Processing of the Mandarin polarity item *renhe* 'any'

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The Mandarin *renhe* is similar to the English *any* in terms of polarity sensitivity (Wang 1993; Wang & Hsieh 1996; Kuo 2003; Cheng & Giannakidou 2013; Shyu 2016). However, the following phenomena regarding *any* in relative clause environments have not been surveyed with respect to *renhe:* a) the NPI illusion effect reported in studies like Parker & Phillips (2011; 2016); b) the subtrigging effect discussed in LeGrand (1975) and Dayal (1998; 2004). We conducted two untimed, offline acceptability judgment experiments and the results suggest that i) NPI illusion does not appear in Mandarin in untimed offline processing, ii) the subtrigging effect of *renhe* holds, and iii) *renhe* can be licensed by certain types of declarative verbs like *tongyi* 'agree' and *zancheng* 'approve'. The results confirm the strict structural requirement of the c-commanding relation between a negation licensor and *renhe* (Wang 1993) and the licensing of *renhe* in non-veridical contexts (Cheng & Giannakidou 2013), and further suggest additional licensing environments for *renhe*: relative clauses and declarative verbs. This requires reconsideration of positing non-veridicality as a necessary licensing condition for *renhe*, and calls for future research on how *renhe* is licensed under these two licensing environments.

Keywords: NPI, subtrigging, relative clause, free choice, locality

1. Introduction

It has been widely held in previous literature (Wang 1993; Wang & Hsieh 1996; Kuo 2003; Cheng & Giannakidou 2013; Shyu 2016, among others) that *renhe* in Mandarin has two functions like its counterpart *any* in English: one is a negative polarity item (NPI) and the other is a free choice item (FCI). [1] An NPI *renhe* needs to be licensed by a negative element (1) or non-veridical contexts, such as conditionals (2) and yes/no questions (3). *Renhe* can be interpreted as an FCI when it is within the scope of modals (4), or it is in subject position and occurs with *dou* 'all' (5).

(1) a. *Wo   mei   zai   **renhe**   difang   douliu   guo.*
         I   not   at   **any**   place   stay   PFV
         'I have not stayed in any place.' (Wang & Hsieh 1996:40)

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[1] Deviating from the common arguments made in the literature, Kuo (2003) treats the FCI *renhe* as a universal NPI and the typical NPI ((1) – (3)) as an existential NPI. The relationship between the NPI/FCI-variants of *renhe* and *any* is not the focus of the present study. For general theoretical discussion of this topic, see Dayal (1998), Horn (2000), Giannakidou (2001).

b.　　*Wo　zai　**renhe**　difang　douliu　guo.
   　　　I　at　**any**　place　stay　PFV
   　　　'I have stayed in any place.' (Wang & Hsieh 1996: 40)

(2)　*Ruguo　　　ta　　xihuan* **renhe**　*ren,　　ni　　jiu　　gaosu　wo.*
　　if　　　　he　　like　**any**　man　　you　then　tell　　me
　　'If he likes anyone, then you tell me.' (Wang 1993: 267)

(3)　*You* **renhe** *ren　　xihuan ta　　ma?*
　　have　any　man　　like　him　　Q
　　'Does anyone like him?' (Wang & Hsieh 1996: 42)

(4)　*Wo　keyi　gen* **renhe** *ren　　tiaowu.*
　　I　　can　with　**any**　man　　dance
　　'I can dance with anyone.' (Wang & Hsieh 1996: 36)

(5)　*Renhe* **ren** **(dou) hui　　kaiche.*
　　any　**man**　all　can　　drive
　　'Anyone can drive.' (Shyu 2016: 1376)

Unlike polarity items in simple sentences where the licensor and licensee are in the same small clause, as in (1) − (5), the licensing of a polarity item in a relative clause environment is more complicated. Regarding the licensing of English polarity items (such as *any* and *ever*) in a relative clause environment, there were two main research questions posed in the literature. One is to investigate the NPI illusion effects when a relative clause creates an intruding licensing environment for NPIs (e.g., Parker & Phillips 2016). For example, speakers may judge the ungrammatical sentence in (6) as acceptable although the negation licensor embedded inside the relative clause only precedes the NPI, but does not c-command it. Another question is related to a phenomenon known as subtrigging (LeGrand 1975:54-69; Dayal 1998, 2004), meaning that the polarity item *any* can be triggered by a subordinate clause (c.f., (7) and (8)).

(6)　*The authors [that no critics recommended] have received **any** acknowledgment for a best-selling novel. (Parker & Phillips 2016: 325)

(7)　*She bought **anything** from Carson's. (LeGrand 1975: 54)

(8)　She bought **anything** she needed at Carson's. (LeGrand 1975: 54)

Very few studies, however, have discussed these two questions regarding *renhe* in Mandarin. Wang (1993) and Yang (2008) report that the matrix negation licensor can license *renhe* in a relative clause (9), but, to the best of our knowledge, there is no discussion on the licensing effects of *renhe*

when the scope of the negation licensor is limited to a relative clause. Wang (1993) and Giannakidou & Lin (2016) mention that *renhe* can be interpreted as an FCI when it is modified by a relative clause, even if it is a non-negative context, as in (10) and (11). However, supporting examples given in those papers involve other factors to consider, such as whether an adjective should be regarded as a relative clause (10), and whether the licensing of *renhe* is triggered by the modal *neng* 'can', instead of the relative clause environment (11).[2]

(9) *Wo   bu   xihuan* **renhe** *ren   xie   de   shu*.
 I   not   like   **any**   man   write REL   book
 'I do not like books that anyone writes.' (Wang 1993: 276)

(10) *Wo   xihuan* **renhe** **(youqu   de)   shu*.
 I   like   **any**   interesting REL   book
 'I like any book that is interesting.' (Wang 1993: 267)

(11) *Yuehan   mai-le   *(ta   neng   zhaodao   de)   * **renhe** *shu*.
 John   buy-PFV   he   can   find   REL   **any**   book
 'John bought any book that he can find.' (Giannakidou & Lin 2016: 17)

The present experimental study explores the licensing effects of *renhe* in a relative clause environment to answer the following questions: (a) Does there exist an illusion effect of licensing *renhe* when the negation licensor only linearly precedes *renhe* but does not c-command it? (b) Does the subtrigging effect still hold when other potential licensors (e.g. negation, modals) are absent? Two untimed, offline experiments were conducted in this study. The first experiment was to investigate the acceptability rate of sentences like (12) where there is only an illusory negation licensor for *renhe*. The second was to see whether there exists the subtrigging effect for *renhe*, in other words, whether sentences like (13) would be accepted by participants.

(12) *Pinglunjia   mei   tuijian-guo   de   na-ben-shu   dedao-guo*
 Critics   not   recommend-PFV   REL   the-CLF-book   receive-PFV
 renhe   *guanfang   renke*.
 any   official   acknowledgment
 (intended meaning) 'The book that critics did not recommend received any official acknowledgment.'

(13) *Zhangsan   chi-guo   Lisi   chi-guo de   * **renhe** *dongxi*.
 Zhangsan   eat-PFV   Lisi   eat-PFV REL   **any**   thing
 (intended meaning) 'Zhangsan ate anything that Lisi ate.'

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[2] If we move *renhe* in (10) to the position between the adjective modifier and the noun, as in (i), the sentence is significantly less acceptable than (10), according to several Mandarin native speakers.
(i) ??? *Wo   xihuan   youqu   de   * **renhe** *shu.*
 I   like   interesting   REL   **any**   book
 (intended meaning) 'I like any book that is interesting.'

2. Experiment 1: investigating the illusory licensing effect of *renhe*

An untimed, offline acceptability judgment experiment was designed to see whether native speakers would judge ungrammatical sentences like (12) as acceptable. In this experiment, we compared the average acceptability rates of three different types of sentences: (a) sentences which have a negation marker c-commanding *renhe*, (b) sentences like (12) which have a negation marker that only precedes but does not c-command *renhe*, and (c) sentences without any negation marker at all. If native speakers treat *renhe* as an NPI and think the c-commanding relation between a negation licensor and *renhe* is obligatory, then sentences like (12) are ungrammatical and should be judged as unacceptable by participants if there is no NPI illusion effect. In other words, if the NPI illusion effect is not triggered, there would be a statistical difference in the acceptability rate between sentences like (12) and sentences with a negation marker c-commanding *renhe*, whereas no statistical difference in acceptability rate is expected to be found between sentences like (12) and sentences without a negation marker.

