

Processing of the Mandarin polarity item *renhe* ‘any’

Hongchen Wu and Jiwon Yun

Georgia Institute of Technology | Stony Brook University

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 licenser 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*

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

needs to be licensed by a negative element in (1) or non-veridical contexts, such as conditionals in (2) and yes/no questions in (3). *Renhe* can be interpreted as an FCI when it is within the scope of modals in (4), or it is in subject position and occurs with *dou* 'all' in (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)
- 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 licenser 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 licenser 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

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), and Giannakidou (2001).

(LeGrand 1975: 54–69; Dayal 1998, 2004), meaning that the polarity item *any* can be triggered by a subordinate clause (cf. (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 licenser 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 licenser 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 could 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 licenser only linearly precedes

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.'

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 renhe guanfang*
 critics not recommend-PFV REL the-CLF-book receive-PFV any official
renke.
 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.'

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 ($=2 \times 4$) 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 eight sets of eight sentences (one sentence for each condition in each set) as target sentences. Sixty-four target sentences were randomized with 128 fillers and distributed across eight sets in a Latin square design. Each participant was presented with eight 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 *

Condition	Structure of the target sentence	Position of NEG	Position of <i>renhe</i>	Negation licenser for <i>renhe</i>
CON1	NP V [_{NEG} V <i>renhe</i> NP] <i>de</i> NP	embedded	embedded	local licenser
CON2	NP NEG V [_V <i>renhe</i> NP] <i>de</i> NP	matrix	embedded	non-local licenser
*CON3	NP V [_V <i>renhe</i> NP] <i>de</i> NP	none	embedded	no licenser
CON4	NP NEG V [_{NEG} V <i>renhe</i> NP] <i>de</i> NP	both	embedded	local licenser + non- local licenser
*CON5	[_{NP} NEG V] <i>de</i> DP V <i>renhe</i> NP	embedded	matrix	illusive licenser
CON6	[_{NP} V] <i>de</i> DP NEG V <i>renhe</i> NP	matrix	matrix	local licenser
*CON7	[_{NP} V] <i>de</i> DP V <i>renhe</i> NP	none	matrix	no licenser
CON8	[_{NP} NEG V] <i>de</i> DP NEG V <i>renhe</i> NP	both	matrix	local licenser + illusive licenser

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

- (14) CON1: [NEG_embedded, *renhe*_embedded]
Zhangsan tingshuo-guo mei dedao-guo renhe guanfang renke de yishujia.
 Zhangsan hear-of-PFV NEG receive-PFV any official 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 renke de yishujia.
 Zhangsan NEG hear-of-PFV receive-PFV any official 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 renke de yishujia.
 Zhangsan hear-of-PFV receive-PFV any official 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 renke de
 Zhangsan NEG hear-of-PFV NEG receive-PFV any official approval REL
yishujia.
 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 NEG recommend-of-PFV REL that-CLF-book receive-PFV any
guanfang renke.
 official approval
 ‘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 recommend-of-PFV REL that-CLF-book NEG receive-PFV any
guanfang renke.
 official approval
 ‘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 guanfang
 editors recommend-of-PFV REL that-CLF-book receive-PFV any official
renke.
 approval
 ‘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 renhe
 editors NEG recommend-of-PFV REL that-CLF-book NEG receive-PFV any
guanfang renke.
 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

Three hundred twenty-two 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 Core Team 2017). We used the *lme4* package (version 1.1–15, Bates et al. 2015) 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 `condition.full <- lmer(response~condition + (1|participant) + (1|set), data=data, REML=FALSE)`.³ The formula for the reduced model is `condition.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(condition.full, condition.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 eight 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 this well-formed sentence is 5.14. We choose the middle point 3 as the baseline for acceptance score. The acceptability results shown in Figure 2 are in general consistent with the grammaticality. However, CON2, CON4, and CON8 rather showed unexpected results. While all these three conditions have a negation licenser 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 licenser and *renhe* as an obligatory requirement, consistent with the theoretical claim made in the literature (e.g. Wang 1993).

3. This formula means that we are modeling the “response” as a function of “condition”, with the “participant” and “set” as the random effects. “1” here refers to the intercept. “1|participant” means that we are telling the model to take by-participant variability into account. Likewise, “1|set” is to take by-set variability into account. REML stands for Restricted Maximum Likelihood. The REML=FALSE in the model specification tells R to fit the model using maximum likelihood, rather than restricted maximal likelihood.

