The acceptability of the resumptive pronoun in the subject and object positions of Chinese relative clauses

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The paper investigates the status of the resumptive pronoun (RP) *ta* in the subject and object[1] positions of Chinese relative clauses (RCs),[2] in order to understand the head derivation in Chinese RCs. We conducted two acceptability judgment experiments to answer the following two questions: (i) within Chinese RCs, is the RP always less preferable than the gap? (ii) if so, is the RP acceptable/grammatical? The experimental results have strong theoretical implications for the head derivation in Chinese RCs.

1. Introduction

Aoun and Li (2003) claimed that the head NP of Chinese RCs can be derived by two strategies: it is raised out of the RC if there is a gap and is base-generated external to the RC if there is an RP. However, previous studies had different arguments towards whether the RP is grammatical in the subject and object positions inside Chinese RCs. On one hand, most theoretical studies claimed that the RP can be grammatically licensed in the object position but not the subject position inside the RC (e.g., Hawkins & Chan, 1997; Hsiao, 2003; Keenan, 1985). On the other hand, previous experimental studies showed mixed results: the RP is prohibited in both the subject and object positions (Hitz, 2012; Yuan & Zhao, 2005) or prohibited in the object position only (Hu & Liu, 2007).

To resolve the controversial issue, two acceptability judgment experiments were conducted. The experimental results suggest that the RP is generally less preferable than the gap in the subject and object positions inside RCs, which is in accord with Hawkins' (2004) proposal that the RP requires more morphological form processing than the gap. However, we argued that the RP can still be considered grammatical based on the statistical analysis of the experimental results, which supports Aoun and Li's (2003) proposal that the head NP of Chinese RCs can be either raised or base-generated.

Moreover, the finding reveals two acceptability asymmetries. First, there is an acceptability asymmetry between different structural positions inside *embedded* RCs: in the subject position, the gap is preferred to the RP whereas in the object position, the gap and the RP are equally favored. Second, there is another acceptability asymmetry

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[1] In this paper, the 'object' position refers only to the direct object position.
[2] We refer Chinese relative clauses to those without involving any islands, if not noted otherwise.

between simple and embedded *object* RCs: in simple object RCs, the gap is preferred to the RP whereas in embedded object RCs, the gap and the RP are equally favored. We argue that the first asymmetry is compatible with Keenan and Comrie's (1977, 1979) Noun Phrase Accessibility Hierarchy while the second asymmetry can be accounted for by Hawkins' (2004) Performance Grammar Correspondence Hypothesis.

In Section 2 and 3, we will review previous theoretical and experimental studies upon the status of the RP in Chinese RCs. In Section 4, we will review the Highest Subject Restriction (McCloskey, 1990), which was evidenced by Hebrew and Irish RCs. Then our research questions will be proposed in Section 5. In Section 6, we will demonstrate the details of our experiments. In Section 7, the results and implications will be discussed, followed by a conclusion in Section 8.

2. Previous theoretical studies on the RP within Chinese RCs

According to Gu (2001), an RP can freely occur at gap positions inside Chinese RCs because it can be locally bound in-situ by a relative operator. The availability of the RP within Chinese RCs is not surprising because many studies (e.g., Cann, Kaplan, & Kempson, 2005; Prince, 1997) showed that the RP can be produced as a general rather than a 'last resort' strategy in RC formation cross-linguistically. The Chinese RP *ta* has been categorized into 'true' RPs, or 'grammatically licensed' RPs (Francis, Lam, Zheng, Hitz, & Matthews, 2015), which have been found in Semitic and Celtic languages such as Hebrew (Sells, 1984). The 'grammatically licensed' RP, which is bound by an operator, is different from the 'intrusive' RP (e.g., the RP in English), which can only occur within an island as a last resort strategy to save the ungrammaticality (Alexopoulou & Keller, 2007; Sells, 1984).

In previous studies on the 'grammatically licensed' RP, it has been claimed that the RP can freely occur in the object position of simple (i.e., singly-embedded) RCs and the subject and object positions of embedded (i.e., doubly-embedded) RCs in Irish (McCloskey 1979, 1990; Shlonsky, 1992) and Hebrew (Sells, 1984, Shlonsky, 1992). However, the RP is prohibited in the subject position of simple RCs, i.e., the highest subject position of RCs in many languages such as Irish (McCloskey, 1979), Welsh and Swahili (Sells, 1984), Swedish (Engdahl, 1982) and Hebrew (Shlongsky, 1992; Ariel, 1999). Hence, McCloskey (1990) proposed that there is a Highest Subject Restriction on the 'grammatically licensed' RP across languages: the highest subject position of an RC can never be occupied by an RP.

As for Chinese RCs, previous studies differ on whether the RP can occur at all structural positions inside the RC, particularly the subject position. While Gu (2001) claimed that an RP can occur at the subject position of RCs, many theoretical and experimental studies (e.g. Francis, et al. 2015; Hawkins & Chan, 1997) were against it, claiming that the RP can only occur at the object position.