2.1 Stimuli and procedure

We controlled two factors for the stimuli: one is the position of *renhe* (inside the relative clause or not) and the other is the position of the sentential negation maker (NEG) *mei* (inside the relative clause, in the matrix clause, both, or neither). There were 8 conditions (=2×4) in total. In all the stimuli, "*renhe*-NP" was in the object position of either the relative clause or the matrix clause. As suggested in Parker & Phillips (2016), in order to eliminate the influence of an FCI reading of *renhe*, we used abstract mass nouns for the NPs that co-occur with *renhe* and past tense which favors an episodic interpretation. We created 8 sets of 8 sentences (one sentence for each condition in each set) as target sentences. 64 target sentences were randomized with 128 fillers and distributed across 8 sets in a Latin Square Design. Each participant was presented with 8 target sentences (one sentence for each condition) intermingled with 16 fillers. The stimuli design is shown in Table 1 and a sample set of stimuli is given in (14) – (21). The list of all target sentences used in Experiment 1 is provided in the Appendix.

Table 1. The stimuli paradigm of Experiment 1[3]

Condition	Structure of the target sentence	Position of NEG	Position of *renhe*	Negation licensor for *renhe*
CON1	NP V [_ NEG V *renhe* NP] *de* NP	embedded	embedded	Local licensor
CON2	NP NEG V [_ V *renhe* NP] *de* NP	matrix	embedded	Non-local licensor
*CON3	NP V [_ V *renhe* NP] *de* NP	none	embedded	No licensor

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[3] The canonical word order in Mandarin is SVO. All the relative clauses used in this paper are prenominal relative clauses. The asterisk (*) indicates ungrammaticality. We consider conditions with no c-commanding relation between *renhe* and negation as ungrammatical.

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Table 1. *(continued)*

Condition	Structure of the target sentence	Position of NEG	Position of *renhe*	Negation licensor for *renhe*
CON4	NP NEG V [_ NEG V *renhe* NP] de NP	both	embedded	Local licensor + Non-local licensor
*CON5	[_ NP NEG V] *de* DP V *renhe* NP	embedded	matrix	Illusive licensor
CON6	[_ NP V] *de* DP NEG V *renhe* NP	matrix	matrix	Local licensor
*CON7	[_ NP V] *de* DP V *renhe* NP	none	matrix	No licensor
CON8	[_ NP NEG V] *de* DP NEG V *renhe* NP	both	matrix	Local licensor + Illusive licensor

(14) CON1: [NEG_embedded, *renhe*_embedded]

Zhangsan	*tingshuo-guo*	*mei*	*dedao-guo*	**renhe**	*guanfang*
Zhangsan	hear-of-PFV	not	receive-PFV	**any**	official

renke	*de*	*yishujia.*
approval	REL	artists

'Zhangsan heard of artists who did not receive any official approval.'

(15) CON2: [NEG_matrix, *renhe*_embedded]

Zhangsan	*mei*	*tingshuo-guo*	*dedao-guo*	**renhe**	*guanfang*
Zhangsan	not	hear-of-PFV	receive-PFV	**any**	official

renke	*de*	*yishujia.*
approval	REL	artists

'Zhangsan did not hear of artists who received any official approval.'

(16) CON3: [NEG_none, *renhe*_embedded]

Zhangsan	*tingshuo-guo*	*dedao-guo*	**renhe**	*guanfang*
Zhangsan	hear-of-PFV	receive-PFV	**any**	official

renke	*de*	*yishujia.*
approval	REL	artists

'Zhangsan heard of artists who received any official approval.'

(17) CON4: [NEG_both, *renhe*_embedded]

Zhangsan	*mei*	*tingshuo-guo*	*mei*	*dedao-guo*	**renhe**	*guanfang*
Zhangsan	not	hear-of-PFV	not	receive-PFV	**any**	official

renke	*de*	*yishujia.*
approval	REL	artists

'Zhangsan did not hear of artists who did not receive any official approval.'

(18) CON5: [NEG_embedded, *renhe*_matrix]

Bianjimen	*mei*	*tuijian-guo*	*de*	*na-ben-shu*	*dedao-guo*	**renhe**
editors	not	hear-of-PFV	REL	that-CLF-book	receive-PFV	**any**

guanfang	*renke*.
approval	official

'That book that editors did not recommend received any official approval.'

(19) CON6: [NEG_matrix, *renhe*_matrix]

Bianjimen	*tuijian-guo*	*de*	*na-ben-shu*	*mei*	*dedao-guo*	**renhe**
editors	hear-of-PFV	REL	that-CLF-book	not	receive-PFV	**any**

guanfang	*renke*.
approval	official

'That book that editors recommended did not receive any official approval.'

(20) CON7: [NEG_none, *renhe*_matrix]

Bianjimen	*tuijian-guo*	*de*	*na-ben-shu*	*dedao-guo*	**renhe**
editors	hear-of-PFV	REL	that-CLF-book	receive-PFV	**any**

guanfang	*renke*.
approval	official

'That book that editors recommended received any official approval.'

(21) CON8: [NEG_both, *renhe*_matrix]

Bianjimen	*mei*	*tuijian-guo*	*de*	*na-ben-shu*	*mei*	*dedao-guo*
editors	not	hear-of-PFV	REL	that-CLF-book	not	receive-PFV

renhe	*guanfang*	*renke*.
any	approval	official

'That book that editors did not recommend did not receive any official approval.'
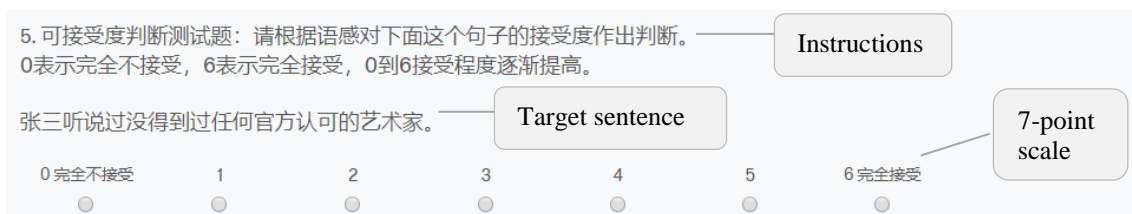

Figure 1. The display sample of the online survey

The experiment was conveyed through the Qualtrics online survey tool. There was no time limitation on completion. Participants were trained to rate the acceptability of each sentence using a 7-point scale (0: least acceptable, 6: most acceptable). Each sentence was fully displayed on the screen with simplified Chinese characters, and the rating scale was shown right below the sentence. To

indicate judgment, the participants needed to click the button representing the numerical rating.

2.2   Participants

322 native Mandarin speakers (age: 18-66, average age: 25.6, the number of female participants: 196) participated in this experiment. Participants were recruited through social media and emails. Participation in this experiment was anonymous.

2.3   Data analysis and results

Data were processed in the environment of R software (version: 3.4.0, R Development Core Team 2017). We used the *lme4* package (version 1.1-15, developed by Ben Bolker, Steve Walker, and Martin Mächler) to perform a linear mixed-effects model with a fixed factor "Condition" (8 conditions that we manipulated in the experiment) and random effects "Participant" and "Set" for different participants and different sets of stimuli. We did not take the position of NEG and the position of NPI as separate fixed factors to the model because they were not expected to be independent of each other. Instead, we considered "Condition" as a single fixed factor and performed statistical comparisons between any two conditions. The formula for the full model is *fm.full <- lmer(response ~ condition + (1|participant) + (1|set), data=data, REML=FALSE)*. The formula for the reduced model is *fm.reduced <- lmer(response ~(1|participant) + (1|set), data=data, REML=FALSE)*. The statistical significance of differences between any two conditions was checked by performing the likelihood ratio test, using the *anova()* function (Winter 2013). The *p*-value returned by *anova (fm.full, fm.reduced)* represents the effect of the factor "Condition" on the difference between the acceptability rates (i.e, "Response") of two conditions.

The mean acceptability of the target sentences in 8 conditions is shown in Figure 2. Among the fillers we included in this experiment, there are four both completely well-formed *lian…dou...* ('even … all…') sentences and the mean acceptance rate of these four filler sentences is 5.02; there are two completely ill-formed *lian…dou...* sentences and the mean acceptance rate of these two is 0.79. Additionally, the practice session at the beginning of the experiment also contains a well-formed sentence and the mean acceptance rate of is 5.14. We choose the middle point 3 as the baseline for acceptance score. The acceptability results shown in Figure 2 is in general consistent with the grammaticality. However, CON2, CON4, and CON8 rather showed unexpected results. While all these three conditions have a negation licensor commanding *renhe*, the acceptance rate of CON2 was lower than 3 and the acceptance rates of CON4 and CON8 were only slightly higher than 3.