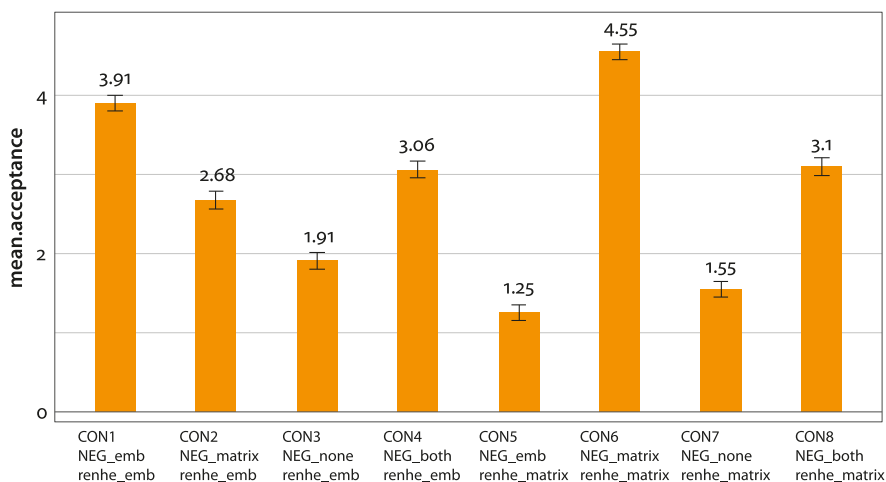


Figure 2. Mean acceptability rates of Experiment 1 ($N=322$)

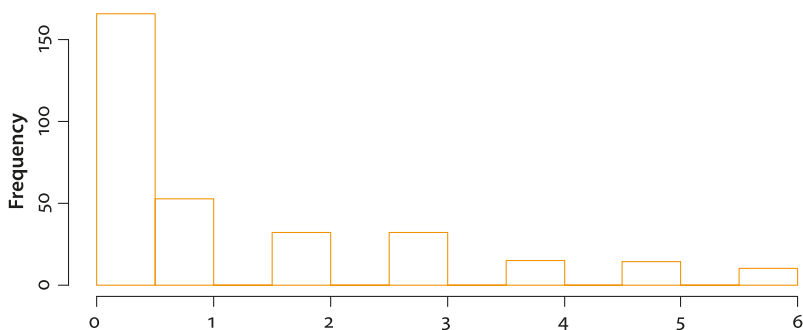


Figure 3. The distribution of the acceptance rate of the “intrusive” condition – CON5 ($N=322$)

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 licenser. For CON1, the licenser and *renhe* are both embedded in the relative clause. For CON 2, the licenser 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 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 licenser 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 licenser and *renhe* matters; long-distance licensing results in high processing difficulty, even in an offline task. For CON2, even though the negation licenser is in a c-commanding relation with *renhe*, *renhe* is deeply embedded in the relative clause so that the distance between the licenser 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

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 receive any award*, does not entail the corresponding affirmative meaning, i.e. 'the book would have received an award if editors recommended so'.

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.

3. Experiment 2: Investigating the subtriggering effect of *renhe*

The goal of this experiment is to check whether the subtriggering effect of *renhe* exists when only a relative clause modifies *renhe* and there is no other potential licenser (such as modals or negation). If the subtriggering 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, the 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

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

5. From the perspective of surface structure, the negation marker in P1 is not a local licenser 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 licenser for *renhe*. Therefore, we put a question mark before “local licenser” in the column of the negation licensing environment for P1.

Table 2. The stimuli paradigm of Experiment 2

Condition	Label	Structure of the target sentence	RC gap	Position of NEG	Negation licensor for <i>renhe</i>	Verb
1	P1	NP V [NP NEG V _] <i>de renhe</i> NP	object	embedded	?local licensor	perfective
2	P2	NP NEG V [NP V _] <i>de renhe</i> NP	object	matrix	local licensor	perfective
3	P3	NP V [NP V _] <i>de renhe</i> NP	object	none	no licensor	perfective
4	D1	NP V [_ NEG V NP] <i>de renhe</i> NP	subject	embedded	illusive licensor	declarative
5	D2	NP NEG V [_ V NP] <i>de renhe</i> NP	subject	matrix	local licensor	declarative
6	D3	NP V [_ V NP] <i>de renhe</i> NP	subject	none	no licensor	declarative
7	P4	NP NEG V <i>renhe</i> NP	/	matrix	local licensor	perfective
	D4	NP NEG V <i>renhe</i> NP	/	matrix	local licensor	declarative
8	P5	NP V <i>renhe</i> NP	/	none	no licensor	perfective
	D5	NP V <i>renhe</i> NP	/	none	no licensor	declarative

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

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 shown in (i).

