. By contrast, when topics are not subjects, the topics are marked and prominent. By investigating sixty articles in Chinese novels, they propose that most topics are also subjects, while the number of sentences with so-called 'Chinese-style topics' (aboutness topics) is not high.

Lu (2000) has different view about the construction of topics with Li & Thompson (1981) and Chen & Kao (2000) in that topics are out of the structure of sentences, like adjuncts. The Spec of CP can only be filled by subjects. That is to say, topics and subjects occupy different positions in syntactic structure. According to Lu, topics are not generated from movements, as shown in (12).

- (12) [CP TOPIC *Lisi* [CP \emptyset [IP *mai le jiu*]]]
 Lisi buy PFV drink
 'Lisi has bought drink.'

Like Chen and Kao (2000), Wu and Shi (2001) suggest that topics are unmarked when they are also subjects, whereas they are marked when they are not subjects. Wu and Shi cite Xu and Langendoen's viewpoints (1985) on the categories that can take place in the topic positions. These categories are NP, S, S', VP, PrepP and PostP.

- (13) a. *Zhexie hua wo bu xiangxin* (NP)
 these words I not believe
 'These words, I do not believe.'
- b. *Ta hui shuo zhexie hua wo bu xiangxin* (S)
 he can say these words I not believe
 Lit: 'That he could have said these words, I don't believe.'
- c. *Zhexie hua ta hui shuo wo bu xiangxin* (S')
 these words he can say I not believe
 Lit: 'That these words he could have said, I don't believe.'

- d. *Shuo zhexie hua wo bu zancheng* (VP)
 say these words I not approve.of
 Lit: 'Saying these words, I don't approve of.'
- e. *Zai zhuozi shang ta fang le jiben shu* (PrepP)
 PREP table on he put ASP some book
 'On the table, he put some books.'
- f. *Zhuozi shang you shu, chuang shang bu hui you shu* (PostP)
 table on have book bed on not can have book
 Lit: 'On a table, there are some books; on a bed there cannot be any books.'

(Xu & Langendoen, 1985: 5)

Shi (2001) compares Japanese with Chinese and argues that the basic topic-comment structures of these two languages are homogeneous. Shi's view on the definition of topics is consistent with Li and Thompson (1981).

Huang et al. (2004) propose that some topics are derived by movement and related to a gap in the comment clause, while some others are not, and are interpreted according to an 'aboutness' relation. The former is derived by movement and the latter is derived by base-generation.

Although many linguists posit the existence of an aboutness relation (Chen & Kao, 2000; Huang et al., 2004; Li & Thompson, 1981; Lu, 2000; Pan & Hu, 2002; Paul, 2002; Shi, 2001; Wu & Shi, 2001), Shi (2000) and Huang and Ting (2006) deny that there is an aboutness relation, 'dangling topic' they term, in Chinese. They claim that Chinese topics must be related to a syntactic position inside the comment clause. The so-called dangling topics are analyzed as subjects, NP adverbials, NP topics and PP-reduced forms in different ways by Shi (2000) and Huang and Ting (2006). Both studies argue that all topics are derived from movement, and there is no base-generated topic in Chinese.

On the issue on topics, Badan and Gobbo (2006) have very different view. They suggest that an aboutness topic and a hanging topic are two different things. In their research, aboutness topics, hanging topics and left dislocation are diverse topics; moreover, aboutness topics can take place with hanging topics or with left dislocation in a sentence. An aboutness topic is not related to any position in the sentence, as there is no trace or pronoun linked to it; as a matter of fact, it is not even subcategorized by the verb. A hanging topic is a topic which co-indexes with a resumption pronoun in the comment. As for left dislocation, the topic leaves a trace in the comment. According to Badan and Gobbo, hanging topics and left dislocation topics can be stressed phonologically and act as Contrastive Topics. In the following sentence, 'hua' is an aboutness topic. 'Meguihua' is a contrastive topic, and 'wo' is a subject.

- (14) *Hua, MEGUIHUA_i, wo zui bu ai ti.*
 flowers roses I most not love
 'Among flowers, ROSES, I dislike most.' (Tang, 1990: 338)

They also discuss about the issue on 'focus' in Chinese, which can be categorized into two parts: *lian*-focus (even-focus) and focus with contrastive stress. The former is always in preverbal position, whereas the latter can never be in the left periphery position; that is, focus with contrastive stress should stay in situ. They also point it out that topics can take place in the left periphery position, and that multiple topics can exist in a sentence. In the light of their theory, the contrastive NP '*meguihua*' in sentence (14) is a topic but not a focus.

Aside from the above syntactic analysis on topics, Chen (1996) not only introduce syntactic interpretations of structural topics and relativization, but also proposes a pragmatic approach to analyze topics and relativization in Chinese. In the syntactic interpretations, Chen suggests that three kinds of topic constructions (TC) can be found in topics: topicalization, left dislocation and Chinese-style TC. The examples are shown below, respectively.

- (15) *Na ji feng xin ta kuai xie wan ti le.* (Topicalization)
 that several CL letter he almost write finish CRS
 'Those several letters, he has almost completed.' (Chen, 1996: 391)
- (16) *Na ge ren wo yiqian jian guo ta ma?* (Left Dislocation)
 that CL person I before see EXP he Q
 'That person, have I met him before?' (Chen, 1996: 391)
- (17) *Na ci bisai, Lao Li de le guanjun* (Chinese-style TC)
 that CL match Lao Li get PFV champion
 'In that match, Lao Li won the championship.' (Chen, 1996: 394)

The topics in Topicalization and Left Dislocation can be relativized, as shown in (18) and (19) respectively. However, the topics in Chinese-style TC sometimes can be relativized, as in (20), but sometimes cannot, as in (21).

- (18) [*Ta kuai xie wan le de*] *na ji feng xin* (Topicalization – Relativization)
 'those letters that he has almost completed'
- (19) [*Wo yiqian jian guo ta de*] *na ge ren* (Left Dislocation – Relativization)
 'That person that I have met before'
- (20) [*Lao Li de le guanjun de*] *na ci bisai* (Chinese-style TC – Relativization)
 'That match in which Lao Li won the championship'
- (21) *Shuiguo, wo zui ai chi xiangjiao* (Chinese-style TC)
 fruit I most love eat banana
 * [*Wo zui ai chi xiangjiao de*] *shuiguo* (Chinese-style TC – Relativization)
 'Fruit that I like to eat banana most' (Chen, 1996: 395)

Therefore, Chen argues that the correlation between RCs and topic construction cannot be captured exclusively in syntactic terms. Chen points out that in Japanese there are instance topics, which can be relativized, and range topics, which cannot be relativized, and hence, further assumes that topic construction, when talking about RCs, should be distinguished into three categories: instance topic, frame topic and range topic.

- (22) An instance topic represents an instance of the object about which a predication is made and assessed. It is typically a definite entity in the cognitive inventory of referential entities in the context.
- (23) A frame topic is one that provides the spatial, temporal and individual frame within which the proposition expressed by the remaining part of the TC, typically a predication made of another expression in the sentence, normally that of the subject, holds true.
- (24) A range topic is one that delimits the range of a variable of which the predication is made.