Figure 2 clearly shows that as we expected, the unlicensed sentences (i.e., CON3 and CON7) were judged as unacceptable (mean for CON3 = 1.91, mean for CON7 = 1.55). It also shows the unacceptability of the intrusive one (CON5) where negation precedes *renhe* but does not c-command it (mean = 1.26, 95% confidence intervals = 1.06-1.44). The acceptance rates of the unlicensed conditions, CON3 and CON7, were significantly lower than their corresponding minimal pairs that

have negation in the matrix clause, CON1 and CON6, respectively (between CON3 and CON1: $p <$ 0.001, between CON6 and CON7: $p < 0.001$). This indicates that participants treated *renhe* as an NPI and the c-commanding relation between the negation licensor and *renhe* as an obligatory requirement, consistent with the theoretical claim made in the literature (e.g. Wang 1993).
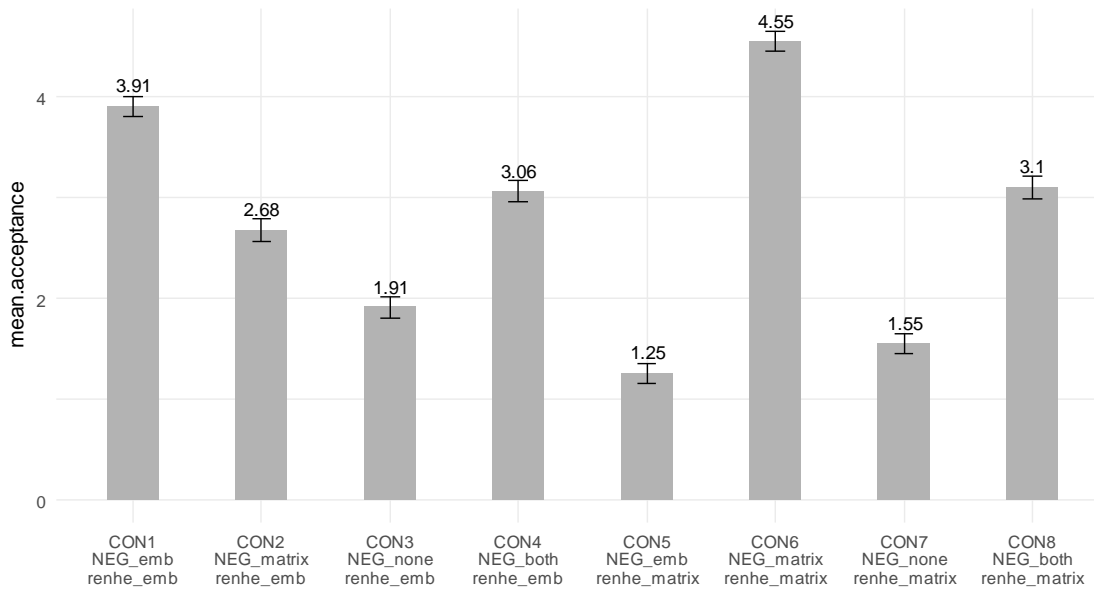

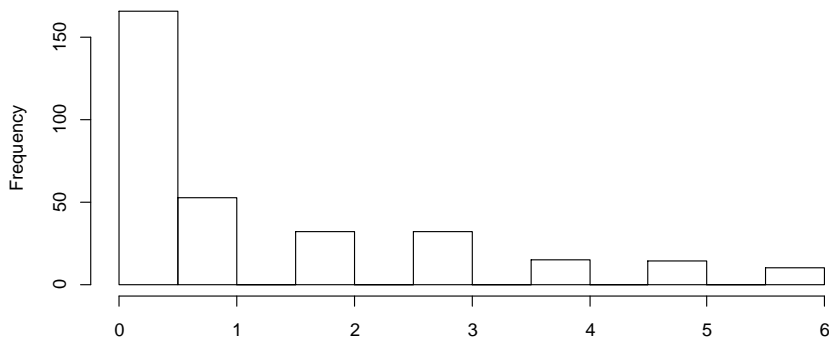**Figure 2**. Mean acceptability rates of Experiment 1 (N=322)

Figure 3. The distribution of the acceptance rate of the "intrusive" condition--CON5 (N=322)

The acceptance rate of the illusive condition (CON5) was significantly lower than all other conditions (between CON5 and CON7, $p = 0.003$; between CON5 and any other condition expect for CON7, $p < 0.001$). The distribution of the acceptance rate of CON5 in Figure 3 further confirms that sentences with an intruding licensor were strongly rejected by participants (among 322 participants, more than 250 participants rated sentences in CON5 less than 3). This result echoes the findings in the

literature on English NPI processing that, in an untimed task, sentential negation like *not* and the NPI *any* do not elicit an illusory licensing effect (Parker & Phillips 2011, 2016; de Dios-Flores et al. 2017).

Both CON1 and CON2 are grammatical since in both cases, the licensor *mei* ('not') c-commands *renhe*. The only difference between these two conditions is the position of the licensor. For CON1, the licensor and *renhe* are both embedded in the relative clause. For CON 2, the licensor is positioned in the matrix clause and *renhe* is embedded in the relative clause. The average acceptance rate of CON2 was 2.68 and the 95% confidence interval was 2.45-2.91, lower than the numerical results for CON1 (mean=3.91, 95% confidence interval = 3.70-4.11). A linear mixed-effect model shows that the acceptance rate of CON2 was significantly lower than the that of CON1 ($p < 0.001$). However, this does not mean that participants completely regarded CON2 as ungrammatical. Compared to CON3 (mean=1.91, 95% confidence interval = 1.70-2.11), which does not have a negation licensor and thus is ungrammatical, the acceptance rate of CON2 was significantly higher ($p < 0.001$). This shows that although participants tend to rate CON2 low, they do distinguish CON2 from an actual ungrammatical sentence. A possible explanation for the relatively low acceptance rate of CON2 is that the distance between the licensor and *renhe* matters; long-distance licensing results in high processing difficulty, even in an offline task. For CON2, even though the negation licensor is in a c-commanding relation with *renhe*, *renhe* is deeply embedded in the relative clause so that the distance between the licensor in the matrix clause and the *renhe* inside the relative clause is longer than that of other conditions. This long-distance causes processing complexity, thus resulting in the low acceptance rate.

Structural complexity seems to be another factor for processing *renhe*, as shown by the average acceptance rates for CON4 and CON8, which were only slightly higher than the baseline 3. Contrary to CON1, which only has negation in the embedded clause, CON4 has both a matrix negation and an embedded negation c-commanding *renhe*. From the perspective of processing, it is unclear whether the negation marker in both positions function to license *renhe* or only the embedded marker does. The structural complexity could explain why the average acceptance rate of CON4 was just slightly over 3 and significantly lower than the acceptance of CON1, the one with only one local negation marker ($p < 0.001$). Multiple negations are both syntactically and semantically more complicated than single negation.[4] The influence of structural complexity is also reflected in the comparison between CON6 and CON8. Similar to the structural difference between CON1 and CON4, CON6 differs from CON8 in a way that the former only has an embedded negation while the latter has both a matrix negation and an embedded negation c-commanding *renhe*. Interestingly, there is also a significant difference in the acceptance rate between CON6 and CON8 ($p < 0.001$). Therefore, we may conclude that the relatively low acceptance rate of CON4 and CON8 can be attributed to the difficulty of processing multiple negations.

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[4] One supporting evidence is that across languages, children acquire double negation later than single negation (Bellugi 1967; Jou 1988) and double negation is not frequently used even in adult languages (Zeijlstra 2004). Another reason is that sentences with more than one negation marker are potentially ambiguous and involve scope interactions. For example, "The book that no editors recommended did not received any award", does not entail the corresponding affirmative meaning, i.e., the book would have received an award if editors recommended so.

3. Experiment 2: investigating the subtrigging effect of *renhe*

The goal of this experiment is to check whether the subtrigging effect of *renhe* exists when only a relative clause modifies *renhe* and there is no other potential licensor (such as modals or negation). If the subtrigging effect does exist, i.e., *renhe* can be triggered by a relative clause which modifies it, then we would expect that sentences like (13) should be readily judged as acceptable by participants, while sentences with no relative clause modifying *renhe* should be rejected.