- (i) *Mama yunxu Zhangsan dai gou chuqu wan.*
 mom allow Zhangsan bring dog out play
 ‘Mom allows Zhangsan to bring the dog outside to play.’

The stimuli consisted of eight sets of eight 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 four sets of the stimuli used a verb (such as *du* ‘read’ and *dedao* ‘receive’) associated with the perfective aspect marker *guo* while the other four 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 kehuan xiaoshuo.
 Gaomei read-PFV Tangling not read-PFV REL any 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 kehuan xiaoshuo.
 Gaomei not read-PFV Tangling read-PFV REL any 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 kehuan xiaoshuo.
 Gaomei read-PFV Tangling read-PFV REL any 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 yimim de renhe
 France president approve not restrain family immigration REL any
ti'an.
 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 yimim de renhe
 France president not approve restrain family immigration REL any
ti'an.
 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 yimim de renhe ti'an.
 France president approve restrain family 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.'

Sixty-four target sentences were randomized with 128 fillers and distributed across eight sets in a Latin square design. Each participant was presented with eight target sentences (one sentence for each condition) intermingled with sixteen 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

One hundred seventy-one 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 in 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 licenser (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.

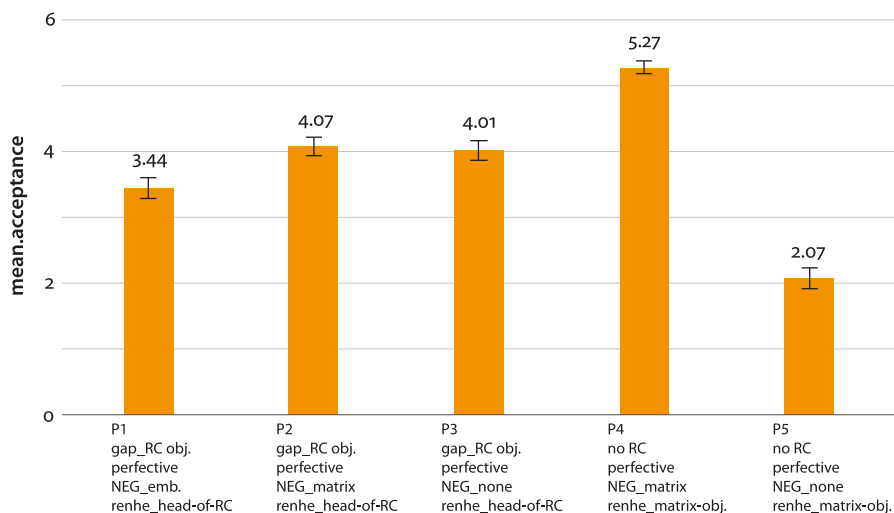


Figure 4. Mean acceptability rates of conditions with a perfective marker in Experiment 2 (for P1, P2, and P3, $N=171$; for P4 and P5, $N=86$)

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 subtriggering 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 subtriggering 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 licenser *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 licenser 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 licenser and *renhe* is still preserved after *renhe* reconstructs back to the relative clause at Logical Form. 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.