(Chen, 1996:399)

According to Chen, only range topics cannot be relativized. Here are the examples of three types of topics and their relativization.

- (25) a. **Lao Li**, *women yijing qing lai le* (Instance Topic)
Lao Li we already invite come CRS
'Lao Li, we have already invited here.'
- b. [*Women yijing qing lai le de*] **Lao Li**
'Lao Li, who we have already invited here' (Chen, 1996: 398)
- (26) a. **Shang ci jiaoyou**, *haizimen dou lei ji le* (Frame Topic)
last CL outing children all tired extremely CRS
'On the last outing, the children were all exhausted.'
- b. [*Haizimen dou lei ji le de*] **shang ci jiaoyou**
'The last outing, in which the children were all exhausted'
(Chen, 1996: 398)
- (27) a. **Wujia**, *niuyue zui gui* (Range Topic)
price New-York most expensive
'Speaking of prices, New York is the most expensive.'
- b. **[Niu Yue zui gui de] wujia*
'Price which New York is the most expensive' (Chen, 1996: 398-399)

Chen's classification hence differs from the syntactic analysis in that whether a topic undergoes a movement or not is not a criterion in distinguishing the topic types in the pragmatic perspective. Therefore, in her view, topicalization and left dislocation should be united into the same category, namely, the instance topic construction.

Considering the issue on whether addressees can recognize where the topics conveyed by speakers are, prosody is an important field to go through. Feng (2000) claims that there must be a pause after a topic so that the topic will not be interpreted as other elements, like modifier. Other researchers also point out that a variety of phonological and intonational cues may be used in combination to mark syntactic structure (Beach, 1991; Lehiste, 1973; Lehiste, Olive & Streeter, 1976; Schafer et al., 2000; Scott, 1982; Streeter, 1978). In Kraljic and Brennan's study (2005), speakers tend to produce prosodic cues to syntactic boundaries regardless of their addressees' needs in particular situations. Such cues did prove helpful to

addressees, who often appear to consider only the interpretation the speakers intend. According to Frazier et al. (2004), prosodic breaks are natural before long upcoming constituents. The use of high level breaks in language comprehension is related to the overall pattern of intonational choices made.

Frazier et al. (2006) also argue that prosody is central to understanding spoken language. Prosodic structure organizes the elements of an utterance, and the prosodic structures within a given language have many predictable properties. The syntactic significance of each prosodic boundary in a sentence is assessed by listeners who assume that the speaker pronounces the sentence by coherently implementing the grammatical constraints on prosody. They divided prosody into two kinds. Some aspects of prosody are obligatory, while other aspects of prosody are not obligatory, but a matter of the speaker's preference or style. The pause after a topic suggested by Feng (2000) may belong to the former kind of prosody. In their study, listeners use obligatory aspects of prosody to identify the words and syntactic phrasing of an utterance.

On the strength of the prior considerations, this recent paper aims to explore whether topics will enhance children's production of RCs in Mandarin Chinese as well as how topic types will affect the RC production, which will in turn suggest the categorization of topics. In view of the research purposes, three major sets of research questions to be addressed in this study are as follows:

1. Is topichood a factor of influencing the RC production? In other words, does the fact that SRC is easier to be processed than ORC in Mandarin found in previous studies result from the topic-prominent system, in which a subject in a base sentence, the head noun of an SRC, is also a topic?
2. How does different topic types affect the RC production? What is the hierarchy of the RC production accuracy in terms of the different types of topics? What are the types of the grammatical RC production and the types of the ungrammatical RC production?
3. How do different types of topics enhance children of diverse age in producing RCs in Mandarin Chinese?

Methodology

This experiment was designed to understand the effect of topics in children's acquisition of head-final RCs in Chinese, and the adult group served as a control group. The elicited production experimental technique used here was similar to that in Hsu's study (2006), in which Hsu adopted picture presentations rather than act-out events to diminish the requirement of memory load. As Su (2006) has pointed out that children's comprehension of RCs in Chiu's research (1996) was much better than Chang (1984) and Cheng (1995) owing to the fact that Chiu's study provided children with two toys of the same type as did in Hamburger and Crain (1982), the child in this current study was also introduced to two identical characters or objects.

Participants

100 children who are native speakers of Taiwan Mandarin Chinese participated in this study, with 20 from each of the age ranges of kindergarten: 2nd level classes (average age: 5;8) and 3rd level classes (average age: 6;3); and elementary school: 1st grade (average age: 7), 3rd grade (average age: 9), and 5th grade (average age: 11). They were students from an elementary school and an affiliated preschool of a high school in Taiwan. In addition, 20 adult native speakers of Mandarin Chinese spoken in Taiwan participated in this study. They were all college students. This group serves as a control group.

Materials

Four sets of source sentences were utilized as prime sentences to elicit RCs. Two sets were designed to embrace an animate subject and an animate object, while the other two sets embraced an inanimate subject and an inanimate object. Although animacy is not a factor we are concerned, it was still taken into consideration in order to avoid any possible noisy effect. Each set of the source sentences involves prime sentences of four topic types. Based on previous studies on topichood, in which researchers adopted diverse terminologies with different perspectives to classify the Chinese topichood, we integrate all the proposed categories and employed the four topic types, including topicalization (TP), left dislocation (LD), range topic (Range), viz. non-relativizable Chinese-style topic, and frame topic (Frame), viz. relativizable Chinese-style topic,⁹ to form the prime sentences that carry different conditions for producing relative clauses. To be more specific, the syntactic properties of the topic types provided the possibilities of manipulating the existence of topichood in the subject NPs of the prime sentences. In each set of the source sentences are nine prime sentences, two of which belong to topicalization, two of which belong to range topic, two of which belong to left dislocation, two of which belong to base sentence, and one of which belong to frame topic. The prime sentences in base sentence and in the topic types, except for

⁹ Different terminologies have been used by different scholars. The ‘topicalization’ category is called as ‘sentences with a topic but without a subject’ and ‘sentences with a topic NP and a subject NP’ by Li & Thompson (1981), as ‘the initial NP of a sentence without a subject’, ‘the 1st subject in a double-subject sentence’ and ‘the initial NP extracted from the subject or object in a sentence’ by Chen & Kao (2000), as ‘left dislocation’ by Badan & Gobbo (2006), and as ‘the instance topic’ by Chen (1996). The ‘left dislocation’ category is called as ‘the initial NP co-indexing with the resumptive pronoun in a sentence’ in Chen & Kao (2000), as ‘hanging topic’ by Badan & Gobbo (2006), and as ‘the instance topic’ by Chen (1996). The ‘range topic’ category is called as ‘double-subject’ or ‘topic-comment’ or ‘whole-part relationship’ by Lin & Thompson (1981), as ‘Chinese-style topic’ by Chen & Kao (2000), and as ‘aboutness’ by Badan & Gobbo (2006). The ‘frame topic’ is called as ‘spatial and temporal phrases as topics’ by Li & Thompson (1981), as ‘Chinese-style topic’ by Chen & Kao (2000), and as ‘aboutness’ by Badan & Gobbo (2000). The terms we used in this study were extracted from some of the above scholars. We leave the precise terminologies of topichood to future research.

the frame topic, were further designed to elicit either SRC or ORC production. Since the topic in the frame topic construction is not generated from or cannot co-index with a subject or object position, it can elicit neither SRC nor ORC, but RCs with temporal or spacial RC head, and hence, only one prime sentence was designed. Table 1 illustrates the distribution of the prime sentences.