3.1 Stimuli and procedure

The stimuli consisted of 8 conditions depending on three main factors: whether there is a relative clause (RC) or not, position of the gap inside the RC (subject or the object), and the position of the sentential negation marker *mei* (inside the relative clause, in the matrix clause, or no negation marker). In this experiment, the "*renhe*-NP" was either on the head position of the RC or on the object position of the matrix clause if there was no relative clause. Different kinds of verbs were used depending on the gap type of the RC. The stimuli design is shown in Table 2.[5]

Table 2. The stimuli paradigm of Experiment 2

	Label	Structure of the target sentence	RC gap	Position of NEG	Negation licensor for *renhe*	Verb
1	P1	NP V [NP NEG V _] *de renhe* NP	object	embedded	?Local licensor	Perfective
2	P2	NP NEG V [NP V _] *de renhe* NP	object	Matrix	Local licensor	Perfective
3	P3	NP V [NP V _] *de renhe* NP	object	None	No licensor	Perfective
4	D1	NP V [_ NEG V NP] *de renhe* NP	subject	embedded	Illusive licensor	Declarative
5	D2	NP NEG V [_ V NP] *de renhe* NP	subject	Matrix	Local licensor	Declarative
6	D3	NP V [_ V NP] *de renhe* NP	subject	None	No licensor	Declarative
7	P4	NP NEG V *renhe* NP	/	Matrix	Local licensor	Perfective
	D4	NP NEG V *renhe* NP	/	Matrix	Local licensor	Declarative
8	P5	NP V *renhe* NP	/	None	No licensor	Perfective
	D5	NP V *renhe* NP	/	None	No licensor	Declarative

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[5] From the perspective of surface structure, the negation marker in P1 is not a local licensor for *renhe*. On the other hand, if we assume a head-raising analysis of Mandarin prenominal relative clauses (Aoun & Li 2003: 132-138; Hsiao 2003:111; Wu 2018), i.e., the head of a relative clause originates internally from the relative clause and can be reconstructed back to its original position, then the negation marker embedded in the RC is a local licensor for *renhe*. Therefore, we put a question mark before "Local licensor" in the column of the negation licensing environment for P1.

For the stimuli where the gap was the object of the relative clause, we chose action verbs such as *du* 'read' and *dedao* 'receive' for both the matrix verb and the embedded verb. These verbs were associated with a perfective aspect marker *guo* to make the stimuli consistent with the typical subtriggering example first mentioned in LeGrand (1975) as shown in (8). When the gap is in the subject position in the relative clause, *renhe*-NP originates from the subject position of the relative clause under a head-raising analysis of Mandarin relative clauses. In general, if *renhe*-NP is in subject position, the universal adverbial marker *dou* 'all' or a modal verb normally is required for the naturalness and proper licensing of the sentence (as in (5)). To make the stimuli sound pragmatically natural and avoid the potential influence of *dou* and modals, we used a different type of verbs for conditions where the gap was in the subject position of the relative clause. In this case, declarative verbs such as *tongyi* 'agree' and *zancheng* 'approve' associated with no aspect marker were used. These verbs were chosen because they have a similar meaning with the verb *allow* (*yunxu* in Mandarin), which has been argued to provide the proper semantic contexts for *any* but not for *renhe* in the literature (e.g. Cheng & Giannakidou 2013).[6]

The stimuli consisted of 8 sets of 8 sentences (one sentence for each condition in each set) as target sentences. We balanced the two kinds of verbs for conditions (i.e., Condition 7 and Condition 8 shown in Table 2) without RCs for two reasons. The first reason is to incorporate the two kinds of verbs used for conditions where there is an RC. The second reason is to check whether sentences in conditions where there is no RC and no other proper licensors for *renhe* would be readily rejected regardless of verb types. Therefore, for conditions without RCs, the first 4 sets of the stimuli used a verb (such as *du* 'read' and *dedao* 'receive') associated with the perfective aspect marker *guo* while the other 4 sets of the stimuli used declarative verbs (such as *tongyi* 'agree' and *zancheng* 'approve') associated with no aspect marker. A sample set of stimuli is shown in (22) – (31). The list of all target sentences used in Experiment 2 is provided in the Appendix.

(22) P1: [gap_RC object, perfective marker, NEG_embedded, *renhe*_head-of-RC]

Gaomei	*du-guo*	*Tangling*	*mei*	*du-guo*	*de*	**renhe**
Gaomei	read-PFV	Tangling	not	read-PFV	REL	**any**

kehuan	*xiaoshuo.*
science	fiction

'Gaomei read any science fiction that Tangling did not read.'

(23) P2: [gap_RC object, perfective marker, NEG_matrix, *renhe*_head-of-RC]

Gaomei	*mei*	*du-guo*	*Tangling*	*du-guo*	*de*	**renhe**
Gaomei	not	read-PFV	Tangling	read-PFV	REL	**any**

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[6] We did not include *yunxu* 'allow' in the experiment because *yunxu* as a transitive verb normally requires an infinitive clause or a verbal phrase as its complement, as show in (ii).

(ii)
Mama	*yunxu*	*Zhangsan*	*dai*	*gou*	*chuqu*	*wan.*
Mom	allow	Zhangsan	bring	dog	out	play

'Mom allows Zhangsan to bring the dog outside to play.'

kehuan   *xiaoshuo.*
science   fiction
'Gaomei did not read any science fiction that Tangling read.'

(24) P3: [gap_RC object, perfective marker, NEG_none, *renhe*_head-of-RC]
Gaomei	*du-guo*	*Tangling*	*du-guo*	*de*	**renhe**
Gaomei	read-PFV	Tangling	read-PFV	REL	**any**

kehuan   *xiaoshuo.*
science   fiction
'Gaomei read any science fiction that Tangling read.'

(25) P4: [no RC, perfective marker, NEG_matrix, *renhe*_matrix object]
Gaomei	*mei*	*du-guo*	**renhe**	*kehuan*	*xiaoshuo.*
Gaomei	not	read-PFV	**any**	science	fiction

'Gaomei did not read any science fiction.'

(26) P5: [no RC, perfective marker, NEG_none, *renhe*_matrix object]
Gaomei	*du-guo*	**renhe**	*kehuan*	*xiaoshuo.*
Gaomei	read-PFV	**any**	science	fiction

'Gaomei read any science fiction.'

(27) D1: [gap_RC subject, declarative verb, NEG_embedded, *renhe*_head-of-RC]
Faguo	*zongtong*	*zancheng*	*bu*	*xianzhi*	*qinshu*
France	president	approve	not	restrain	family

yimim	*de*	**renhe**	*ti'an.*
immigration	REL	**any**	proposal

'The President of France approves any proposal that does not restrain family-based immigration.'

(28) D2: [gap_RC subject, declarative verb, NEG_matrix, *renhe*_head-of-RC]
Faguo	*zongtong*	*bu*	*zancheng*	*xianzhi*	*qinshu*
France	president	not	approve	restrain	family

yimim	*de*	**renhe**	*ti'an.*
immigration	REL	**any**	proposal

'The President of France does not approve any proposal that restrains family-based immigration.'

(29) D3: [gap_RC subject, declarative verb, NEG_none, *renhe*_head-of-RC]
Faguo	*zongtong*	*zancheng*	*xianzhi*	*qinshu*
France	president	approve	restrain	family

yimim	*de*	***renhe***	*ti'an.*
immigration	REL	**any**	proposal

'The President of France approves any proposal that restrains family-based immigration.'

(30) D4: [no RC, declarative verb, NEG_matrix, *renhe*_head-of-RC]

Faguo	*zongtong*	*bu*	*zancheng*	***renhe***	*ti'an.*
France	president	not	approve	**any**	proposal

'The President of France does not approve any proposal.'

(31) D5: [no RC, declarative verb, NEG_none, *renhe*_head-of-RC]

Faguo	*zongtong*	*zancheng*	***renhe***	*ti'an.*
France	president	approve	**any**	proposal

'The President of France approves any proposal.'

64 target sentences were randomized with 128 fillers and distributed across 8 sets in a Latin Square Design. Each participant was presented with 8 target sentences (one sentence for each condition) intermingled with 16 fillers.

The same procedure from Experiment 1 was used. This experiment was launched two weeks after the data collection for Experiment 1.

3.2   Participants

171 native Mandarin speakers (age: 18-58, average age: 24, number of female participants: 112) participated in this experiment. They were recruited through advertisements in social media and emails. We targeted participants who did not participate in Experiment 1 to ensure participants were unfamiliar with the stimuli and would not detect the purpose of the experiments. Participation in this experiment was anonymous.