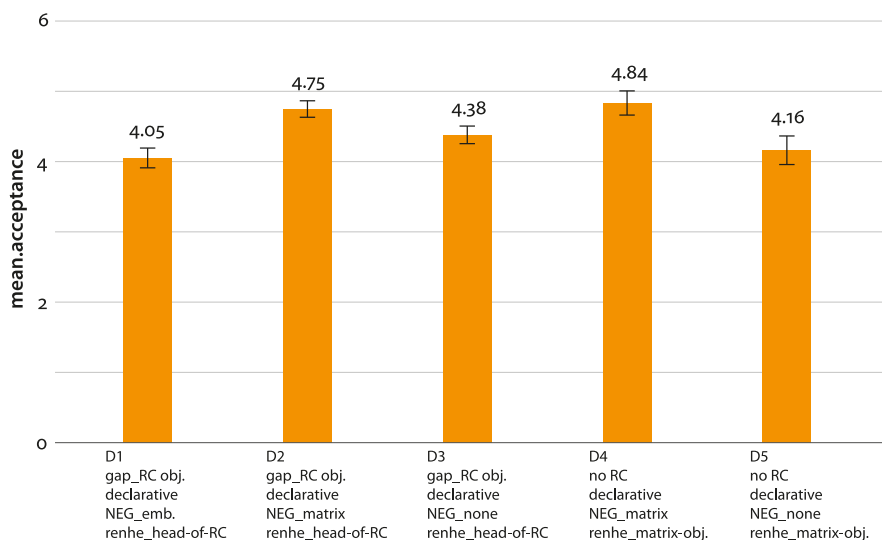


Figure 5. Mean acceptability rates of conditions with declarative verbs in Experiment 2 (for D1, D2, and D3, $N=171$; for D4 and D5, $N=85$)

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 Corpus.⁷ However, the high acceptability rate of D5 not only shows that *renhe* in simple sentences can be in the scope of 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 ($p > 0.05$).

7. The Chinese Internet Corpus contains 280 million words (tokens). This corpus has been compiled by Serge Sharoff from the internet in February 2005. It can be retrieved from <http://corpus.leeds.ac.uk/query-zh.html>.

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.

4.1 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 licenser *mei* ‘not’ only linearly precedes *renhe*, but does not c-command it. This confirms that the c-commanding relation between licensers 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; Vasisht et al. 2008; Xiang et al. 2009; Parker & 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.

4.2 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 licenser 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: 275) claims that “*renhe* is not always clause-bound by its licenser”, if the licenser 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.

4.3 The existence of the subtriggering 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 subtriggering 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 subtriggering 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* as an experiencer perfect marker entails that the eventuality is not always true in the time interval that begins in the past and ends by the time of the utterance (Cheng & Giannakidou 2013).

(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 & Giannakidou 2013: 134)

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

If we extend this analysis of *guo* to the subtriggering 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 differ-

ent: for everything Lisi has ever eaten, Zhangsan ate it as well, and it has always been the case. Moreover, the proposal suggested in Cheng & Giannakidou (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 subtriggering 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 subtriggering 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 subtriggering effect of the English *any*, researchers debated over whether conditionality is the source of the subtriggering effect. Some researches argued that the subtriggering effect results from the relative clause environment being an underlying conditional structure (LeGrand 1975; Quer 1998; Ginnakidou 2001), whereas other researchers argued that the subtriggering 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 subtriggering effect. Nevertheless, the confirmation of the subtriggering 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 subtriggering effect can also be found in adjectives and prepositional phrases, a theoretical proposal on how the subtriggering effect of *renhe* is triggered, and a comparative study of the Mandarin *renhe* and the English *any* with respect to their subtriggering effects.

4.4 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).⁸

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.⁹ 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 sentence (36a) becomes ungrammatical if the declarative verb in it is 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.’

8. Duffley & Larrivé (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.

9. Thanks to Lingzi Zhuang for pointing this data out to us.

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.

Acknowledgements

For their valuable comments and suggestions, we are grateful to the two anonymous reviewers for *Language & Linguistics*, and the audience at the 93rd Annual Meeting of the Linguistic Society of America in 2019, where an earlier version of this paper was presented. We thank Shaohua Fang, Tianshu Li, Yaobin Liu, Lei Liu, Yang Liu, Jian Jiang, and Wenqin Zhang for participating in the pilot study and helping with finalizing the experiment materials. Special thanks to Professor Zhuang Wu at Guangdong University of Foreign Studies and Ms. Weina Lin at Hunan University for helping with recruiting participants. We also want to thank Professor Richard Larson, and Professor Daniel Finer for their comments and suggestions. All remaining errors are our own.