Table 1. The distribution of the prime sentences (Two sets have been listed.)

Animacy	RC	Topic Types				
		TP	Range	LD	Base	Frame
Animate-S + Animate-O	SRC	1	1	1	1	1
	ORC	1	1	1	1	
Inanimate-S + Inanimate-O	SRC	1	1	1	1	1
	ORC	1	1	1	1	

Descriptions of one set of prime sentences are given below. The full contexts of prime sentences are listed in the appendix.

- (28) a. *Nage nansheng, xihuan genzhe nazhi xiaogou.* (TP: SRC)
 that-CL boy like follow that-CL dog
 ‘Regarding that boy, he likes to follow that puppy.’
- b. *Nazhi xiaogou, nage nansheng xihuan genzhe.* (TP: ORC)
 that-CL puppy that-CL boy like follow
 ‘Regarding that puppy, that boy likes to follow it.’
- c. *Xuesheng, nage nansheng xihuan genzhe nazhi xiaogou.* (Rg.: SRC)
 student that-CL boy like follow that-CL puppy
 ‘Among students, that boy likes to follow that puppy.’
- d. *Dongwu, nage nansheng xihuan genzhe nazhi xiaogou.* (Rg.: ORC)
 anima that-CL boy like follow that-CL puppy
 ‘Among animals, that boy likes to follow that puppy.’
- e. *Nage nansheng, ta xihuan genzhe nazhi xiaogou.* (LD: SRC)
 that-CL boy he like follow that-CL puppy
 ‘Regarding that boy, he likes to follow that puppy.’
- f. *Nazhi xiaogou, nage nansheng xihuan genzhe ta.* (LD: ORC)
 that-CL puppy that-CL boy like follow it
 ‘Regarding that puppy, that boy likes to follow it.’
- g. *Natian, nage nansheng xihuan genzhe nazhi xiaogou.* (Frame)
 that day that-CL boy like follow that-CL puppy
 ‘On that day, that boy likes to follow that puppy.’

- h. ***Nage nansheng** xihuan genzhe nazhi xiaogou.* (Base: SRC)
 that-CL boy like follow that-CL puppy
 ‘That boy likes to eat that apple.’
- i. ***Nage nansheng** xihuan genzhe nazhi xiaogou.* (Base: ORC)
 that-CL boy like follow that-CL puppy
 ‘That boy likes to eat that apple.’

The prime sentences in topicalization, range topic, and base sentence were further used to examine whether topichood enhance the SRC production. As shown in (28) and Table 2, in topicalization, the subject-extracted topic prime sentences were used to elicit SRCs, in which the head nouns of the RCs were topics rather than subjects in prime sentences. On the other hand, the object-extracted topic prime sentences were designed to elicit ORCs, in which the head nouns of the RCs were also topics rather than objects in prime sentences. In this category, no subject or object can be found in the SRC or ORC prime sentences, respectively. In range topic, the topics were designed according to the RC type we would like to elicit; however, the subjects or objects, which were to be used as the head nouns of RCs, were not topics and do exist in the prime sentences. As for base sentence, subjects play both topic and subject roles, while objects play only object roles. The following table illustrates the topic design of the prime sentences.

Table 2. The first set of prime sentences with/without topics

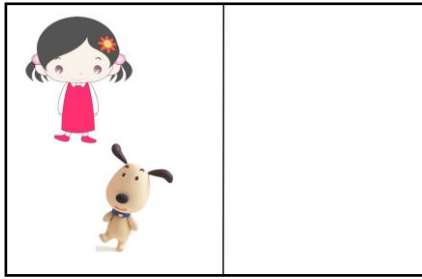
		Topicalization	Range	Base
Head N of SRC	Topic	+	-	+
	Subject	-	+	+
Head N of ORC	Topic	+	-	-
	Object	-	+	+

All prime sentences were recorded via Praat in a sound-proof studio. A 0.4-second pause was inserted after each topic. All stimuli were given with a Latin square design so that no subject would hear similar sentences from the same set. To complete the elicited task, the stimuli were accompanied with pictures shown in a laptop screen.

Four sets of pictures corresponding to the four sets of prime sentences were used in this experiment. Each set of pictures consisted of three filler pictures, three base pictures, and three question pictures, where the filler pictures and the base pictures together introduced the two identical characters or objects and their events, while the question pictures had changes from the base ones for the subjects to describe. Of the pair of base pictures, question pictures and filler pictures, one was used to elicit SRCs, another was employed to elicit ORCs, and the other was utilized to elicit RCs in the frame topic condition. In a question picture designed to elicit SRCs, the agent of the event in its corresponding (base) picture underwent a

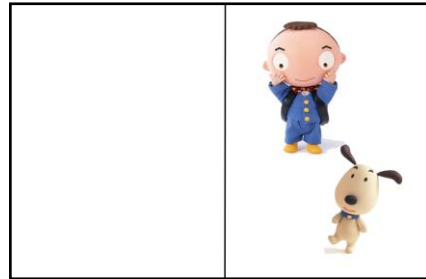
change. By contrast, in a question picture designed to elicit ORCs, it was the patient that underwent a subsequence change. The introduction of each base picture is always the second one. Take the pictures used to elicit an ORC under the topicalization condition as an example¹⁰:

- Filler picture:



(a) *Nazhi xiaogou, nage nüsheng xihuan genzhe.*
'About that dog, that girl likes to follow it.'

- Base picture:



(b) *Nazhi xiaogou, nage nansheng xihuan genzhe.*
'About that dog, that boy likes to follow it.'

- Question picture



(c) *Qingwen, nazhi xiaogou nale qiqiu?*
'Question: which dog is with balloons?'

Procedure

Child group

In the experiment, each child and the experimenter sit on one side of the table looking at the computer screen. The helper, who the child needs to describe the picture to, sit on the other side of the table so that she is not able to see the computer screen. Each trial includes three picture presentations: one filler picture, one base picture, and one question picture. The child is presented with the first

¹⁰ The figures used in the pictures were extracted from Ai-bao Early Childhood Network (<http://www.kid520.com/youjiao/pic/>), San-lian Source Material (<http://www.3lian.com/>), and Jiou-jiou Source Material Network (<http://www.99sucai.com/>) in May, 2010.

picture with a filler sentence broadcast from the computer, and then, the computer presented the second picture with a prime sentence. The third picture showed a change from the second picture and the computer asked the child to answer a question about the change at the same time. All questions are asked about the intended head of the target RC. After being asked, the child had to describe the change in the second picture to the helper who sits on the other side of the table and help her to choose a picture. The child would tell the helper whether she has selected the correct picture. The experiment began with two practice trials to help the child become familiar with the content they are going to participate, and then the main session which contains 9 trials began. The whole experiment was recorded and transcribed for the analysis.