3.3   Data analysis and Results

Data were processed in the same way as Experiment 1. Among the fillers we included in this experiment, there are two semantically implausible sentences and the mean acceptance rate of these two filler sentences is 2.28; additionally, the practice session of this experiment includes a completely ill-formed sentence and the mean acceptance rate of this sentence is 0.96. In this experiment, we also choose the middle point 3 as the baseline for acceptance score. Figure 4 shows the mean acceptance rate of sentences in conditions where the gap inside the relative clause was in the object position and the verbs were associated with the perfective marker, namely, conditions labeled as P1, P2, P3, P4, and P5. Taking the score 3 as the baseline for acceptance, sentences in P5, where *renhe* is not modified by a relative clause and there is no other licensor (i.e., *renhe* in simple veridical sentences), were

judged as unacceptable (mean = 2.07), while sentences in which *renhe* is either modified by a relative clause (P3) or in the scope of negation (P4), or both (P1 and P2) were judged as acceptable by participants.
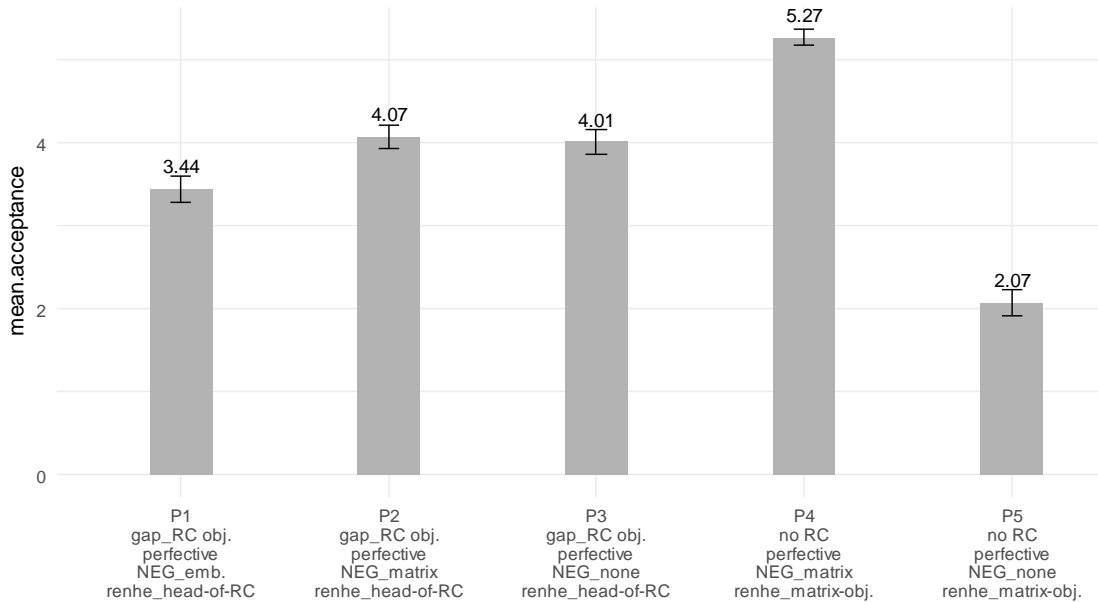

Figure 4. Mean acceptability rates of conditions with a perfective marker in Experiment 2 (for P1, P2, and P3, N=171; for P4 and P5, N=86)

The acceptance rate of P5 was significantly lower than that of any other condition ($p < 0.001$). The rejection of sentences in P5 is expected since it is neither licensing environment for the NPI *renhe* nor triggering environment for the FCI *renhe*. Compared with P5, the mean acceptability rate of P3 was much higher (mean = 4.01, 95% confidence interval = 3.72-4.30), demonstrating that *renhe* improves when modified by a relative clause. A linear mixed-effects model shows that there is a significant statistical difference between P3 and P5 ($p < 0.001$). Since the only structural difference between P3 and P5 is that *renhe* is modified by a relative clause in the former but not in the latter, the statistically significant difference between the acceptance rates of P3 and P5 confirms the existence of the subtrigging effect of *renhe*.

For sentences in P2, the negation in the matrix clause c-commands *renhe*, satisfying the licensing requirement of NPI *renhe*; it is thus not surprising that sentences in P2 were accepted by participants (mean = 4.07). The absence of a significant statistical difference between P3 and P2 ($p > 0.05$) further confirms the subtrigging effect of *renhe* since participants judged P3 as acceptable as the licensed condition P2.

The influence of structural complexity on the acceptance rate is also shown in the results of

Experiment 2. For sentences in P2 and P4, there was a negation licensor c-commanding *renhe*. However, sentences in P2 are structurally more complicated than those in P4, because *renhe* in P2 is modified by a relative clause. This could be why the acceptance rate of P2 was significantly lower than that of P4 ($p < 0.001$) although the acceptance rates of both conditions exceeded the acceptance baseline of 3.

For sentences in condition P1, the negation licensor embedded inside the relative clause is not in a c-commanding relation with *renhe*, unless we adopt the head-raising analysis of Mandarin relative clause. If we do so, we must also assume that the c-commanding relation between the negation licensor and *renhe* is still preserved after *renhe* reconstructs back to the relative clause at LF. Although sentences in P1 were judged as acceptable by participants (mean = 3.44), it is not clear whether the acceptance of P1 is because of the possibly proper c-commanding relation between negation and *renhe*, or because of *renhe* being modified by a relative clause, or both. Nevertheless, the complex structure of sentences in P1 may cause processing complexity, which could be responsible for the acceptance rate of condition P1 being significantly lower than P2, P3, and P4 ($p < 0.001$).

Figure 5 displays the mean acceptability rate of sentences in conditions where the gap was in the subject of the relative clause and the matrix verbs were declarative verbs (such as *tongyi* 'agree' and *zancheng* 'approve') associated with no aspect maker. Unlike the results in Figure 4, sentences in all conditions with declarative verbs were all rated over 3, meaning that participants regarded sentences in these conditions as acceptable.
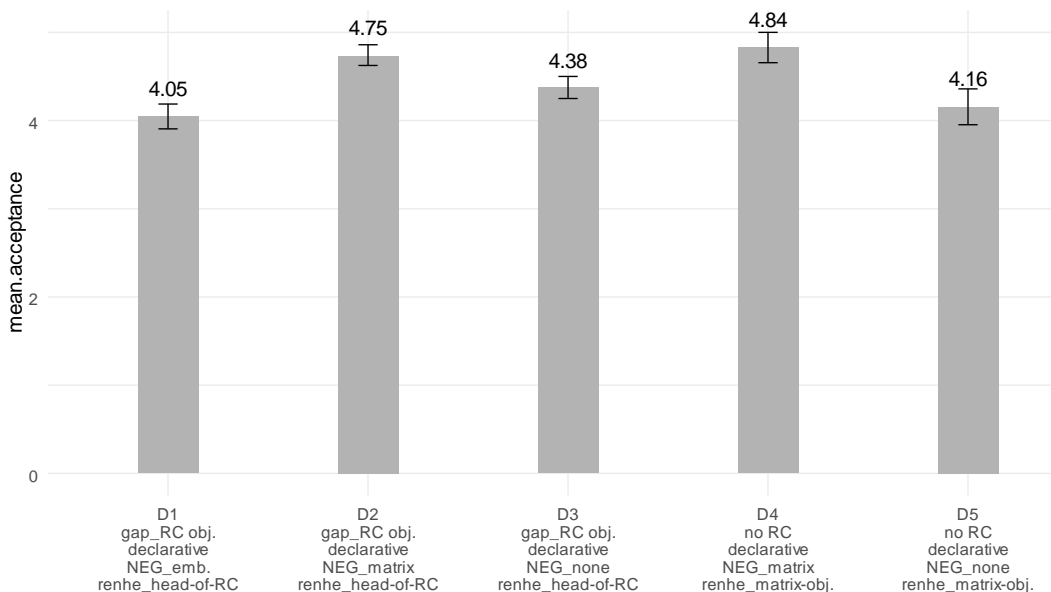

Figure 5. Mean acceptability rates of conditions with declarative verbs in Experiment 2 (for D1, D2, and D3, N=171; for D4 and D5, N=85)

The mean acceptability rate of D5, the condition without a relative clause modifying *renhe*, was 4.16 (95% confidence interval = 3.77-4.56), showing that *renhe* can be used in the scope of declarative verbs (such as *tongyi* 'agree' and *zancheng* 'approve'). To the best of our knowledge, it has not been reported in the literature that declarative verbs can trigger polarity items. Cheng & Giannakidou (2013) argues that *renhe* cannot co-occur with directive intentional verbs (such as *jianchi* 'insist') or epistemic intentional verbs (such as *yiwei* 'think'). Lin & Giannakidou (2015) also reports that no usage of *renhe* in the complement of non-factive predicates (including intentional verbs) is found in the Chinese Internet Corpora. However, the high acceptability rate of D5 not only shows that *renhe* in simple sentences can be in the scope of a non-factive predicates (more precisely, declarative verbs), but also suggests that the semantic properties of verbs could be a factor for *renhe* licensing/triggering.