Abbreviations

CLF	classifier
FCI	Free Choice Item
NEG	negative marker
NP	Noun Phrase
NPI	Negative Polarity Item
PFV	perfective
Q	question particle/marker
RC	Relative Clause
REL	relative
REML	Restricted Maximum Likelihood
V	Verb

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 guanfang renke de yishujia.*
 Zhangsan not hear-of-PFV not receive-PFV any 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 dedao-guo renhe guanfang renke.*
 editors not recommend-PFV REL that-CLF-book not receive-PFV any official approval
 approval
 'That book that editors did not recommend did not receive any official approval.'

(40) *Lisi mei jian-guo mei jieshou-guo renhe waiyu jiaoyu de daxue xiaozhang.*
 Lisi not meet-PFV not receive-PFV any foreign-language education REL college president
 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 jieshou-guo renhe*
 newspaper not report-PFV REL that-CLF-college-president not receive-PFV **any**
waiyu jiaoyu.
 foreign-language education
 ‘The college president whom the newspaper did not report on did not receive any foreign language education.’
- (42) *Wangwu mei canguan-guo mei jinxing-guo renhe renshi gaige de da-gongsi.*
 Wangwu not visit-PFV not conduct-PFV **any** 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 mei jinxing-guo*
 federal government not support-PFV REL that-CLF-big-company not conduct-PFV
renhe renshi gaige.
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 zhengzhi mubiao de zhengke.*
 Zhouping not interview-PFV not realize-PFV **any** 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 mei shixian-guo*
 Democrat congressmam not support-PFV REL that-CLF-politician not realize-PFV
renhe zhengzhi-baofu.
any political-ambition
 ‘The politician whom the Democrats did not support did not realize any political ambition.’
- (46) *Zhaolin mei qu-guo mei fazhan-guo renhe xu’ni jingji de feizhou guojia.*
 Zhaolin not go-PFV not develop-PFV **any** virtual economy REL African country
 ‘Zhaolin did not go to African-countries that did not develop any virtual economy.’
- (47) *Meiguo zongtong mei chufang-guo de na-ge-feizhou-guojia mei fanzhan-guo*
 American president not visit-PFV REL that-CLF-African-country not develop-PFV
renhe xu’ni jingji.
any virtual economy
 ‘The African country that the American president did not visit did not develop any virtual economy.’
- (48) *Wuping mei qingjiao-guo mei xiangshou-guo renhe zhuanjia daiyu de jiaoshou.*
 Wuping not consult-PFV not enjoy-PFV **any** 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 mei xiangshou-guo renhe*
 university leaders not visit-PFV REL that-CLF-professor not enjoy-PFV any
zhuanjia daiyu.
 expert benefit
 ‘The professor whom the university leaders did not visit did not enjoy any benefit to experts.’
- (50) *Zhangxiaolu mei canyan-guo mei huode-guo renhe shangye zanzhu de*
 Zhangxiaolu not participate-PFV not receive-PFV any corporate sponsorship REL
jilupian xiangmu.
 documentary project
 ‘Zhangxiaolu did not participate in documentary projects that did not receive any corporate sponsorship.’
- (51) *Dongfang-weishi mei touzi-guo de na-ge-jilupian-xiangmu mei huode-guo*
 Dragon-TV not invest-PFV REL that-CLF-documentary-project not receive-PFV
renhe shangye zanzhu.
 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 zige de*
 Zhengzhi not investigate-PFV not acquire-PFV any professional license REL
jiaolianyuan.
 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 kaoqu-guo*
 Yuanda-driving-school not hire-PFV REL that-CLF-coach not acquire-PFV
renhe zhuanye zige.
 any professional license
 ‘The coach whom driving schools did not hire did not get any professional license.’