Adult group

The procedure implemented in the adult group is similar to that in the child group. Nevertheless, there was no helper in the experiment with adults. The adult subjects were asked to describe the change of the picture to the experimenter by writing down the answers.

Data Analysis

In coding the data, all responses were firstly classified into correct answers and incorrect answers. The correct answers were further categorized into four types: complete RCs, RC head omission, Frame-topic RC with null subject, and Bei construction. Regarding incorrect answers, five categories were used: simple sentence, resumptive NP, wrong RC head or role reversal error, other structures, and response with directions. Each type of responses in each category is illustrated below:

(29) Correct answers

a. Complete RCs

Nüsheng kan de nazhi niao
girl look DE that-CL bird
'the bird who the girl is looking'

b. RC head omission

Kan xiaoniao de
look bird DE
'(the girl) who is looking at the bird'

c. Frame-topic RC with null subject

Xihuan genzhe xiaogou de
like follow puppy DE
'the day when (she) likes to follow the puppy'

d. Bei construction

Bei hanbao nongzang de najian waitao
BEI hamburger dirty DE that-CL coat
'the coat which is stained by the hamburger'

(30) Incorrect answers

Incorrect Answers	Expected Answers
<p>a. Simple sentence <i>Nage biandang pengdaole yifu</i> that-CL lunch-box touch clothes ‘That lunch box touched the clothes’</p>	<p><i>Nage biandang pengdao de yifu</i> that-CL lunch-box touch DE clothes ‘the clothes which that lunch box touched’</p>
<p>b. Resumptive NP <i>Nansheng genzhe xiaogou de nazhi</i> boy follow puppy DE that-CL ‘*the one which the boy is following the dog’</p>	<p><i>Nansheng genzhe de xiaogou</i> boy follow DE dog ‘the dog which the boy is following’</p>
<p>c. Wrong RC head or Role reversal error <u>Wrong RC head</u> <i>Xihuan kan xiaoniao de nage nüsheng</i> like look bird DE that-CL girl ‘the girl who likes to look at the bird’ <u>Role reversal error</u> <i>Pengdao biandang de beixin</i> touch lunch box DE vest ‘the vest which touched the lunch box’</p>	<p><i>Nage nüsheng xihuan kan de xiaoniao</i> that-CL girl like look DE bird ‘the bird who the girl likes to look at’ <i>Biandang pengdao de beixin</i> lunch-box touch DE vest ‘the vest which the lunch box touched’</p>
<p>d. Other structures <u>Possessive marker DE</u> <i>Waitao de hanbao</i> coat DE hamburger ‘the hamburger of the coat’ <u>Deictic answers</u> <i>Nage waitao</i> that-CL coat ‘that coat’</p>	<p><i>Nongzang waitao de hanbao</i> stain coat DE hamburger ‘the hamburger which stained the coat’</p>
<p>e. Response with directions <i>Zhege</i> this-CL ‘this’</p>	<p><i>Pengdao beixin de biandang</i> touch vest DE lunch-box ‘the lunch box which touched the vest’</p>

To answer questions concerning relationships between the variables tested, ANOVA, T-test and Chi-square test were conducted according to the types of the data and the research questions we dealt with.

Results and Discussions

Accuracy

The results of the ANOVA revealed no significant difference on accuracy of the RC production between topic types and between RC types. T-test also showed that there were also no statistically significant effects of RC types within each topic

type. However, Chi-square test indicated that there is significant effect of topic types on RC types ($X^2=220.947$, $p < .00$). As shown in Table 3, children tended to produce RCs equally accurately in both SRC- and ORC-elicited tasks under the topicalization and range topic conditions. By contrast, they were able to generate more accurate RCs in the SRC-elicited task than in the ORC-elicited task under the left dislocation and base sentence conditions. However, the accuracy pattern of the RC production by adults was different ($X^2=87.377$, $p < .00$). Adults could better shoot the correct answers in the SRC-elicited task under the topicalization condition, while they generated more accurate RCs in the ORC-elicited task under range topic. They performed the RCs equally well in both SRC- and ORC-elicited tasks under the left dislocation conditions and base sentence conditions.

Table 3. The frequency counts and the percentage of the correct RC production between RC types under each topic type

		SRC	ORC	Note
Children (N=100)	TP	25 (45.5%)	30 (54.5%)	SRC \leq ORC
	LD	32 (56.1%)	25 (43.9%)	SRC $>$ ORC
	Range Topic	23 (50%)	23 (50%)	SRC = ORC
	Base	25 (61%)	16 (39%)	SRC $>$ ORC
Adults (N=20)	TP	14 (58.3%)	10 (41.7%)	SRC $>$ ORC
	LD	9 (47.4%)	10 (52.6%)	SRC \leq ORC
	Range Topic	7 (41.2%)	10 (58.8%)	SRC $<$ ORC
	Base	9 (50%)	9 (50%)	SRC = ORC

The accuracy produced by children indicates that for children, topichood is a factor influencing the accuracy of RC types. For the sake of making this conclusion, we ought to compare the RC scores among topicalization, range topic and base sentence conditions. Results in topicalization condition shows that the head nouns in both SRCs and ORCs are equally easily picked out. This is attributable to the fact that the head nouns of SRCs or ORCs are both topics in topicalization source sentences. Likewise, the head nouns of SRCs or ORCs are not topics in range topic source sentences, and our result shows the same accuracy in both SRCs and ORCs. Compared with topicalization and range topic, base sentence condition reflects higher accuracy in SRC-elicited task than in ORC-elicited task, which confirms the results given by previous studies. This can be readily explained by the fact that the subjects in base sentence condition are also topics. Additionally, the accuracy of ORC production in topicalization is much higher than that in base sentence, which further proves that the reason why ORCs are more difficult than SRCs in the base

sentence condition may be the fact that the object nouns are not topics. Therefore, we may conclude that 'topic' is a dominant factor for children to pick out the head noun of an RC and then to form a grammatical RC.

There were other small evidences that proposed the influences of topichood on RC production found in children's production. One 1st grader and two 5th graders adopted the topic in the range topic condition, which can never be relativized, to be the RC head. An example is shown below to illustrate that topichood indeed brings some effects on RC production.

- (31) Prime sentence: *Shiwu, nage hanbao nongzang le najian yifu*
 food that-CL hamburger stain LE that-CL clothes
 'Regarding food, that hamburger stained that clothes.'
- RC production: *Pengdao najian yifu de shiwu*
 touch that-CL clothes DE food
 'the food which touched that clothes'
- Expected answer: *Nongzang le najian yifu de nage hanbao*
 stain LE that-CL clothes DE that-CL hamburger
 'the hamburger which stained that clothes'

The pattern shown in adults is rather weird in that the frequency counts of correct RC production in the base sentence condition tend to recommend that SRC-elicited task and ORC-elicited task are equally easy, which is a different result of children's production as well as an inconsistent finding of Hsu's study though she only recruited 10 adults as her subjects. From adults' data, it is hardly found that topichood is a factor since the production of RC types does not follow the expectations of the research design, and the production of ORCs in the topicalization condition does not perform better than that in the base sentence condition. However, the inconsistent RC development cannot be trusted. The results may be due to the small number of adult subjects or the method of eliciting the subjects' responses, which is different from the way we asked our child subjects to produce RCs. Consequently, we do not take adults' production as a control group but reserve it as a reference.