A linear mixed-effects model shows that there is no statistical significance on the acceptability rate between D1 and D5, D3 and D5, or D2 and D4 ($p > 0.05$). Unlike P5, which was mostly rejected by participants, D5 was mostly judged as well-formed; thus, it is unclear the role of relative clause environment in D3. It could be the case that the declarative verbs and the relative clause environment together contribute to the proper licensing of *renhe* in D3. The same holds for D1, although there is a negation marker in D1, not in D3. In D1, the negation marker is not in a c-commanding relation with *renhe*, no matter whether we adopt a head-raising analysis of Mandarin relative clauses or not. Therefore, the licensing of *renhe* in D1 is not from the negation maker, but rather comes from the relative clause environment and/or the matrix declarative verbs.

4. Discussion

The results of the two experiments suggest answers to the research questions we have raised: they confirm the lack of illusory NPI licensing effects in untimed offline processing and the existence of subtrigging effects of *renhe*. Though there are still many open questions on the processing of *renhe* left to explore, the results of the present study present important implications as follows.

A. No illusion effect of *renhe* was found in an offline task:

The results of Experiment 1 show that there does not exist an illusion effect of *renhe* licensing when the negation licensor *mei* 'not' only linearly precedes *renhe*, but does not c-command it. This confirms that the c-commanding relation between licensors and *renhe* is an obligatory requirement (e.g. Wang 1993). The absence of the NPI illusion effect of *renhe* shown by Experiment 1 is consistent with a claim regarding the processing of *any* in English: the NPI *any* and sentential negation *not* do not trigger an NPI illusion effect in an untimed offline task (Parker & Phillips 2011, 2016; de Dios-Flores et al. 2017). However, we cannot conclude that Mandarin does not allow NPI illusion effects at all. First, it could be the case that NPI illusion effects are elicited in online processing in Mandarin as it is the case in English (Drenhaus et al. 2005; Vasishth et al. 2008; Xiang et al. 2009; Parker and Phillips 2016). While untimed offline judgment tasks allow time for reflection to detect ungrammaticality, fast online processing tasks are more likely to induce the illusion of grammaticality. Also, it could be the case that a different choice of the NPI and the structural environment causes

illusive licensing effects. Yun et al. (2017) reports that the NPI *amwu* 'any' and sentential negation do elicit NPI illusion in Korean in an untimed offline task when the NPI is in a complement clause. Further research is needed to investigate whether the types of the NPI, negation, sentential structure, and the task are responsible for the existence of NPI illusion in Mandarin.

B. Locality and structural complexity affect processing of *renhe*:

A surprising result of Experiment 1 is that grammatical conditions (CON2, CON4, and CON8) with a proper negation licensor for *renhe* were rated much lower than we had expected. The lower acceptance rate of the non-local licensing condition (i.e, CON2, mean = 2.68) compared with the acceptance rate of the corresponding local licensing condition (i.e., CON1, mean = 3.91) is consistent with the findings of a recent ERP study on Turkish NPI processing (Yanilmaz & Drury 2018). Yanilmaz & Drury (2018) reports that acceptance rates for clausal-local licensing conditions were much higher than for the non-local licensing conditions when the NPI was embedded inside a clause. However, unlike the online ERP experimental setting in Yanilmaz & Drury (2018), our experiments in the present study were untimed and offline. Under such experimental settings, while participants have enough time to reflect on the grammaticality of the sentences, one might expect that the non-local licensing condition will still be judged as acceptable despite a heavier cognitive load for processing. Wang (1993) claims that "*renhe* is not always clause-bound by its licensor", if the licensor c-commands *renhe*. However, the low acceptance rate of the non-local licensing condition (i.e., CON2) shows that *locality* plays a crucial role in the processing of NPI licensing, even in an offline task.

Sentences with double negation (i.e., CON4 and CON8) were rated slightly higher than 3, but much lower than the sentences with single negation (i.e., CON1 and CON6). Our current explanation for this is that a double negation structure (CON4 and CON8) causes a processing complexity of NPI licensing. It has been argued that negation by itself increases processing difficulty (Kaup et al. 2007; Tian & Breheny 2016), so we can expect that double negation would increase cognitive load. However, the influence of locality on processing seems more significant than that of double negation because CON2 (changing the local licensing in CON1 into non-local licensing condition) shows a significantly lower acceptance rate than CON4 (adding one more negation to CON1) ($p < 0.01$).

In addition, sentences in CON1 (embedded negation and embedded NPI) were rated significantly lower than sentences in CON6 (matrix negation and matrix NPI) ($p < 0.001$), although the licensing conditions of *renhe* in both cases are local licensing. In the ERP study of Yanilmaz & Drury (2018), the local licensing in both the embedded environment and the matrix environment were judged as well-formed, with very similar rates. However, our data clearly show the divergence in acceptability rates between CON1 and CON6, suggesting that there exists an asymmetry between embedded relative clause environment and matrix clause environment for NPI licensing processing.

C. The existence of the subtrigging effect of *renhe* was confirmed:

The first part of the results of Experiment 2 (i.e., conditions with action verbs and a perfective marker) confirms the existence of the subtrigging effect of *renhe*, just like the English *any* (LeGrand 1975).

The design of the experiment confirms that the high acceptability of *renhe* is due to the relative clause that modifies *renhe*, not due to any other potential licensors (e.g. negation or non-veridical contexts). This suggests that the claim that *renhe* must be licensed in non-veridical environments is too strict (cf. Cheng & Giannakidou 2013), calling for a reconsideration of *renhe* and its specific requirements for proper licensing.

One may argue that the proper licensing of *renhe* in the subtrigging cases like (32) results from the property of the perfective marker *guo*, based on a proposal made in Cheng & Giannakidou (2013). According to Cheng & Giannakidou (2013), the contrast between (33) and (34) can be accounted for by arguing that *guo* is an *experiencer perfective marker* and can create a non-episodic and non-veridical environment for *renhe*, unlike the run-of-the-mill perfective marker *le*. In their point of view, the context in (34) is not episodic because *guo* does not denote a single event; it is not veridical because *guo* "contains an extended now interval (McCoard 1973) that can be rendered nonveridical in the sense that the eventuality is not true at all the times in the interval (Giannakidou 1995)" (Cheng & Giannakidou 2013: 137).

(32) *Zhangsan   chi-guo   Lisi   chi-guo de   **renhe**   dongxi.*
     Zhangsan   eat-PFV   Lisi   eat-PFV REL   **any**   thing
     'Zhangsan ate anything that Lisi ate.'

(33) **Renhe-ren   dou   jin-lai-le.*
      any-person   all   enter-come-PFV
     'Anyone came in.' (Cheng & Giannkidou 2013: 134)

(34) ***Renhe**-xuesheng   dou   jin-lai-guo.*
     any-student   all   enter-come-PFV
     'Anyone has come in (at least once before).' (Cheng & Giannkidou 2013:137)

If we extend this analysis of *guo* to the subtrigging sentences that we tested in Experiment 2, then (32) should mean that the situation in which Zhangsan ate everything that Lisi ate has occurred at least once before and the eventuality does not necessarily hold all the times in the relevant interval. However, for several Mandarin native speakers we consulted, the natural meaning of (32) was different: For everything Lisi has ever eaten, Zhangsan ate it as well, and it has always been the case. Moreover, the proposal suggested in Cheng & Ginnakidou (2013) cannot explain why participants rejected sentences like *Gaomei du-guo renhe kehuan xiaoshuo* 'Gaomei read any science fiction' where *guo* was present. Additionally, the influence of aspect markers is not salient in subtrigging sentences, although aspect markers seem to affect *renhe* licensing as in (33) and (34). Substituting *guo* in (32) with another aspect marker *le*, (35) is still acceptable according to our consultation with native speakers. This suggests that it is the relative clause environment (even in veridical contexts) that provides proper licensing for *renhe* and triggers the subtrigging effect, and non-veridical context is a sufficient but not necessary condition for proper licensing of *renhe.*

(35) | *Zhangsan* | *(jintian)* | *chi-le* | *Lisi* | *chi- (le)* | *de* | ***renhe*** | *dongxi.* |
| Zhangsan | today | eat-PFV | Lisi | eat-PFV | REL | **any** | thing |

'Zhangsan ate anything that Lisi ate.'

In the literature on the subtrigging effect of the English *any*, researchers debated over whether conditionality is the source of the subtrigging effect. Some researches argued that the subtrigging effect results from the relative clause environment being an underlying conditional structure (LeGrand 1975; Quer 1998; Ginnakidou 2001), whereas other researchers argued that the subtrigging effect can also be found in adjectives and prepositional phrases and cannot be accounted for by a pure conditional structure analysis (Dayal 2004; Jayez & Tovena 2005, 2007). Regarding *renhe*, we are currently uncertain about how the relative clauses environment matches the requirement for its proper licensing and whether conditionality is a fitting analysis for its subtrigging effect. Nevertheless, the confirmation of the subtrigging effect of *renhe* in Mandarin can be our stepping stone for further experiments and theoretical research on Mandarin *renhe*. Future research may include an experiment on testing whether the subtrigging effect can also be found in adjectives and prepositional phrases, a theoretical proposal on how the subtrigging effect of *renhe* is triggered, and a comparative study of the Mandarin *renhe* and the English *any* with respect to their subtrigging effects.