Hawkins and Chan (1997) claimed that a gap can alternate freely with an RP only in the object position (1a), not the subject position (1b). In contrast, Gu (2001) claimed that either a gap or an RP can freely occur in both the subject (2a) and object (2b) positions:

(1a)   wo xihuan t_i/ta_i de [nage   nvhai]$_i$
         I   like   her DE that-CL girl
         'The girl that I like' (Hawkins & Chan, 2004, p.193)

(1b) t_i/ *ta_i gongzuo qinglao de [nage   nvhai]$_i$
            she work   hard   DE that-CL   girl
         'the girl that worked hard' (Hawkins & Chan, 2004, p.193)

(2a) t_i/ ta_i neng jiang liuli   yingyu   de [nage   ren]$_i$
            he can speak fluent English   DE   that-CL man
         'the man that can speak fluent English' (Gu, 2001, p.35)

(2b)   Mali yizhi   anlian t_i/ta_i de   [nage   nanren]$_i$
         Mary for long love secretly   him DE   that-CL   man
         'the man that Mary loves secretly for long' (Gu, 2001, p. 36)

Thus, it is controversial whether the RP is allowed in the subject position of Chinese RCs. Since the theoretical studies only relied on the researchers' own or a few native speakers' intuitive judgment, they might be influenced by idiosyncratic preferences. Meanwhile, many experimental studies have been conducted to investigate the status of the RP inside Chinese RCs, which is reviewed in the next section.

3. Previous experimental studies on the RP within Chinese RCs

Many experimental studies (Hitz, 2012; Hu & Liu, 2007; Su, 2004; Yuan & Zhao, 2005) have been conducted to investigate the acceptability of the RP inside Chinese RCs.

First, by using an acceptability judgment task with a 4-point scale, Hitz (2012) found that the RP seems to be prohibited in both the subject and object positions of RCs, as its mean ratings are very low (Table 1):

Table 1. Mean ratings of the critical items in Hitz (2012)

RC Type	Items with a gap	Items with an RP
Subject RCs	3.95	**1.39**
Object RCs	3.9	**1.64**

Hitz' (2012) results were in parallel with Yuan and Zhao's (2005), which also observed that the RP is disfavored in both the subject and object positions (Table 2) with an acceptability judgment task in a 5-point scale.

Table 2. Means ratings of the critical items in Yuan and Zhao (2005)

RC Type	Items with a gap	Items with an RP
Subject RCs	4.8	**1.6**
Object RCs	4.7	**1.8**

Based on the low mean ratings of the RP, Hitz (2012) and Yuan and Zhao (2005) concluded that the RP is ungrammatical at the subject and object positions of Chinese RCs. Moreover, this argument was supported by elicited production studies such as Su (2004). Su (2004) found that the RP were never produced in Chinese RCs by adult Chinese speakers. That is, only RCs with gap were produced.

Although the RP had low mean ratings in Hitz (2012) and Yuan and Zhao (2005) and was never produced in Su's (2004) production task, it does not necessarily mean the RP is ungrammatical or unacceptable. Moreover, we notice there was a problem with the experimental design in Hitz (2012) and Yuan and Zhao (2005): each native Chinese participant saw all four critical conditions (subject gap, object gap, subject RP, object RP) of the same template within one list. It is likely that participants' judgment in one condition affected their judgment in another condition.

On the other hand, some other experimental studies on the RP inside Chinese RCs had different results. With a forced-choice acceptability judgment task, Hu and Liu (2007) found that RCs with an object RP are actually acceptable to the participants (14 out of 15 participants considered them acceptable) whereas RCs with a subject RP are unacceptable (none of the 15 participants judged them acceptable), which suggests that the RP is allowed only in the object position of Chinese RCs, which is compatible with Hawkins and Chan's (1997) argument. Moreover, by adopting a 7-point scale acceptability judgment task to examine the RP in Cantonese RCs, Francis et al. (2015) found that the RP is disfavored in the subject position but allowed in the object position, which is in accord with Hu and Liu (2007). They further concluded that the RP should be ungrammatical in the subject position. However, by checking their experimental results carefully, we notice that the RP may still be acceptable in the subject position. In their acceptability judgment study with a 7-point scale, the subject RP in simple RCs (M=3.86) was rated significantly higher than the subject gap within a complex NP island (M=3.08). Also, it was rated much higher than the pre-assigned ungrammatical fillers (M=2.8) but very close to the pre-assigned medium fillers (M=4.2). Thus, Francis et al.'s (2015) results may not necessarily suggest that the RP is ungrammatical in the subject position. Rather, what we can only infer from their results is that the gap is preferred to the RP in the subject position.

So far we have seen that previous experimental studies on the RP in Chinese RCs had two types of results: (i) the RP is less favored than the gap in both subject and object positions, if not ungrammatical; (ii) the RP is not less favored than the gap in the subject position but they are equally favored in the object position. Thus, no experimental studies seemed to show the RP is allowed in the subject position, which is incompatible with Gu's (2001) proposal that the RP is optional in the subject position of Chinese RCs. Further, Francis et al. (2015) stated that the *Highest Subject Restriction* (McCloskey, 1990) can account for why the RP cannot occur in the subject position inside Mandarin and Cantonese RCs.