In addition to show the importance of topics, Table 3 also suggests that left dislocation may not be categorized into the topic type in which topicalization belongs to. Instead, it acts more like the base sentence. The accuracy in the SRC-elicited task is higher in both left dislocation and base sentence conditions; by contrast, the topicalization condition reveals slightly higher accuracy in the ORC-elicited task. This can be explicated by the syntactic features among these three topic types. First of all, the topic of topicalization undergoes a movement, while the topic of left dislocation does not. Besides, the topic of left dislocation co-indexes with the noun in either subject or object position, whereas the topic of topicalization does not. Although in base sentence, unlike left dislocation, only nouns in the subject position can be topics, it is similar to left dislocation because in the SRC-elicited task subjects are both subjects and topics. Accordingly, it may

not be appropriate to put the topicalization and left dislocation into the same topic category, as Chen (1996) did.

In regard to the accuracy hierarchy of diverse topic types, the ANOVA revealed no statistically significant differences. By looking into the percentage of children's correct production, we found that under topicalization and left dislocation conditions more accurate RCs were generated (27.5% and 28.5%, respectively) than under range topic condition (23%), which in turn invokes more accurate RCs than base sentence and frame topic conditions (20.5% and 19%, respectively). The reason why the topics in topicalization and left dislocation give rise to more accurate RC production may attribute to the prominence of topics, which are located at the initial NP with a obvious pause and are either extracted from the subject/object position or referred by the subject/object position. The latter characteristics is considered as a factor which leads to the ease of process because as mentioned above, the topics in the range topic and the frame topic conditions, which are also located at the initial NP with a obvious pause but are not extracted from or do not co-index with the subject/object position, are at the lower ranking compared to the topics in topicalization and left dislocation. However, the range topic condition is still at the higher ranking in the accuracy hierarchy than the frame topic condition because the range topics and the subject/object nouns are in whole-part relation, while the frame topics have nothing to do with the subject/object nouns. The lower ranking of base sentence, which reserves subject/object nouns in situ but only assign the topic role to the subject, further proves that the topichood is a more important factor in relativization than the subject/object position.

As for the effects of age, the ANOVA indicated a significant effect for different grades ($F(5, 1079) = 22.736, p < .00$). With the increase of age, subjects tended to produce more correct RCs. The Scheffe Test further revealed that children of elementary school and adults generated much more accurate RCs than children of kindergarten Level 2. Also, children of grade 5 and adults produced RCs more correctly than children of kindergarten Level 3. Subjects of diverse grades also performed significantly differently in topicalization ($F(5, 239) = 6.509, p < .00$), range topic ($F(5, 239) = 5.946, p < .00$), left dislocation ($F(5, 239) = 3.73, p < .00$) and base sentence conditions ($F(5, 239) = 7.606, p < .00$). The development of each topic type has been shown in Figure 1. When we look into each topic type, we discovered no significant difference between SRCs and ORCs in each age group. Nevertheless, T-test showed that children of kindergarten Level 3 significantly produced more correct SRCs than ORCs ($p < .05$). Figure 2 illustrates that children of grade 3 and 5 also generate more SRCs than ORCs although the differences were not found by statistics.

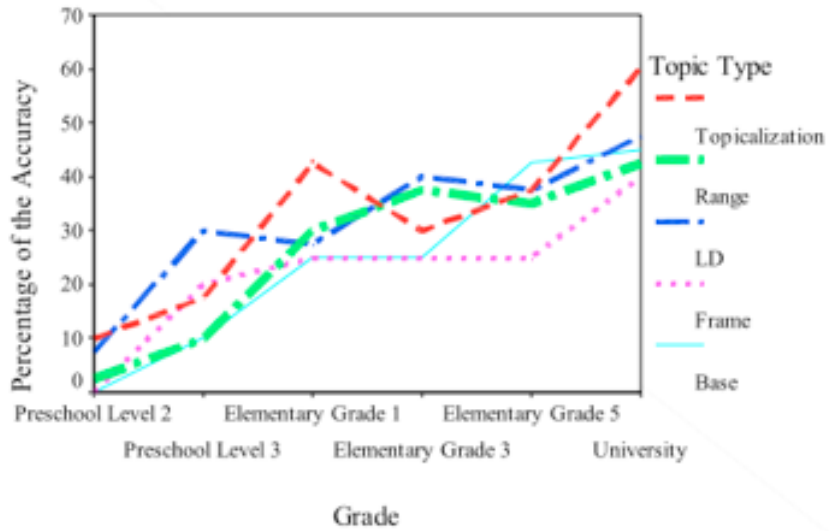


Figure 1. The effects of Topic hood by different grades

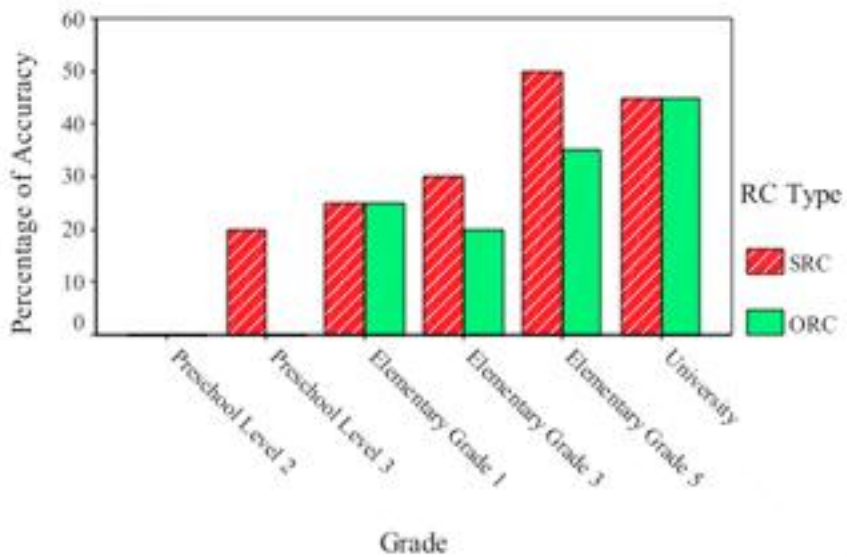


Figure 2. The RC production under base sentence condition by RC types

Types of the RC production

Correct RC Production

In the correct RC production, the Chi-square analysis showed that there were

effects of topic types on the types of the RC production ($p < .00$). Table 4 presents that topicalization and left dislocation conditions invoke more RC head omission than the other topic types. This may result from the fact that the topics, which in turn becomes the RC head, are quite marked, and hence, our subjects thought that there was no need to mention. However, the range topic and base sentence conditions tend to elicit more complete RCs than other topic types. The reason why the RC head needs to be mentioned is that, topics in range topic cannot be relativized. Besides, in base sentence condition, the objects which are head nouns of ORCs are never topics in the source sentences.