D. The declarative verbs can license *renhe*:

The results of the other half of Experiment 2 (i.e., conditions with declarative verbs and no perfective marker) present a completely new finding that *renhe* can be licensed by declarative verbs. The results suggest that the distinction made in the literature between licensed and unlicensed contexts for *renhe*, such as non-factive verbs versus factive verbs, or negative verbs versus non-negative verbs, was too broad (cf. Wang 1993; Cheng & Giannakidou 2013; Lin & Giannakidou 2015). [7]

Regarding the proper licensing of *renhe* in the environment of declarative verbs, we have two conjectures, both of which call for further research for verification. One conjecture is treating the declarative verbs like *zancheng* 'approve', *tongyi* 'agree' as essentially non-veridical predicates, following the analysis of classifying the English word *agree* as a non-veridical predicate (Lahiri 2002, Spector & Egré 2015; Uegaki 2015: §4.4.4.3; Xiang 2016: chapter 4). The high acceptance rate of sentences like (36a) would, then, not be surprising. Another conjecture is the absence of aspect markers in sentences like (36a) also contributes to the proper licensing of *renhe*. One reason for this conjecture is that (36a) has an implication that, in general, the subject approves any proposal submitted to him and approving proposals is habitual rather than a specific individual event, hence providing a non-veridical context. The other reason behind this conjecture is that the sentence is degraded if we add a perfective maker, as in (36b) and (36c), which was noticed by native speakers we consulted. [8]

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[7] Duffley and Larrivée (2019) reports the usage of *any* in veridical factive contexts and suggests that the licensing of *any* is based on at-issue content: separating usages of *renhe* in factives from *renhe* in other contexts is not necessary.
[8] Thanks to Lingzi Zhuang for pointing out this data to us.

Yet, the degraded acceptability of those sentences with a perfective marker does not indicate that the absence of aspect markers is a source for the proper licensing of *renhe* in sentences like (36a). The absence of aspect markers cannot be the only source for the proper licensing of *renhe*, because the sentence (36a) becomes ungrammatical if the declarative verb in it replaced with an action verb, as in (37). It indicates that the declarative verbs are certainly responsible for the proper licensing of *renhe*.

(36) a. *Ta   zancheng   renhe   ti'an.*
       he   approve   **any**   proposal
       'He approves any proposal.'

    ?b. *Ta   zancheng-le   renhe   ti'an.*
       he   approve-PFV   **any**   proposal
       'He approved any proposal.'

    ?c. *Ta   zancheng-guo   renhe   ti'an.*
       he   approve-PFV   **any**   proposal
       'He approved any proposal.'

(37) *Ta   kan   renhe   dianying.*
       he   watch   **any**   movie
       *'He watches any movie.'

The finding that declarative verbs can license *renhe* provides a starting point for theoretical research on whether declarative verbs generally behave like non-veridical predicates and how the property of declarative verbs is matched with *renhe*'s specific requirements for proper licensing.

5.   Conclusion

In this paper, we have examined the processing of *renhe* with relative clauses to investigate the existence of the NPI illusion effect and subtrigging effect. The results of our experiments demonstrate that i) NPI illusion effects do not appear in Mandarin in untimed offline text processing; ii) the subtrigging effect of *renhe* holds when *renhe* is modified by a relative clause, even in a veridical context; iii) *renhe* can be licensed by certain types of declarative verbs, such as *tongyi* 'agree', *zancheng* 'approve'. These experimental results suggest the following theoretical implications. First, negation licenses *renhe* only in a c-commanding position (e.g. Wang 1993). This structural requirement is so strong that no illusory licensing effect is observed when negation precedes but does not c-command *renhe*. Second, non-veridical contexts provide licensing environments for *renhe* (Cheng & Giannakidou 2013). Our study extends the relevant non-veridical contexts to the declarative verbs that have not been previously discussed. Third, relative clauses provide yet another licensing condition for *renhe* as *any* in English (LeGrand 1975). The subtrigging effect is observed even in

veridical contexts, which calls for future research on the semantic property of *renhe* and the mechanism of how *renhe* is licensed in such contexts.

Acknowledgments

Abbreviations

CLF	classifier
PFV	perfective
Q	question particle/marker
REL	relative

Appendix. Stimuli examples of Experiment 1 and 2

The list of target sentences used in the two experiments is shown below.

Stimuli examples of Experiment 1 are shown in (38) - (53). Only sentences with both matrix negation and embedded negation are shown here to save space. The other three types of stimuli (i.e., only matrix negation, only embedded negation, and no negation) were derived from each sentence as illustrated in Table 1.

(38) *Zhangsan*   *mei*   *tingshuo-guo*   *mei*   *dedao-guo*   ***renhe***
      Zhangsan   not   hear-of-PFV   not   receive-PFV   **any**
      guanfang   *renhe*   *de*   *yishujia.*
      official   approval   REL   artist
      'Zhangsan did not hear of artists who did not receive any official approval.'

(39) *Bianjimen*   *mei*   *tuijian-guo*   *de*   *na-ben-shu*   *mei*
      editors   not   recommend-PFV   REL   that-CLF-book   not
      dedao-guo   ***renhe***   *guanfang*   *renhe.*

receive-PFV **any** official approval

'That book that editors did not recommend did not receive any official approval.'

(40) *Lisi*   *mei*   *jian-guo*   *mei*   *jieshou-guo*   ***renhe***
Lisi   not   meet-PFV   not   receive-PFV   **any**
waiyu   *jiaoyu*   *de*   *daxue*   *xiaozhang.*
foreign-language   education   REL   college   president

'Lisi did not meet college presidents who did not receive any foreign language education.'

(41) *Baozhi*   *mei*   *baodao-guo*   *de*   *na-wei-daxue-xiaozhang*   *mei*
newspaper   not   report-PFV   REL   that-CLF-college-president   not
jieshou-guo   ***renhe***   *waiyu*   *jiaoyu.*
receive-PFV   **any**   foreign-language   education

'The college president who newspaper did not report did not receive any foreign language education.'

(42) *Wangwu*   *mei*   *canguan-guo*   *mei*   *jinxing-guo*   ***renhe***
Wangwu   not   visit-PFV   not   conduct-PFV   **any**
renshi   *gaige*   *de*   *da-gongsi.*
personnel   reform   REL   big-company

'Wangyu did not visit big companies that did not conduct any personnel reform.'

(43) *Zhongyang*   *zhengfu*   *mei*   *fuchi-guo*   *de*   *na-jia-da-gongsi*
Federal   government   not   support-PFV   REL   that-CLF-big-company
mei   *jinxing-guo*   ***renhe***   *renshi*   *gaige.*
not   conduct-PFV   **any**   personnel   reform

'The big company that the government did not support did not conduct any personnel reform.'

(44) *Zhouping*   *mei*   *caifang-guo*   *mei*   *shixian-guo*   ***renhe***
Zhouping   not   interview-PFV   not   realize-PFV   **any**
Zhengzhi   *mubiao*   *de*   *zhengke.*
political   ambition   REL   politician

'Zhouping did not interview reformers who did not realize any political ambition.'

(45) *Minzhudang*   *yiyuan*   *mei*   *zhichi-guo*   *de*   *na-ge-zhengke*
Democrat   Congressmam   not   support-PFV   REL   that-CLF-politician
mei   *shixian-guo*   ***renhe***   *zhengzhi-baofu.*
not   realize-PFV   **any**   political-ambition

'The politician who the Democrats con did not support did not realize any political ambition.'

(46) *Zhaolin*   *mei*   *qu-guo* *mei*   *fazhan-guo*   **renhe** *xu'ni* *jingji*
Zhaolin   not   go-PFV not   develop-PFV   **any**   virtual economy
de   *feizhou*   *guojia.*
REL   African   country
'Zhoulin did not go to African-countries that did not develop any virtual economy.'

(47) *Meiguo*   *zongtong*   *mei*   *chufang-guo*   *de*
American   President   not   visit-PFV   REL
na-ge-feizhou-guojia   *mei*   *fanzhan-guo*   **renhe** *xuni* *jingji.*
that-CLF-African-country   not   develop-PFV   **any** virtual economy
'The African country that American president did not visit did not develope any virtual economy.'