This study conducted two acceptability judgment tasks to investigate the grammatical status of the RP in the subject and object positions of Chinese RCs. Before delving into the details of the experiment, we review how the Highest Subject Restriction was motivated by evidence from Hebrew and Irish.

4. The Highest Subject Restriction on RCs

By examining the distribution of the RP in Hebrew and Irish RCs, McCloskey (1990) proposed that Hebrew and Irish RCs are subject to a restriction: the RP cannot occur in the highest subject position, i.e., the subject position of simple RCs, in Hebrew RCs (3a). The restriction is called *Highest Subject Restriction*. In contrast, the RP can freely occur in the object position of simple RCs, as in (3b):

(3a)   ha-√is   še-(*hu)   √ohev √et   Rina   (Hebrew)
          the-man   that-(he)   love ACC   Rina
          'the man who loves Rina.' (Shlonsky, 1992, p.445)

(3b)   ha-√is   še-   ra√ti   (√oto)   (Hebrew)
          the-man   that-(I) saw   (him)
          'the man that I saw (him).' (Shlonsky, 1992, p.444)

The same asymmetry was also found in Irish RCs (McCloskey, 1990): the subject position allows a gap rather than an RP while the object position allows either a gap or an RP. Meanwhile, the RP can freely occur at *doubly embedded* subject and object positions of RCs in both Hebrew and Irish (McCloskey, 1990; Shlonsky, 1992), as shown below.

(4a)   ha-√is   še-   xašavt   še(-hu)   melamed √anglit   (Hebrew)
          the-man   that(-you) thought that(-he) teaches   English
          'the man that you thought (he) teaches English.' (Shlonsky, 1992, p. 444)

(4b)   ha-√is   še-   xašavt   še-Dani   pagaš (√oto)   (Hebrew)
          the-man   that(-you) thought that Dani   met   him
          'the man that you thought that Dani met (him).' (Shlonsky, 1992, p. 445)

(5a) an   t-ŏr seo ar   chreid   corr-dhuine go   raibh sé ann (Irish)
    this   gold   COMP$_{pro}$ believed a few people COMP was   it   there
    'this gold that a few people believed (it) was there ' (McCloskey, 1990, p. 78)

(5b) an rud$_i$ ar   duirt sé go   gcoinneodh sé ceilte é   (Irish)
    the thing   COMP$_{pro}$ said he COMP keep   he hidden it
    'the thing that he said he would keep (it) hidden' (McCloskey, 1990, p. 75)

To sum up, Hebrew RCs and Irish RCs are parallel in licensing the RP (Shlonsky, 1992): (i) the RP is prohibited in the subject position but allowed in the object position of simple RCs; (ii) the RP is allowed in both the subject and object positions of simple and embedded RCs. The above similarities between Hebrew and Irish are summarized in Table 3:

Table 3. Distribution of the RP in Hebrew and Irish RCs

Positions\Clause Types	Simple RCs	Embedded RCs
Subject position	No	Yes
Object position	Yes	Yes

Asudeh (2012) claimed that McCloskey's (1990) Highest Subject Restriction should hold for all languages that involve 'grammatically licensed' RPs. Since the RP in Chinese RCs is regarded as a 'grammatically licensed' RP (Francis, et al. 2015; Gu, 2001), we expect it is subject to the Highest Subject Restriction. Under this approach, we predict that in Chinese, the RP is grammatical in the object position of simple RCs and both the subject and object positions of embedded RCs while it is not acceptable in the subject position of simple RCs. To the best of our knowledge, the grammaticality of the RP in the embedded subject and object positions of Chinese RCs has not been investigated with an experimental approach.

5. **Research Questions**

    To summarize, there are two issues on the status of the RP inside Chinese RCs: (i) whether the RP is subject to the Highest Subject Restriction; (ii) whether the gap is preferred to the RP in both the subject and object positions of embedded RCs. In the following section, we will demonstrate two controlled experiments, which were conducted to answer the following three research questions:

(6) *Research Question 1*: Is there any significant difference of native speakers' judgments between the gap and the RP in the subject and object positions of simple Chinese RCs?
    Research Question 2: Is the RP allowed in the subject position of simple Chinese RCs?

Research Question 3: Is there any significant difference of native speakers' judgments between the gap and the RP in the subject and object positions of embedded Chinese RCs?

6. Experiment

Two experiments were designed to address the three research questions above. The first experiment examined the grammatical status of the gap/RP in the *subject* position inside simple/embedded Chinese RCs. The second experiment examined the grammatical status of the gap/RP in the *object* position inside simple/embedded Chinese RCs. In this section, we will first illustrate the design of the two experiments respectively, followed by the statistical analysis of the results.

6.1 Participants

A total of 60 adult native speakers of Chinese were recruited to participate in the two experiments. Thirty participants participated in the first experiment and the other thirty participants participated in the second experiment. They were all undergraduate students from a university in Southwest China, whose age ranges from 18 to 23. After finishing the task, they were given an extra course credit for their participation. According to a short background survey, no one had ever lived outside China before.