Table 4. The percentage of types of correct RC production in each topic type

	Complete RC	RC head omission	Frame-topic RC with null subject	Bei construction
Topicalization	51 (65.6%)	16 (20.3%)		12 (15.2%)
Range Topic	45 (71.4%)	8 (12.7%)		10 (15.9%)
Left Dislocation	50 (65.8%)	14 (18.4%)		12 (15.8%)
Frame Topic	18 (66.7%)	3 (11.1%)	6 (22.2%)	
Base Sentence	43 (72.9%)	7 (11.9%)		9 (15.3%)

The Chi-square analysis also revealed the statistically significant effects of RC types on the types of the RC production ($p < .00$). The SRC production is higher than ORC production in both complete RC type (77.1% for SRC and 58.6% for ORC) and RC head omission type (22.9% for SRC and 9% for ORC). Among the grammatical RCs produced by our subjects, Bei construction is a very interesting finding. 32% of our subjects tended to use this structure to generate an SRC in the ORC-elicited task. If we take age into consideration, we found that children aged 6;3 were able to skillfully adopt Bei construction to turn the ORC-target production into an SRC production pattern. The percentage of SRC production in the ORC-elicited task are: 25% in Kindergarten Level 3, 42.9% in Grade 1, 50% in Grade 3, 22.2% in Grade 5, and 30.8% in adults. This tells us that SRC is easier than ORC so that our subjects would rather used one more transformational rule, that is, from the active voice to passive voice, to form an SRC. It is worth mentioning that adults, who tended to generate more accurate RCs in the ORC-elicited task, produce more SRCs than ORCs.

The Chi-square analysis also showed significant effects of age on the types of correct RCs. Table 5 offers the effects of age on complete RC and RC head omission. With the increase of age, our subjects tended to produce more complete RCs but less RC head omission.

Table 5. The percentage of types of correct RC production in each grade

	Complete RC	RC head omission	Frame-topic RC with null subject	Bei construction
Kindergarten 2	2 (25%)	6 (75%)		
Kindergarten 3	17 (54.8%)	11 (35.5%)		3 (9.7%)
Grade 1	36 (65.5%)	7 (12.7%)	1 (1.8%)	11 (20%)
Grade 3	36 (62.1%)	7 (12.1%)	3 (5.2%)	12 (20.7%)
Grade 5	42 (63.6%)	17 (25.8%)	2 (3%)	5 (7.6%)
Adults	74 (86%)			12 (14%)

Incorrect RC Production

In the incorrect RC production, the Chi-square analysis indicated no significant effects of topic types and of RC types. However, the effects of age were found ($p < .00$). As shown in Table 6, with the increase of age, our subjects were able to use longer sentences to describe the picture they saw, but the older subjects may just repeat what they hear instead of producing RCs.

The types of the incorrect RC production offer a perspective on language production processes. According to Bock & Levelt's model of speech production (1994), there are four levels processing: message level, functional level, positional level and phonological encoding level. At the message level, the main idea to be conveyed is produced. In her study, which shows that SRC is generated in the ORC-elicited task, Hsu (2006) claims that 'the wrong head errors' she found from the children's production are results of problems in the message planning level because when children are presented with the pictures, they can distinguish the identical objects by paying attention to the different actions that the agent roles act upon them, pick out the patient role by describing the patient's agent and its particular action, and hence, produce an SRC rather than an ORC. The data collected in this study also expose the phenomenon that children of different age groups tend to incorrectly generate SRCs in the ORC-elicited task. The results tell that sentences which are more difficult to be processed at the message planning level are more easily wrongly generated.

At the functional level, the processing first enter the lexical selection stage, where the conceptual representation is transformed into a lexical representation. After words are selected to express the intended message, these lexical items are then assigned their grammatical function roles, known as the function assignment stage. If children have problems in assigning syntactical roles to the lexical items, then we should find some role disorders in the RC production, and in fact, we did. There were seven examples distributed in grade 1, 3 and 5 found in our study, which in turn suggests that children aged under 11 still cannot deal with the RCs

thoroughly at the functional processing level.

The third level of the model is the positional level, where the order of the words matters. Finally, the phonological encoding level indicates the pronunciation of the words. Based on Hsu's study (2006), if children have problems in mapping the phrasal constituents and the hierarchical structure, then we expect to find more 'simple sentence' or more 'resumptive NP' in the ORC-elicited task than in the SRC-elicited task because the NVN sequence produced in ORC production shows that a processor fails to suppress the pronunciation of the NP in the object position. However, in the current study, we did not find higher NVN sequences in ORC-elicited task than in SRC-elicited task. Therefore, the subject-object asymmetry in the children's RC production is not likely to be related to this level. Instead, it is the topichood that makes the impact on the subject-object asymmetry.

Table 6. The percentage of types of wrong RC production in each grade

	Simple sentence	Resumptive NP	Wrong RC head & Role reversal error	Other structures	Response with directions
Kindergarten 2	14 (8.3%)	2 (1.2%)	4 (2.4%)	149 (88.2%)	
Kindergarten 3	12 (8.2%)	1 (7%)		129 (87.8%)	5 (3.4%)
Grade 1	50 (41%)	8 (6.6%)	6 (4.9%)	57 (46.7%)	1 (0.8%)
Grade 3	83 (68%)	7 (5.7%)	8 (6.6%)	24 (19.7%)	
Grade 5	64 (56.1%)	3 (2.6%)	10 (8.8%)	37 (32.5%)	
Adults	72 (78.3%)	8 (8.7%)		11 (12%)	1 (1.1%)

Conclusion

Four major findings are worth summarizing in the study. Firstly, topichood is a major factor of influencing the RC production for children. In the base sentence condition, children, as expected, produce more accurate RCs in the SRC-elicited task, as discovered in many previous studies. Nevertheless, they tend to generate correct RCs equally in both SRC-elicited and ORC-elicited tasks under the topicalization condition, where the subject-extracted and the object-extracted topics are the head noun of RCs, as well as under range topic condition, where both subject and object nouns are not topics.

In addition, left dislocation cannot be categorized into the same class which topicalization belongs to. Although the accuracy of RC production under the left dislocation condition is similar with that under the topicalization condition, the different accuracy distributions of diverse RC types under these two topic conditions illustrate that there are discrepancies between the two. The accuracy hierarchy of the topic types, viz topicalization & left dislocation, range topic, base

sentence, and finally frame topic, shown from high to low, also reveals that distinct topic types bring different effects on relativization. With the constraint approach, we can conclude that whether there is a pause, which clearly marks the existence of a topic, after a topic is the most important criterion for children to pick out the RC head. The presence of the pause ensures the higher accuracy of RC production. The second prominent constraint is whether a topic is a temporal or spacial topic. A temporal or spacial topic is less preferred to be used as head nouns of RCs than ordinary topics. The third constraint is the degree of how a topic has a link with the subject or object position. Subject- or object-extracted topics and subject- or object-co-indexed topics are the most preferred. Whole-part relation between a topic and its relevant noun in the subject or object position is less preferred. However, 'no link' between a topic and the subject or object position is the least preferred. The hierarchy of the constraint is: Topic with a pause after it >> Temporal/Spacial topic >> Topic-S/O relation. Table 7 highlights the differences between the topic types evaluated by the three constraints.