(48) *Wuping*   *mei*   *qingjiao-guo*   *mei*   *xiangshou-guo* **renhe**
Wuping   not   consult-PFV   not   enjoy-PFV   **any**
zhuanjia   *daiyu*   *de*   *jiaoshou.*
expert   benefit   REL   professor
'Wuping did not consult professors who did not enjoy any benefit to experts.'

(49) *Xuexiao*   *lingdao*   *mei*   *kanwang-guo*   *de*   *na-wei-jiaoshou*
university   leaders   not   visit-PFV   REL   that-CLF-professor
mei   *xiangshou-guo* **renhe** *zhuanjia*   *daiyu.*
not   enjot-PFV   **any**   expert   benefit
'The professor who the university leaders did not visit did not enjoy any benefit to experts.'

(50) *Zhangxiaolu*   *mei*   *canyan-guo*   *mei*   *huode-guo*   **renhe**
Zhaoxiaolu   not   participate-PFV not   receive-PFV   **any**
shangye   *zanzhu*   *de*   *jilupian*   *xiangmu.*
corporate   sponsorship   REL   documentary   project
'Zhangxiaolu did not participate documentary projects that did not receive any corporate sponsorship.'

(51) *Dongfang-weishi*   *mei*   *touzi-guo*   *de*   *na-ge-jilupian-xiangmu*
Dragon-TV   not   invest-PFV   REL   that-CLF-documentary-project
mei *huode-guo*   **renhe** *shangye*   *zanzhu.*
not receive-PFV   **any**   corporate   sponsorship
'The documentary project that Dragon TV did not invest in did not receive any corporate sponsorship.'

(52) *Zhengzhi*   *mei*   *diaocha-guo*   *mei*   *kaoqu-guo*   **renhe**   *zhuanye*
Zhengzhi   not   investigate-PFV   not   acquire-PFV   **any**   professional
zige   *de*   *jiaolianyuan.*
license   REL   coach
'Zhengzhi did not investigate the coach who did not acquire any professional license.'

(53) *Yuanda-jiaoxiao*   *mei*   *pinqing-guo*   *de*   *na-ming-jiaolianyuan*   *mei*
Yuanda-driving-school   not   hire-PFV   REL   that-CLF-coach   not
kaoqu-guo   **renhe**   *zhuanye*   *zige.*
acquire-PFV   **any**   professional   license
'The coach who driving schools did not hire did not get any professional license.'

  (54) - (77) are stimuli examples used for Experiment 2. To save space, only the sentences without negation are shown here. The other two types of stimuli were derived from sentences listed below by adding a matrix negation or adding an embedded negation if there is a relative clause, as illustrated in Table 2.

(54) *Gaomei*   *du-guo*   *Tangling*   *du-guo*   *de*   **renhe**
Gaomei   read-PFV   Tangling   read-PFV   REL   **any**
kehuan   *xiaoshuo.*
science   fiction
'Gaomei read any science fiction that Tangling read.'

(55) *Faguo*   *zongtong*   *zancheng*   *xianzhi*   *qinshu*
France   president   approve   restrain   family
yimin   *de*   **renhe**   *ti'an.*
immigration   REL   **any**   proposal
'The President of France approves any proposal that restrains family-based immigration.'

(56) *Gaomei*   *du-guo*   **renhe**   *kehuan*   *xiaoshuo.*
Gaomei   read-PFV   **any**   science   fiction
'Gaomei read any science fiction.'

(57) *Linxiaoou*   *kan-guo*   *Yenan*   *kan-guo*   *de*   **renhe**
Linxiaoou   watch-PFV   Yenan   watch-PFV   REL   **any**
mingxing   *yanchanghui.*
star   concert
'Liuxiaoou watched any star concert that Yenan watched.'

(58) *Oumeng*   *chengyuanguo*   *yonghu*   *zhichi*   *maoyizhan*
European-Union   member-state   endorse   support   trade-war
de   ***renhe*** *oumeng*   *lingxiu.*
REL   **any**   European-Union   leader
'EU member states endorse any EU leader who supports trade war.'

(59) *Linxiaoou*   *kan-guo*   ***renhe*** *mingxing*   *yanxhanghui.*
Linxiaoou   watch-PFV   **any**   star   concert
'Liuxiaoou watched any star concert.'

(60) *Yuwei*   *xiangshou-guo*   *Mengdazhi*   *xiangshou-guo*   *de*
Yuwei   enjoy-PFV   Mengdazhi   enjoy-PFV   REL
renhe *zhuanjia*   *daiyu.*
any   expert   benefit
'Yuwei enjoyed any benefit to experts that Mengdazhi enjoyed.'

(61) *Hanguo*   *tongyi* *guli* *chaoxian*   *de*   ***renhe*** *zhuzhang.*
South-Korea   agree   isolate   North Korea   REL   **any**   proposition
'South Korea agrees with any proposition which is about isolating North Korea.'

(62) *Yuwei*   *xiangshou-guo*   ***renhe*** *zhuanjia*   *daiyu.*
Yuwei   enjoy-PFV   **any**   expert   benefit
'Yuwei enjoyed any benefit to experts.'

(63) *Du-benke*   *de-shihou,*   *Zhangsan*   *dedao-guo*
being-undergraduate   when,   Zhangsan   receive-PFV
Lisi *dedao-guo*   *de*   ***renhe*** *rongyujiangli.*
Lisi   receive-PFV   REL   **any**   award
'While being an undergraduate, Zhangsan received any award that Lisi received.'

(64) *Yingguo*   *zhichi*   *fazhan*   *hewuqi*   *de*
Britain   support   develop   nuclear-weapon   REL
renhe *tiyi.*
any   proposal
'Britain supports any proposal that is about developing nuclear weapon.'

(65) *Du-benke*   *de-shihou,*   *Zhangsan*   *dedao-guo*
being-undergraduate   when,   Zhangsan   receive-PFV
renhe rongyujiangli.
any   award

'While being an undergraduate, Zhangsan received any award.'

(66) *Xiaohan*   *wan-guo*   *Wuzheng*   *wan-guo*   *de*
     Xiaohan   play-PFV   Wuzheng   play-PFV   REL
     renhe   *wangyi-youxi.*
     any   163.com-game
     'Xiaohan played any game on 163.com that Wuzheng played.'

(67) *Meiguo*   *lalong* *fandui* *siyouzhi*   *de*   ***renhe*** *guojia.*
     America   court   object private-ownership   REL   **any** country
     'America courts any country that objects private ownership.'

(68) *Meiguo*   *lalong* ***renhe*** *guojia.*
     America   court   **any**   country
     'America courts any country.'

(69) *Xuping*   *jingli-guo*   *Wangyang*   *jingli-guo*   *de*
     Xuping   experience-PFV Wangyang   experience-PFV REL
     renhe   *cuozhe.*
     any   setback
     'Xuping experienced any setback that Wangyang experienced.'

(70) *Eguo*   *zancheng*   *gongda*   *xuliya*   *de*
     Russia   approve   attack   Syria   REL
     renhe   *anlihui*   *jueyi.*
     any   Security Council   resolution
     'Russia approves any resolution of Security Council which is about attacking Syria.'

(71) *Eguo*   *zancheng*   ***renhe*** *anlihui*   *jueyi.*
     Russia   approve   **any**   Security Council   resolution
     'Russia approves any resolution of Security Council.'

(72) *Wangwu*   *chi-guo*   *Zhaoliu*   *chi-guo de* ***renhe*** *dongxi.*
     Wangwu   eat-PFV   Zhaoliu   eat-PFV REL **any** thing
     'Wangwu ate anything that Zhaoliu ate.'

(73) *Deguo*   *zhengfu*   *caina* *jianzhi*   *nanmin*   *de*
     Germany   government   accept surveillance   refugee   REL
     renhe   *changyi.*
     any   proposal

'German government accepts any proposal which puts refugees under surveillance.'

(74) *Deguo*   *zhengfu*   *caina*   **renhe**   *changyi.*
Germany   government   accept   **any**   proposal
'German government accepts any proposal.'

(75) *Liuming*   *jieshou-guo*   *Lilin*   *jieshou-guo*   *de*
Liuming   receive-PFV   Lilin   receive-PFV   REL
renhe   *zhuanye*   *peixun.*
any   professional   training
'Liuming received any professional training that Lilin received.'

(76) *Shate*   *renke*   *zhicai Yilang de*   **renhe** *fang'an.*
Saudi-Arabia   approve   punish Iran   REL   **any**   proposal
'Saudi Arabia approves any proposal which imposes a sanction against Iran.'

(77) *Shate*   *renke*   **renhe** *fang'an.*
Saudi-Arabia   approve   **any**   proposal
'Saudi Arabia approves any proposal.'

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