6.2 Procedure

The experiment was designed by Ibex Farm (http://spellout.net/ibexfarm/), an online software tool for creating and running linguistic experiments. Participants were asked to assess the naturalness of sentences on a 5-point Likert scale from 1 (very unacceptable) to 5 (natural and acceptable) with a computer. Only Chinese characters were displayed on the screen. Before participants started doing the experiment, they were asked to fill out a short background survey, which includes age, year of the class, native language, experience of living abroad. They were also informed that their personal information and judgments will be kept confidential. All participants were able to finish the experiment within 15 minutes. In what follows, we illustrate the first experiment (Experiment 1) that investigated the gap and RP in the *subject* position of Chinese RCs.

6.3 Design and materials of Experiment 1

All experimental sentences were generated from 16 templates, which involve 16 different transitive verbs. One template, with the transitive verb *shenwen* 'interrogate,' is below:

(7) Jingguan   shenwen-le   _____ zuifan.
     police   interrogate-PST   criminal
     'The police officer interrogated the criminal who _____.'

All sentences involved an RC at the matrix object position. In Experiment 1, the gap/RP was always located at the SUJBECT position of the RC. There were two factors: CLAUSE TYPE (simple/embedded RC) and GAP TYPE (gap/ RP). Accordingly, there were four conditions for each template: (i) a simple RC with a gap (SG); (ii) a simple RC with an RP (SRP); (iii) an embedded RC with a gap (EG); (iv) an embedded RC with an RP (ERP)[3]. The four conditions created from (7) are shown as follows:

(8a) **Simple RC** with a **gap** (SG)
Jingguan shenwen-le [$_{CP}$ t_i zai zhubaodian-li   tou-le   baoshi de] zuifan$_i$.
police   interrogate-PST   at jewelry store-in   steal-PST jewelry DE   criminal
'The police interrogated the criminal who stole jewelry at the jewelry store.'

(8b) **Simple RC** with an **RP** (SRP)
Jingguan shenwen-le [$_{CP}$ **ta**$_i$ zai zhubao dian-li   tou-le   baoshi de] zuifan$_i$.
police   interrogate-PST he   at jewelry store-in   steal-PST jewelry DE   criminal
'The police interrogated the criminal who (he) stole jewelry at the jewelry store.'

(8c) **Embedded RC** with a **gap** (EG)
Jingguan shenwen-le [$_{CP}$ faguan duanding [$_{CP}$ t_i zai zhubao dian-li tou-le   baoshi
police   interrogate-PST judge assert   at jewelry store-in steal-PST jewelry
de]] zuifan$_i$.
DE   criminal
'The police interrogated the criminal who the judge asserted stole jewelry at the jewelry store.'

(8d) **Embedded RC** with an **RP** (ERP)
Jingguan shenwen-le [$_{CP}$ faguan duanding [$_{CP}$ta$_i$ zai zhubao dian-li tou-le   baoshi
police   interrogate-PST judge   assert   he at   jewelry store-in steal-PST jewelry
de]] zuifan$_i$.
DE   criminal
'The police interrogated the criminal who the judge asserted (he) stole jewelry at the jewelry store.'

Four lists were created, each of which had 16 critical items that had been generated from 16 templates. Different from Hitz (2012) and Yuan and Zhao (2005) where participants saw all conditions of the same item, we adopted a Latin Square to balance the number of conditions in each list so each participant only saw one condition from each template. Additionally, the same 32 fillers were included in each list.

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[3] The simple RCs only involve one CP node between the gap/RP and the head NP while the embedded RCs involve two CP nodes between the gap/RP and the head NP.

To sum up, for each of the 4 lists in Experiment 1, there were 16 critical items and 32 fillers. All items were randomized to rule out sequencing effects.

6.4 Findings of the Experiment 1

Recall that there were four critical conditions in total: (i) simple RCs with a gap (SG); (ii) simple RCs with an RP (SRP); (iii) embedded RCs with a gap (EG); (iv) embedded RCs with an RP (ERP). The means of the four conditions are: SG (M=4.55, SD=0.829, SE=0.151), SRP (M=2.758, SD=0.784, SE=0.143), EG (M=2.683, SD=0.863, SE=0.158) and ERP (M=2.167, SD=0.603, SE=0.11):