Table 7. The constraints of acquiring how to relativize the different topic type

Topic Type	Topic with a pause after it	Temporal/Spacial topic	Topic-S/O relation
☞ TP			
☞ LD			
Range			*
Frame		*	**
Base	*		

The third major finding is that Bei construction, which is a passive form in Chinese, is highly adopted to form SRCs in the ORC-elicited task. This further proves that SRC production is more preferred than ORC production. Otherwise, a processor would not choose to use one more transformational rule to generate an RC. Not only do children, who produce more accurate RCs in the SRC-elicited task, choose to use SRCs in response to the ORC-elicited task, but also the adults, who produce higher accuracy in the ORC-elicited task, do. About one third of adults still perform SRCs in the ORC-elicited task.

Finally, with the increase of age, children perform dramatically more accurate RCs. Even though the development of relativizing each topic types presents the similar shape, they differ with each other in the degree of acquiring how to produce an RC. Moreover, children at early age of 5;8 are able to distinguish the difference between the topic types.

In spite of the major findings we address above, the design of the present

study is not without limitations. We readily acknowledged that our research is mostly exploratory and that there are problems with the statistical results. Although we could tell the tendency by percentages shown in each table, many of which do not reveal statistically significant differences. Following studies should remove some annoying data and are suggested incorporating more test items. The second limitation is rooted in the different methods used to elicit the RCs between children and adults. It is then suggested that although adults have already acquired their native language, it may not be adequate to use the writing task for RC elicitation after the pictures and the prime sentences are presented. After all, writing takes more time than speaking, and hence, it demands memory cost, which may in turn influence the RC production. Another problem we are facing is that the results performed by adults are far from those by children. What makes us more worried is that the inconsistency cannot be explained. Future studies on adults' RC production concerning the effect of RC types and topic types are recommended to recruit more subjects and avoid using the writing task.

Appendix: The Contexts of Prime Sentences

Animate-S + Animate-O

1. As given in (28)
2. a. *Nage nüsheng, zhengzai kan nazhi xiaoniao.* (TP: SRC)
that-CL girl Prog. look that-CL little bird
'Regarding that girl, she is looking at that little bird.'
- b. *Nazhi xiaoniao, nage nüsheng zhengzai kan.* (TP: ORC)
that-CL little bird that-CL girl Prog. look
'Regarding that little bird, the girl is looking at it.'
- c. *Xuesheng, nage nüsheng zhengzai kan nazhi xiaoniao.* (Rg.: SRC)
student that-CL girl Prog. look that-CL little bird
'Among students, that girl is looking at that little bird.'
- d. *Dongwu, nage nüsheng zhengzai kan nazhi xiaoniao.* (Rg.: ORC)
animal that-CL girl Prog. look that-CL little bird
'Among animals, that girl is looking at that little bird.'
- e. *Nage nüsheng, ta zhengzai kan nazhi xiaoniao.* (LD: SRC)
that-CL girl she Prog. look that-CL little bird
'Regarding that girl, she is looking at that little bird.'
- f. *Nazhi xiaoniao, nage nüsheng zhengzai kan ta.* (LD: ORC)
that-CL little bird that-CL girl Prog. look it
'Regarding that little bird, that girl is looking at it.'
- g. *Natian, nage nüsheng zhengzai kan nazhi xiaoniao.* (Frame)
that day that-CL girl Prog. look that-CL little bird
'On that day, that girl is looking at that little bird.'
- h. *Nage nüsheng zhengzai kan nazhi xiaoniao.* (Base: SRC)
that-CL girl Prog. look that-CL little bird
'That girl is looking at the little bird.'
- i. *Nage nüsheng zhengzai kan nazhi xiaoniao.* (Base: ORC)
that-CL girl Prog. look that-CL little bird
'That girl is looking at the little bird.'

Inanimate-S + Inanimate-O

3. a. *Nage hanbao, nongzangle najian waitao.* (TP: SRC)
that-CL hamburger stain that-CL coat
'Regarding that hamburger, it stained that coat.'
- b. *Najian waitao, nage hanbao nongzangle.* (TP: ORC)
that-CL coat that-CL hamburger stain
'Regarding that coat, that hamburger stained it.'
- c. *Shiwu, nage hanbao nongzangle najian waitao.* (Rg.: SRC)
food that-CL hamburger stain that-CL coat
'Among food, that hamburger stained that coat.'

- d. *Yifu*, nage hanbao nongzangle najian waitao. (Rg.: ORC)
 clothes that-CL hamburger stain that-CL coat
 ‘Among clothes, that hamburger stained that coat.’
- e. *Nage hanbao*, ta nongzangle najian waitao. (LD: SRC)
 that-CL hamburger it stain that-CL coat
 ‘Regarding that hamburger, it stained that coat.’
- f. *Najian waitao*, nage hanbao nongzangle ta. (LD: ORC)
 that-CL coat that-CL hamburger stain it
 ‘Regarding that coat, that hamburger stained it.’
- g. *Naci chifan*, nage hanbao nongzangle najian waitao. (Frame)
 that dining, that-CL hamburger stain that-CL coat
 ‘Last dining, that hamburger stained that coat.’
- h. *Nage hanbao* nongzangle najian waitao. (Base: SRC)
 that-CL hamburger stain that-CL coat
 ‘That hamburger stained that coat.’
- i. *Nage hanbao* nongzangle najian waitao. (Base: ORC)
 that-CL hamburger stain that-CL coat
 ‘That hamburger stained that coat.’
4. a. *Nage biandang*, pengdaole najian beixin. (TP: SRC)
 that-CL lunch box touch that-CL vest
 ‘Regarding that lunch box, it touched that vest.’
- b. *Najian beixin*, nage biandang pengdaole. (TP: ORC)
 that-CL vest that-CL lunch box touch
 ‘Regarding that vest, that lunch box touched it.’
- c. *Shiwu*, nage biandang pengdaole najian beixin. (Rg.: SRC)
 food that-CL lunch box touch that-CL vest
 ‘Among food, that lunch box touched that vest.’
- d. *Yifu*, nage biandang pengdaole najian beixin. (Rg.: ORC)
 clothes that-CL lunch box touch that-CL vest
 ‘Among food, that lunch box touched that vest.’
- e. *Nage biandang*, ta pengdaole najian beixin. (LD: SRC)
 that-CL lunch box, it touch that-CL vest
 ‘Regarding that lunch box, it touched that vest.’
- f. *Najian beixin*, nage biandang pengdaole ta. (LD: ORC)
 that-CL vest that-CL lunch box touch it
 ‘Regarding that vest, that lunch box touched it.’
- g. *Naci chifan*, nage biandang pengdaole najian beixin. (Frame)
 that-CL dining that-CL lunch box touch that-CL vest
 ‘Last dining, that lunch box touched that vest.’
- h. *Nage biandang* pengdaole najian beixin. (Base: SRC)
 that-CL lunch box touch that-CL vest
 ‘That lunch box touched that vest.’

