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). 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)

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 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 renhe guanfang renke.  
Critics not recommend-PFV REL the-CLF-book receive-PFV any official acknowledgment renhe  
(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 renhe  
(intended meaning) ‘Zhangsan ate anything that Lisi ate.’

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 marker (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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Structure of the target sentence</th>
<th>Position of NEG</th>
<th>Position of renhe</th>
<th>Negation licensor for renhe</th>
</tr>
</thead>
<tbody>
<tr>
<td>CON1</td>
<td>NP V [ _ NEG V renhe NP] de NP</td>
<td>embedded</td>
<td>embedded</td>
<td>Local licensor</td>
</tr>
<tr>
<td>CON2</td>
<td>NPNEG V [ _ V renhe NP] de NP</td>
<td>matrix</td>
<td>embedded</td>
<td>Non-local licensor</td>
</tr>
<tr>
<td>*CON3</td>
<td>NP V [ _ V renhe NP] de NP</td>
<td>none</td>
<td>embedded</td>
<td>No licensor</td>
</tr>
</tbody>
</table>

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.
### Table 1. (continued)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Structure of the target sentence</th>
<th>Position of NEG</th>
<th>Position of renhe</th>
<th>Negation licensor for renhe</th>
</tr>
</thead>
<tbody>
<tr>
<td>CON4</td>
<td>NP <strong>NEG</strong> V [ _ NEG V renhe NP] de NP</td>
<td>both</td>
<td>embedded</td>
<td>Local licensor + Non-local licensor</td>
</tr>
<tr>
<td>*CON5</td>
<td>[ _ NP NEG V] de DP V renhe NP</td>
<td>embedded</td>
<td>matrix</td>
<td>Illusive licensor</td>
</tr>
<tr>
<td>CON6</td>
<td>[ _ NP V] de DP <strong>NEG</strong> V renhe NP</td>
<td>matrix</td>
<td>matrix</td>
<td>Local licensor</td>
</tr>
<tr>
<td>*CON7</td>
<td>[ _ NP V] de DP renhe NP</td>
<td>none</td>
<td>matrix</td>
<td>No licensor</td>
</tr>
<tr>
<td>CON8</td>
<td>[ _ NP NEG V] de DP <strong>NEG</strong> V renhe NP</td>
<td>both</td>
<td>matrix</td>
<td>Local licensor + Illusive licensor</td>
</tr>
</tbody>
</table>

(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 renhe
editors not hear-of-PFV REL that-CLF-book not 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

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 \( fm.full \leftarrow \text{lmer}(\text{response} \sim \text{condition} + (1|\text{participant}) + (1|\text{set}), \text{data}=\text{data}, \text{REML}=\text{FALSE}) \). The formula for the reduced model is \( fm.reduced \leftarrow \text{lmer}(\text{response} \sim (1|\text{participant}) + (1|\text{set}), \text{data}=\text{data}, \text{REML}=\text{FALSE}) \). The statistical significance of differences between any two conditions was checked by performing the likelihood ratio test, using the \text{anova}() \ function (Winter 2013). The \( p \)-value returned by \text{anova} \( \text{fm.full, fm.reduced} \) 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 \text{lian}...\text{dou}... (‘even … all…’) sentences and the mean acceptance rate of these four filler sentences is 5.02; there are two completely ill-formed \text{lian}...\text{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 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 \text{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 \text{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)](image)

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.

\(^4\) 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.

Table 2. The stimuli paradigm of Experiment 2

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

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 subtrigging 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).

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]

<table>
<thead>
<tr>
<th>Gaomei</th>
<th><em>du-guo</em></th>
<th>Tangling</th>
<th><em>mei</em></th>
<th><em>du-guo</em></th>
<th><em>de</em></th>
<th><em>renhe</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaomei</td>
<td><em>read-PFV</em></td>
<td>Tangling</td>
<td><em>not</em></td>
<td><em>read-PFV</em></td>
<td>REL</td>
<td><em>any</em></td>
</tr>
<tr>
<td><em>kehuan</em></td>
<td><em>xiaoshuo.</em></td>
<td><em>science</em></td>
<td><em>fiction</em></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

‘Gaomei read any science fiction that Tangling did not read.’

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

<table>
<thead>
<tr>
<th>Gaomei</th>
<th><em>mei</em></th>
<th><em>du-guo</em></th>
<th>Tangling</th>
<th><em>du-guo</em></th>
<th><em>de</em></th>
<th><em>renhe</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaomei</td>
<td><em>not</em></td>
<td><em>read-PFV</em></td>
<td>Tangling</td>
<td><em>read-PFV</em></td>
<td>REL</td>
<td><em>any</em></td>
</tr>
</tbody>
</table>

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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.
iimmigration 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.
iimmigration 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
‘The President of France approves any proposal that restrains family-based immigration.’

(30) D4: [no RC, declarative verb, NEG_matrix, renhe_head-of-RC]
\[\text{Faguo zongtong bu zancheng renhe ti’an.}\]
‘The President of France does not approve any proposal.’

(31) D5: [no RC, declarative verb, NEG_none, renhe_head-of-RC]
\[\text{Faguo zongtong zancheng renhe ti’an.}\]
‘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.

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](image-url)

**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; Vassishth 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) report 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 subtriggings 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-gu 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 subtriggings 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 subtriggings 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 subtriggings effect, and non-veridical context is a sufficient but not necessary condition for proper licensing of renhe.
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

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Abbreviations

<table>
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<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tr>
<td>CLF</td>
<td>classifier</td>
</tr>
<tr>
<td>PFV</td>
<td>perfective</td>
</tr>
<tr>
<td>Q</td>
<td>question particle/marker</td>
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<td>REL</td>
<td>relative</td>
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</table>

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
‘Zhouting 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 develop 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 enjoy-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 zhige de jiaoliangyuan.
Zhengzhi not investigate-PFV not acquire-PFV any professional license REL coach
‘Zhengzhi did not investigate the coach who did not acquire any professional license.’

(53) Yuanda-jiaoxiao mei pingqiu-guo de na-ming-jiaoliangyuan mei kaoqu-guo renhe zhuanye zige.
Yuanda-driving-school not hire-PFV REL that-CLF-coach not 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
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) Linxiaou kan-guo Yenan kan-guo de renhe
Linxiaou watch-PFV Yenan watch-PFV REL any
mingxing yanchanghui.
star concert
‘Liuxiaou 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) **Linxiaou, kan-guo renhe mingxing yanxanghui.**
Linxiaou watch-PFV any star concert
‘Linxiaou watched any star concert.’

(60) **Yuwei xiangshou-guo Mengdaizi xiangshou-guo de**
Yuwei enjoy-PFV Mengdaizi enjoy-PFV REL
renhe zhuanjia daiyu.
any expert benefit
‘Yuwei enjoyed any benefit to experts that Mengdaizi 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, Zhashans dedao-guo**
being-undergraduate when, Zhashans receive-PFV
Lisi dedao-guo de renhe rongyujiangli.
Lisi receive-PFV REL any award
‘While being an undergraduate, Zhashans 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, Zhashans dedao-guo**
being-undergraduate when, Zhashans 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 renhe zhuanye 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.’

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