Figure 1. Acceptability judgments on the critical items of Experiment 1
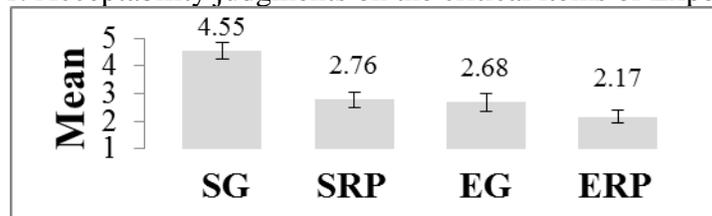
Two-way repeated measures ANOVA was run on SPSS to investigate the effects of the gap type in simple/embedded subject RCs. The analysis found a significant interaction between the two factors (i.e., the gap type and the clause type), $F (1, 29) =27.175$, $p<.001$. Thus, simple main effects were further run. First, the simple main effects of the gap type were checked: pairwise comparison shows that the participants' judgments are significantly different between SG (M=4.55, SE=0.151) and SRP (M=2.758, SE=0.143): $F (1, 29)=75.205$, $p<.001$, with a mean difference of 1.792 (95% CI, 1.369 to 2.214). Also, there is a significant difference between EG (M=2.683, SE=0.158) and ERP (M=2.167, SE=0.11): $F(1,29)= 17.539$, $p<.001$, with a mean difference of 0.517 (95% CI, 0.264 to 0.769). Second, the simple main effects of the clause type were checked: pairwise comparison shows a significant difference between SG (M=4.55, SE=0.151) and EG (M=2.683, SE=0.158): $F(1,29)=87.32$, $p<.001$, with a mean difference of 1.867 (95% CI, 1.458 to 2.275). Moreover, there is a significant difference between SRP (M=2.758, SE=0.143) and ERP (M=2.167, SE=0.11): $F(1,29)=14.635$, $p=.001$, with a mean difference of 0.592(95% CI, 0.275 to 0.908).

The results suggest that the gap is always preferred to the RP in both simple and embedded RCs. Meanwhile, simple RCs are preferred to embedded RCs, regardless of the gap type. Also, as shown in Figure 1, the mean of SRP is higher than that of EG. If we assume that the sentences of EG (i.e., embedded RCs with a gap) are grammatical, we can infer that the sentences of SRP (i.e., simple RCs with an RP) are also grammatical, which suggests that the RP may occur in the subject position of simple RCs.

The results can be confirmed by z-scores. The z-score means of these four conditions are: SG (M=1.619, SD=0.739, SE=0.135), SRP (M=0.13, SD=0.513,

SE=0.094), EG (M=0.087, SD=0.475, SE=0.087) and ERP (M= -0.304, SD=0.37, SE=0.068):

Figure 2. Acceptability judgments on the critical items of Experiment 1 (z-scores)
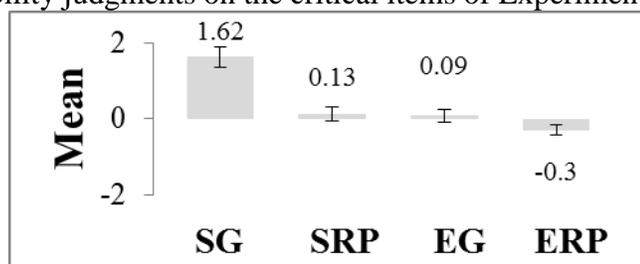
Two-way repeated measures ANOVA reveal a significant interaction between the two factors, $F_{(1, 29)}= 30.87$, p<.001. As for the simple main effects of the gap type, pairwise comparison shows a significant difference between SG and SRP: $F_{(1, 29)}=70.239$, p<.001, with a mean difference of 1.489 (95% CI, 1.125 to 1.852). Also, there is a significant difference between EG and ERP: $F_{(1, 29)} =19.262$, p<.001, with a mean difference of 0.391 (95% CI, 0.209 to 0.573). As for the simple main effects of the clause type, pairwise comparison shows a significant difference between SG and EG: $F_{(1, 29)}= 88.704$, p<.001, with a mean difference of 1.531 (95% CI, 1.199 to 1.864). Also, there is a significant difference between SRP and ERP: $F_{(1, 29)} = 11.905$, p=.002, with a mean difference of 0.433 (95% CI, 0.177 to 0.69).

Hence, both the raw score and z-score results had the following implications for the Chinese RCs that involve a gap/RP in the subject position: (i) the gap is always preferred over the RP in the subject position of RCs, regardless of whether they are singly or doubly embedded; (ii) simple RCs are always preferred over embedded RCs, regardless of whether they involve a gap or an RP; (iii) the RP is grammatical in the subject position of simple RCs.

In the next section, I will demonstrate the design of the second experiment (Experiment 2), which was used to investigate the gap and RP at the *object* position of Chinese RCs.

6.5 Design and materials of Experiment 2

Similar to Experiment 1, all experimental sentences in Experiment 2 were created from 16 templates, which involve 16 different transitive verbs. One template with the verb *xunwen* 'ask' is shown below:

(9) Jingguan   xunwen-le   _____ yuangong.
      police   ask-PST   staff
      'The police officer asked the staff whom _____.'

In Experiment 2, the gap/RP is located at the object position of RCs. There were two factors: CLAUSE TYPE (whether the RC is simple or embedded) and GAP TYPE (whether it is a gap or an RP). Accordingly, there were four conditions for each template: (i) a simple RC with a gap (SG); (ii) a simple RC with an RP (SRP); (iii) an embedded RC with a gap (EG); (iv) an embedded RC with an RP (ERP). The four conditions that were created from (10) are below:

(10) Jingguan   xunwen-le   _____ yuangong.
     police   ask-PST   staff
     'The police officer asked the staff whom _____.'

(11a)**Simple RC** with a **gap** (SG)
Jingguan xunwen-le [$_{CP}$ zuifan   zai zhubaodian-li   xiji-le t_i de] yuangong$_i$.
police   ask-PST   criminal at jewelry store-in   hit-PST   DE staff
'The police asked the staff whom the criminal hit at the jewelry store.'