Examples (54)–(77) are stimuli 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 kehuang xiaoshuo.*
 Gaomei read-PFV Tangling read-PFV REL any science fiction
 ‘Gaomei read any science fiction that Tangling read.’
- (55) *Faguo zongtong zancheng xianzhi qinshu yimin de renhe tian.*
 France president approve restrain family 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 mingxing yanchanghui.*
 Linxiaoou watch-PFV Yenan watch-PFV REL any star concert
 'Linxiaoou watched any star concert that Yenan watched.'
- (58) *Oumeng chengyuanguo yonghu zhichi maoyizhan de renhe*
 European-Union member-state endorse support trade-war REL any
Oumeng lingxiu.
 European-Union leader
 'European Union member states endorse any EU leader who supports trade war.'
- (59) *Linxiaoou kan-guo renhe mingxing yanchanghui.*
 Linxiaoou watch-PFV any star concert
 'Linxiaoou watched any star concert.'
- (60) *Yuwei xiangshou-guo Mengdazhi xiangshou-guo de renhe zhuanjia daiyu.*
 Yuwei enjoy-PFV Mengdazhi enjoy-PFV REL 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 Lisi dedao-guo de renhe*
 being-undergraduate when, Zhangsan receive-PFV Lisi receive-PFV REL any
rongyujiangli.
 award
 'While being an undergraduate, Zhangsan received any award that Lisi received.'
- (64) *Yingguo zhichi fazhan hewuqi de renhe tiyi.*
 Britain support develop nuclear-weapon REL any proposal
 'Britain supports any proposal that is about developing nuclear weapons.'
- (65) *Du-benke de-shihou, Zhangsan dedao-guo renhe rongyujiangli.*
 being-undergraduate when, Zhangsan receive-PFV any award
 'While being an undergraduate, Zhangsan received any award.'

- (66) *Xiaohan wan-guo Wuzheng wan-guo de renhe wangyi-youxi.*
 Xiaohan play-PFV Wuzheng play-PFV REL 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 to private ownership.'
- (68) *Meiguo lalong renhe guojia.*
 America court any country
 'America courts any country.'
- (69) *Xuping jingli-guo Wangyang jingli-guo de renhe cuozhe.*
 Xuping experience-PFV Wangyang experience-PFV REL any setback
 'Xuping experienced any setback that Wangyang experienced.'
- (70) *Eguo zancheng gongda Xuliya de renhe anlihui jueyi.*
 Russia approve attack Syria REL any Security Council resolution
 'Russia approves any resolution of the Security Council which is about attacking Syria.'
- (71) *Eguo zancheng renhe Anlihui jueyi.*
 Russia approve any Security Council resolution
 'Russia approves any resolution of the 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 jianshi nanmin de renhe changyi.*
 Germany government accept surveillance refugee REL any proposal
 'The German government accepts any proposal which puts refugees under surveillance.'
- (74) *Deguo zhengfu caina renhe changyi.*
 Germany government accept any proposal
 'The German government accepts any proposal.'
- (75) *Liuming jieshou-guo Lilin jieshou-guo de renhe zhuan ye peixun.*
 Liuming receive-PFV Lilin receive-PFV REL 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.'

References

- Aoun, Joseph E. & Li, Yen-Hui Audrey. 2003. *Essays on the representational and derivational nature of grammar: The diversity of wh-constructions*. Cambridge: The MIT Press. <https://doi.org/10.7551/mitpress/2832.001.0001>
- Bates, Douglas & Mächler, Martin & Bolker, Benjamin M. & Walker, Steven C. 2015. Fitting linear mixed-effects models using lme4. *Journal of Statistical Software* 67(1). 1–48. <https://doi.org/10.18637/jss.v067.i01>
- Bellugi, Ursula. 1967. *The acquisition of the system of negation in children's speech*. Cambridge: Harvard University. (Doctoral dissertation.)
- Cheng, Lisa Lai-Shen & Giannakidou, Anastasia. 2013. The non-uniformity of wh-indeterminates with polarity and free choice in Chinese. In Gil, Kook-Hee & Harlow, Steve & Tsoulas, George (eds.), *Strategies of quantification* (Oxford Studies in Theoretical Linguistics 44), 123–151. Oxford: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199692439.003.0007>
- Dayal, Veneeta. 1998. *Any* as inherently modal. *Linguistics and Philosophy* 21(5). 433–476. <https://doi.org/10.1023/A:1005494000753>
- Dayal, Veneeta. 2004. The universal force of free choice *any*. In Pica, Pierre & Rooryck, Johan & van Craenenbroeck, Jeroen (eds.), *Linguistic variation yearbook 2004* (Linguistic Variation Yearbook 4), 5–40. Amsterdam: John Benjamins. <https://doi.org/10.1075/livy.4.02day>
- de Dios-Flores, Iria. & Muller, Hanna. & Phillips, Colin. 2017. Negative polarity illusions: Licensors that don't cause illusions, and blockers that do. (Poster presented at the 30th CUNY Conference on Human Sentence Processing, Cambridge (MIT), 30 March–1 April 2017.)
- Drenhaus, Heiner & Frisch, Stefan & Saddy, Douglas. 2005. Processing negative polarity items: When negation comes through the backdoor. In Kepser, Stephan & Reis, Marga (eds.), *Linguistic evidence: Empirical, theoretical and computational perspectives* (Studies in Generative Grammar 85), 145–164. Berlin: De Gruyter Mouton. <https://doi.org/10.1515/9783110197549.145>
- Duffley, Patrick & Larrivéé, Pierre. 2019. The use of *any* with factive predicates. *Linguistics* 57(1). 195–219. <https://doi.org/10.1515/ling-2018-0034>
- Giannakidou, Anastasia. 2001. The meaning of free choice. *Linguistics and Philosophy* 24(6). 659–735. <https://doi.org/10.1023/A:1012758115458>
- Giannakidou, Anastasia & Lin, Jing. 2016. The Mandarin NPI *shenme* is not exhaustive: A reply to Chierchia and Liao (2015). Chicago/Amsterdam: University of Chicago and University of Amsterdam. (<https://home.uchicago.edu/~giannaki/pubs/Final.LinGianna.Mar.11.2016.pdf>) (Accessed 2021-03-09.) (Manuscript.)
- Horn, Laurence R. 2000. *Any* and (-)ever: Free choice and free relatives. In Wyner, Adam Zachary (ed.), *Proceedings of the 15th Annual Conference of the Israel Association for Theoretical Linguistics (IATL 15)*, 71–111. Haifa: University of Haifa.