- i. *Nage biandang pengdaole najian beixin.*
that-CL lunch box touch that-CL vest
'That lunch box touched that vest.'

(Base: ORC)

References

- Badan, L., & Gobbo, F. D. (2006). On the Syntax of Topic and Focus in Chinese. Paper Presented at *the Paris Meeting on East Asian Linguistics*, CRLAO, France, and at WECOL 2006, Fresno, CA.
- Beach, C. M. (1991). The interpretation of prosodic patterns at points of syntactic structure ambiguity: Evidence for cue-trading relations. *Journal of Memory and Language*, 30, 644-663.
- Bever, T. G. (1970). The cognitive basis for linguistic structures. In J.R. Hayes (Ed.), *Cognition and the development of language* (pp. 279-360). New York: Wiley.
- Bock, K., & Levelt, W. (1994). Language Production: Grammatical Encoding. In Morton Ann Gernsbacher (Ed.), *Handbook of Psycholinguistics* (pp. 945-984). Academic Press.
- Chang, H.-W. (1984). The comprehension of complex Chinese sentences by children: Relative clause. *Chinese Journal of Psychology*, 26 (1), 57-66.
- Chen, J., & Kao, Y. (2000). Hanyu shi zhuti tuchu de yuyian ma? (Is Mandarin Chinese a topic-prominent language?) *Foreign Languages and Their Teaching*, 5, 11-14.
- Chen, P. (1996). Pragmatic interpretations of structural topics and relativization in Chinese. *Journal of Pragmatics*, 26 (3), 389-406.
- Cheng, Y.-Y. S. (1995). *The Acquisition of Relative Clauses in Chinese*. A master thesis, National Taiwan Normal University.
- Chiu, H.-C. B. (1996). *The Nature of Relative Clauses in Chinese-Speaking Children*. NSC research report, National Taiwan Normal University.
- Feng, S.-L. (2000). On Chinese Rhyme Syntax. *Academics in China*, 80 (1), 100-123.
- Frazier, L., Carlson, K., & Clifton, C. Jr. (2006). Prosodic phrasing is central to language comprehension. *TRENDS in Cognitive Sciences*, 10 (6), 244-249.
- Frazier, L., Clifton, C. Jr., & Carlson, K. (2004). Don't break, or do: prosodic boundary preferences. *Lingua*, 114, 3-27.
- Hsiao, F., & Gibson, E. (2003). Processing relative clauses in Chinese. *Cognition*, 90 (1), 3-27.
- Hsu, C.-C. N. (2006). *Issues in Head-Final Relative Clauses in Chinese – Derivation, Processing, and Acquisition*. Doctoral dissertation, University of Delaware.
- Huang, C.-T. J., Li, Y.-H. A., & Li, Yafei. (2009). *The Syntax of Chinese*. NY: Cambridge University.
- Huang, R.-H. R., & Ting, Jen (2006). Are There Dangling Topics in Mandarin Chinese? *Concentric: Studies in Linguistics*, 32 (1), 119-146.
- Kralijic, T., & Brennan, S. E. (2005). Prosodic disambiguation of syntactic structure: For the speaker or for the addressee? *Cognitive Psychology*, 50, 194-231.

- Kuno, S. (1973). *The structure of the Japanese language*. Cambridge, MA: MIT Press.
- Lehiste, I. (1973). Phonetic disambiguation of syntactic ambiguity. *Glossa*, 7, 102-122.
- Lehiste, I., Olive, J. P., & Streeter, L. A. (1976). Role of duration in disambiguating syntactically ambiguous sentences. *Journal of the Acoustical Society of America*, 60, 1199-1202.
- Li, C. N., & Thompson, S. A. (1981). *Mandarin Chinese: A functional reference grammar*. Berkeley and Los Angeles, CA: University of California Press.
- Lin, C.-J. C., & Bever, T. G. (2006). Subject Preference in the Processing of Relative Clauses in Chinese. *Proceedings of the 25th West Coast Conference on Formal Linguistics*, ed. Donald Baumer et al., 254-260.
- Lu, Y.-S. (2000). A Note on the Source of the Topic in Mandarin Chinese. *Journal of Fuyang Teachers College*, 6, 6-10.
- Mak, W. M., Vonk, W., & Schriefers, H. (2006). Animacy in processing relative clauses: The hikers that rocks crush. *Journal of Memory and Language*, 54, 466-490.
- Pan, H.-H., & Hu, J.-H. (2002). Licensing dangling topics in Chinese. Paper Presented at *the 2002 LSA Annual Meeting* in San Francisco, CA, USA.
- Paul, W. (2002). Sentence-internal Topics in Mandarin Chinese: The Case of Object Preposing. *Language and Linguistics*, 3 (4), 695-714.
- Portner, P., & Yabushita, K. (1998). The semantics and pragmatics of topic phrases. *Linguistics and Philosophy*, 21, 117-157.
- Schafer, A. J., Speer, S., Warren, P., & White, S. D. (2000). Intonational disambiguation in sentence production and comprehension. *Journal of Psycholinguistic Research*, 29 (2), 169-182.
- Scott, D. R. (1982). Duration as a cue to the perception of a phrase boundary. *Journal of the Acoustical Society of America*, 71 (4), 996-1007.
- Shi, D.-X. (2000). Topic and topic-comment constructions in Mandarin Chinese. *Language*, 76, 383-408.
- Shi, J.-J. (2001). Topic and Basic Sentence Patterns in Chinese: as Compared with those in Japanese. *Journal of PLA University of Foreign Languages*, 24 (3), 15-19.
- Streeter, L. A. (1978). Acoustic determinants of phrase boundary perception. *Journal of the Acoustical Society of America*, 64 (6), 1582-1592.
- Su, Y.-C. J. (2006). Word order effect in children's garden path of relative clauses. *Concentric*, 32 (2), 33-57.
- Su, Y.-C. J. (2004). Relatives of Mandarin children. Paper presented in *the 2004 Generative Approaches to Language Acquisition* in North America, the University of Hawaii at Manoa.
- Tang, C.-C. J. (1990). *Chinese Phrase Structure and the Extended X'-Theory*. Unpublished doctoral dissertation, Cornell University, USA.

- Tsao, F.-F. (1979). *A Functional Study of Topic in Chinese: the First Step Towards Discourses Analysis*. Taiwan: Student Bookstore.
- Wu, Q., & Shi, M. (2001). Chinese Topic Structure and Its English Translation. *Journal of Zhangjiakou Teachers College*, 17 (1), 17-22.
- Xu, L.-J., & Langendoen, D. T. (1985). Topic Structure in Chinese. *Language*, 61 (1), 1-27.