(11b) **Simple RC** with an **RP** (SRP)
Jingguan xunwen-le [$_{CP}$ zuifan   zai zhubaodian-li   xiji-le   ta$_i$ de] yuangong$_i$.
police   ask-PST   criminal at jewelry store-in   hit-PST him DE   staff
'The police asked the staff whom the criminal hit (him) at the jewelry store.'

(11c) **Embedded RC** with a **gap** (EG)
Jingguan xunwen-le [$_{CP}$ faguan duanding [$_{CP}$ zuifan   zai zhubaodian-li   xiji-le t_i
police   ask-PST   judge assert   criminal at jewelry store-in hit-PST
de]] yuangong$_i$.
DE   staff
'The police asked the staff whom the judge asserted the criminal hit at the jewelry store.'

(11d) **Embedded RC** with an **RP** (ERP)
Jingguan xunwen-le [$_{CP}$ faguan duanding [$_{CP}$ zuifan   zai zhubaodian-li   xiji-le ta$_i$
police   ask-PST   judge assert   criminal at jewelry store-in hit-PST him
de]] yuangong$_i$.
DE   staff

'The police asked the staff whom the judge believed the criminal hit (him) at the jewelry store.'

Four lists were created and each list had 16 critical items that were generated from 16 different templates. A Latin Square was constructed to balance the number of conditions in each list so each participant only saw one condition from each template. Moreover, the same set of fillers from Experiment 1 was included in Experiment 2.

To summarize, there were 16 critical items and 32 fillers in each list. All items in each list were randomized to control sequencing effects.

6.6 Findings of the Experiment 2

There were four critical conditions: (i) a simple RC with a gap (SG); (ii) a simple RC with an RP (SRP); (iii) an embedded RC with a gap (EG); (iv) an embedded RC with an RP (ERP). The means were: SG (M=3.658, SD=0.925, SE=0.169), SRP (M=2.458, SD= 0.896, SE=0.164), EG (M=2.467, SD= 0.9, SE=0.164) and ERP (M=2.258, SD=0.959, SE=0.175):

Figure 7. Acceptability judgements on the critical items of Experiment 2
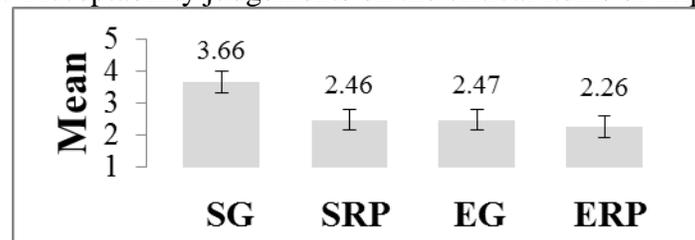
Two-way repeated measures ANOVA were run on SPSS to investigate the effects of the gap type in simple/embedded object RCs. The analysis reveals a significant interaction between the two factors (i.e., the gap type and the clause type), F (1, 29) =42.917, $p<.001$. Thus, simple main effects were further run. First, the simple main effects of the gap type were checked: pairwise comparison shows that the participants' judgments are significantly different between SG (M=3.658, SE=0.169) and SRP (M=2.458, SE=0.164): F (1, 29)=77.453, p<.001 , with a mean difference of 1.2 (95% CI, 0.921 to 1.479). However, there is no significant difference between EG (M=2.467, SE=0.164) and ERP (M=2.258, SE=0.175): F(1,29)=2.58 , p=0.119, with a mean difference of 0.208 (95% CI, -0.057 to 0.474) . Second, the simple main effects of the clause type were checked: pairwise comparison shows a significant difference between SG (M=3.658, SE=0.169) and EG (M=2.467, SE=0.164): F(1,29)=90.94, p<.001, with a mean difference of 1.192 (95% CI, 0.936 to 1.447). Moreover, there is a significant difference between SRP (M=2.458, SE=0.164) and ERP (M=2.258, SE=0.175): F(1,29)=1.736, p=.198, with a mean difference of 0.2 (95% CI, -0.11 to 0.51).

The results suggest that simple RCs are preferred over embedded RCs when they involve a gap. However, they do not differ in their acceptability when they involve an RP. Moreover, the results show the gap is preferred to the RP only in simple RCs, not in embedded RCs. Furthermore, the mean of SRP is similar to that of EG. If we assume that the sentences of EG (i.e., embedded RCs with a gap) are grammatical, we can infer that the sentences of SRP (i.e., simple RCs with an RP) should also be grammatical, which further suggests that the RP can occur at the object position of simple RCs.