- Hsiao, Franny Pai-Fang. 2003. *The syntax and processing of relative clauses in Mandarin Chinese*. Cambridge: MIT. (Doctoral dissertation.)
- Jayez, Jacques & Tovena, Lucia M. 2005. Free choiceness and non-individuation. *Linguistics and Philosophy* 28(1). 1–71. <https://doi.org/10.1007/s10988-005-1072-3>
- Jayez, Jacques & Tovena, Lucia M. 2007. Subtrigging as alternatives through regularities. In Aloni, Maria & Dekker, Paul & Roelofsen, Floris (eds.), *Proceedings of the 16th Amsterdam Colloquium, 17–19 December 2007*, 127–132. Amsterdam: Institute for Logic, Language and Computation (ILLC)/Department of Philosophy, University of Amsterdam.
- Jou, Jerwen. 1988. The development of comprehension of double negation in Chinese children. *Journal of Experimental Child Psychology* 45(3). 457–471. [https://doi.org/10.1016/0022-0965\(88\)90042-2](https://doi.org/10.1016/0022-0965(88)90042-2)
- Kaup, Barbara & Lüdtke, Jana & Zwaan, Rolf A. 2007. The experiential view of language comprehension: How is negation represented? In Schmalhofer, Franz & Perfetti, Charles A. (eds.), *Higher level language processes in the brain: Inference and comprehension processes*, 255–288. Mahwah: Lawrence Erlbaum Associates.
- Kuo, Chin-Man. 2003. *The fine structure of negative polarity items in Chinese*. Los Angeles: University of Southern California. (Doctoral dissertation.)
- Lahiri, Utpal. 2002. *Questions and answers in embedded contexts* (Oxford Studies in Theoretical Linguistics 2). Oxford: Oxford University Press.
- LeGrand, Jean Ehrenkranz. 1975. *Or and any: The semantics and syntax of two logical operators*. Chicago: University of Chicago. (Doctoral dissertation.)
- Lin, Jing & Giannakidou, Anastasia. 2015. No exhaustivity for the Mandarin NPI *shenme*. Amsterdam/Chicago: University of Amsterdam and University of Chicago. (<https://home.uchicago.edu/giannaki/pubs/LinGianna.2015.23.05.pdf>) (Accessed 2021-03-09.) (Manuscript.)
- Parker, Dan & Phillips, Colin. 2011. Illusory negative polarity item licensing is selective. (Poster presented at the 24th CUNY Conference on Human Sentence Processing, Palo Alto, 24–26 March 2011.)
- Parker, Dan & Phillips, Colin. 2016. Negative polarity illusions and the format of hierarchical encodings in memory. *Cognition* 157. 321–339. <https://doi.org/10.1016/j.cognition.2016.08.016>
- Quer, Josep. 1998. *Mood at the interface*. Utrecht: University of Utrecht. (Doctoral dissertation.)
- R Core Team. 2017. *R: A language and environment for statistical computing (Version 3.4.0)*. Vienna: R Foundation for Statistical Computing. (<https://cran.r-project.org/bin/windows/base/old/3.4.0/>) (Accessed 2021-03-36.)
- Shyu, Shu-ing. 2016. Minimizers and EVEN. *Linguistics* 54(6). 1355–1395. <https://doi.org/10.1515/ling-2016-0031>
- Spector, Benjamin & Egré, Paul. 2015. A uniform semantics for embedded interrogatives: An answer, not necessarily *the* answer. *Synthese* 192(6). 1729–1784. <https://doi.org/10.1007/s11229-015-0722-4>
- Tian, Ye & Breheny, Richard. 2016. Dynamic pragmatic view of negation processing. In Larivière, Pierre & Lee, Chungmin (eds.), *Negation and polarity: Experimental perspectives* (Language, Cognition, and Mind 1), 21–43. Cham: Springer. https://doi.org/10.1007/978-3-319-17464-8_2
- Uegaki, Wataru. 2015. *Interpreting questions under attitudes*. Cambridge: MIT. (Doctoral dissertation.)