The raw score results were confirmed by z-scores. The z-score means of the four conditions were: SG (M=0.897, SD=0.473, SE=0.086), SRP (M= -0.201, SD= 0.546, SE=0.1), EG (M= -0.196, SD=0.532, SE=0.097) and ERP(M= -0.38, SD= 0.483, SE=0.088):

Figure 8. Acceptability judgments on the critical items of Experiment 2 (z-scores)
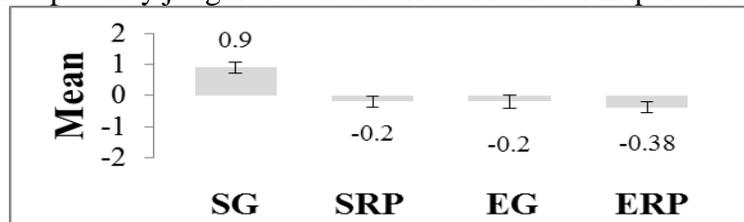
Two-way repeated measures ANOVA found a significant interaction between the gap type and the clause type: $F(1, 29)= 45.247$, $p<.001$. Thus, simple main effects were run. As for the simple main effects of the gap type, there is a significant difference between SG (M=0.897, SE=0.086) and SRP (M= -0.196, SE=0.097): $F (1, 29)=86.909$, $p<.001$, with a mean difference of 1.092 (95% CI, 0.853 to 1.332). However, there is no significant difference between EG (M= -0.201, SE=0.1) and ERP (M= -0.38, SE=0.088): $F(1, 29)= 2.53$, $p=.123$, with a mean difference of 0.18 (95% CI, -0.051 to 0.411). As for the simple main effects of the clause type, the analysis shows a significant difference between SG (M=0.897, SE=0.086) and EG (M= -0.201, SE=0.1): $F(1, 29)= 101.137$, $p<.001$, with a mean difference of 1.097 (95% CI, 0.874 to 1.32). By contrast, there is no significant difference between SRP (M= -0.196, SE=0.097) and ERP (M= -0.38, SE=0.088): $F (1, 29) = 2.071$, $p=.161$.

To sum up, in Chinese RCs, the gap is preferred to the RP at the object position inside simple RCs. However, they are equally favored at the object position inside embedded RCs. Meanwhile, simple RCs are preferred over embedded RCs when an object gap is involved while they are equally favored when an object RP is involved.

7. Discussion and implications

Recall our first research question is whether there is any significant difference of native speakers' judgments between the gap and the RP in the subject and object positions of simple Chinese RCs. The experimental results suggested that the gap is

always preferred to the RP at both the subject and object positions of simple RCs, which is in accord with the experimental results from Hitz (2012) and Yuan and Zhao (2005).

The second research question is whether the RP is allowed in the subject position of simple RCs. The results showed that the mean of SRP is higher or similar to that of the EG in both the subject and object positions of simple RCs. If we assume that the embedded RCs with a gap (EG) are grammatical, we can infer that the simple RCs with an RP are also grammatical, which supports Gu's (2001) proposal that the RP can occur in the subject position of Chinese RCs. This implication differs from the theoretical studies such as Hawkins and Chan (1997) and the experimental studies such as Hitz (2012) and Hu and Liu (2007), which argued that the RP is unacceptable in the subject position. Also, given the grammatical status of the RP in the subject position of simple Chinese RCs, we can infer that the Highest Subject Restriction (McCloskey, 1990) does not apply to Chinese RCs.

The third research question is whether there is any significant difference of judgments between the gap and the RP in the subject and object positions of embedded Chinese RCs. The results demonstrate two asymmetries: (i) an asymmetry between the subject and object positions in embedded RCs: in the subject position, the gap is significantly preferred to the RP whereas in the object position, the gap and the RP do not differ significantly in their acceptability; (ii) an asymmetry between the object position in simple RCs and that in embedded RCs: in the object position of simple RCs, the gap is significantly preferred to the RP whereas in the object position of embedded RCs, the gap and the RP do not differ significantly in their acceptability. Under the Minimalist Program (Chomsky, 1995), the gap is predicted to be preferred to the RP because the trace is expected to win over the RP due to fewer steps in derivation. However, it needs to be explained why the gap and the RP in the object position of embedded RCs are equally favored.

First of all, the asymmetry (i) is compatible with Keenan and Comrie's (1977, 1979) Noun Phrase Accessibility Hierarchy (NPAH), which claims that the distribution of the RP and the gap follows the following hierarchy:

(12) Subject>Direct Object>Indirect Object>Oblique>Genitive>Object of Comparison
(Keenan & Comrie, 1977, p.66)

The NPAH has two crucial implications. First, if the grammar licenses a gap in one structural position on the hierarchy, it licenses a gap in all other positions to its left. Second, if the grammar licenses an RP in one structural position on the hierarchy, it licenses an RP in all other positions to its right. Keenan and Comrie (1977, 1979) claimed that the NPAH is relevant to the processing difficulty: complex filler-gap dependency can be easier to process if the RP occurs. Since the direct object position is less accessible than the subject position, RP is more likely to occur, which accounts for the asymmetry

(i) in embedded RCs: the RP is more acceptable in the object position than the subject position.

Second, Hawkins's (2004) Performance-Grammar Correspondence Hypothesis (PGCH) can account for the asymmetry (ii). It seems that 'embedding' plays an important role in licensing the RP in the object position of embedded RCs.