- Vasishth, Shravan & Brüssow, Sven & Lewis, Richard L. & Drenhaus, Heiner. 2008. Processing polarity: How the ungrammatical intrudes on the grammatical. *Cognitive Science* 32(4). 685–712. <https://doi.org/10.1080/03640210802066865>
- Wang, Yu-Fang Flora. 1993. The Chinese NPI *renhe* in contexts with negative values. In Huang, Chu-Ren & Chang, Claire Hsun-hui & Chen, Keh-jiann & Liu, Cheng-Hui (eds.), *Proceedings of the First Pacific Asia Conference on Formal and Computational Linguistics: PACFoCoL I (1993)*, 265–281. Taipei: The Computational Linguistics Society of R.O.C.
- Wang, Yu-Fang Flora & Hsieh, Miao-Ling. 1996. A syntactic study of the Chinese negative polarity item *renhe*. *Cahiers de Linguistique Asie Orientale* [East Asian Languages and Linguistics] 25(1). 35–62. <https://doi.org/10.3406/clao.1996.1491>
- Winter, Bodo. 2013. *Linear models and linear mixed effects models in R with linguistic applications*. (<http://arxiv.org/pdf/1308.5499.pdf>) (Accessed 2018-06-15.)
- Wu, Hongchen. 2018. The head raising analysis of Mandarin prenominal relative clause: Evidence from quantifier scope interpretation. (Paper presented at the 26th Annual Conference of the International Association of Chinese Linguistics (IACL-26) & The 20th International Conference on Chinese Language and Culture (ICCLC-20), Madison, 4–6 May 2018.)
- Xiang, Ming & Dillon, Brian & Phillips, Colin. 2009. Illusory licensing effects across dependency types: ERP evidence. *Brain and Language* 108(1). 40–55. <https://doi.org/10.1016/j.bandl.2008.10.002>
- Xiang, Yimei. 2016. *Interpreting questions with non-exhaustive answers*. Cambridge: Harvard University (Doctoral dissertation.)
- Yang, Barry Chung-Yu. 2008. *Intervention effects and the covert component of grammar*. Hsinchu: National Tsing Hua University. (Doctoral dissertation.)
- Yanilmaz, Aydogan & Drury, John E. 2018. Prospective NPI licensing and intrusion in Turkish. *Language, Cognition and Neuroscience* 33 (1). 111–138. <https://doi.org/10.1080/23273798.2017.1371779>
- Yun, Jiwon & Lee, So-Young & Drury, John E. 2017. Negative polarity illusion in Korean. (Paper presented at the 13th Workshop on Altaic Formal Language, Tokyo, 25–28 May 2017.)
- Zeijlstra, Hedzer (Hedde) Hugo. 2004. *Sentential negation and negative concord*. Amsterdam: University of Amsterdam. (Doctoral dissertation.)

Authors' addresses

Jiwon Yun (corresponding author)
 Department of Linguistics
 Stony Brook University
 Stony Brook, NY 11794-4376
 USA
jiwon.yun@stonybrook.edu

Publication history

Date received: 13 September 2018
 Date accepted: 8 May 2019