Following Keenan and Comrie (1977, 1979), Hawkins (2004) argued that the complexity of the filler-gap dependency can be quantified by the size of the filler-gap domain (FGD), which includes the structural distance between the head NP and the subcategorizing verb, along with any other arguments that the gap/RP depends on for its interpretation. This is based on his *Proximity Hypothesis*:

(13) Proximity Hypothesis
    Given a structure of {A, X, B}, X is a variable for a phrase or phrases intervening
    between A and B, then the more relations of combination or dependency that link B
    to A, the smaller will be the size and complexity of X. (Hawkins, 2004, p. 183)

Moreover, Hawkins (2004) proposed that the FGD can predict the distribution of the gap and the RP in languages that allow the two options to occur in one structural position: the RP is used more frequently in more complex structural environment/FGD to facilitate processing. Hawkins (2004) provided Hebrew examples from Ariel (1999) to illustrate his point:

(14a) Shoshana hi   ha-isaha$_i$ [she-nili   ohevet t$_i$/? ota$_i$]
       Shoshana is   the woman that-Nilly loves   her
       'Shoshana is the woman that Nilly loves'

(14b) Shoshana hi ha-isaha$_i$ [she-dani   siper   she-moshe rixel   she-nili
       Shoshana is the woman that Danny said   that Moshe gossiped that Nilly
       ohevet t$_i$/ ota$_i$]
       loves   her.
       'Shoshana is the woman that Danny said that Moche gossiped that Nilly loves'

(14a) and (14b) involve a simple RC and an embedded RC respectively. In (14a), the gap is acceptable while the RP is marginal. By contrast, in (14b), where an embedded RC is involved, both the gap and the RP are acceptable. This is predicted by Hawkins' (2004) proposal because the RP seems to be more acceptable in a more complicated structural environment. Recall that the structural complexity can be measured by FGD, which includes the structural distance between the head NP and the subcategorizing verb, along with any other arguments that the gap/RP depends on for its interpretation. Obviously, the FGD in (14a) is smaller than that in (14b), which accounts for why the RP is preferred in (14b). Hawkins' proposal is also supported by Francis et al.'s (2015) findings on

Cantonese RCs: the RP is significantly more acceptable at the object position than the subject position in simple Cantonese RCs. Thus, the asymmetry (ii) can be accounted for by Hawkins' (2004) proposal: the RP becomes more acceptable when occurring in more complicated structural environment[4].

As we have seen, in the object position of embedded RCs, the gap and the RP do not differ significantly in their acceptability. With the assumption that the gap is possible in the object position of Chinese RCs, if the RP cannot be grammatically licensed in that position, it should always be less preferable than the gap, no matter how many levels they are embedded, as observed with the English RP (Alexopoulou & Keller, 2007; Heestand et al., 2011; Hofmeister & Norcliffe, 2013). Therefore, the RP must be considered grammatical in the object position of Chinese RCs.

To sum up, both the gap and the RP are acceptable in the subject and object positions of Chinese RCs so both the head raising and the head base-generation derivations should be available to derive Chinese RCs, which supports Aoun and Li's (2003) proposal. However, the gap is generally preferred over the RP, which suggests that the head raising derivation should be preferable than the head base-generation derivation in forming Chinese RCs.

8. Conclusion

This paper used a controlled experiment to investigate the status of the RP in the subject and object positions of Chinese RCs. The experimental results had two main findings.

First, the mean rating of the RP in the subject position of simple RCs are higher or similar to that of the gap in the subject position of embedded RCs. Under the assumption that the embedded RCs with a gap are grammatical, we can infer that simple RCs with an RP are also grammatical, which further suggests that the RP can occur in the subject position of Chinese RCs. This evidence argues against the Highest Subject Restriction (McCloskey, 1990) on the distribution of the RP that can be 'grammatically licensed' within RCs.

Second, the experimental results exhibited two asymmetries: (i) in the subject position of embedded RCs, the gap is preferred to the RP whereas in the object position of embedded RCs, the gap and the RP are equally favored; (ii) in the object position of simple RCs, the gap is preferred to the RP whereas in the object position of embedded RCs, the gap and the RP are equally favored. We propose that the first asymmetry is compatible with Keenan and Comrie's (1977, 1979) Noun Phrase Accessibility Hierarchy and the second asymmetry can be accounted for by Hawkins' (2004) proposal. Moreover,

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[4] Nevertheless, Hawkins' (2004) proposal for Mandarin Chinese is different. He claimed that in Mandarin Chinese, FGDs of the subject RCs and the object RCs are the same. This argument is not supported by the findings in this study.

since the gap and the RP are equally favored in the embedded object position, we can infer that the RP is allowed in the object position of Chinese RCs.

To summarize, the experimental findings altogether suggested that the RP can occur in both the subject and object positions of Chinese RCs, which supports Aoun and Li's (2003) proposal that the head NP can be either raised out of the RC or base-generated external to the RC in Chinese RCs: the head NP is raised when there is a gap but is base-generated when there is an RP. The experimental results also implicated that the gap is generally preferred over the RP in the subject and object positions of Chinese RCs, which indicates that the head-raising derivation is a preferred strategy to derive Chinese RCs.

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