

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

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Outline

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What we've known about *renhe*

Renhe in Mandarin has two functions like its counterpart *any* in English: a negative polarity item (NPI) and a free choice item (FCI). (Wang 1993; Wang & Hsieh 1996; Kuo 2003; Cheng & Giannakidou 2013; Shyu 2016).

An NPI *renhe* needs to be licensed by a negative markers (1), or non-veridical contexts, such as *yes/no* questions.

- (1) 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)

Renhe can be interpreted as an FCI when it is within the scope of modals or it is in subject position and co-occurs with *dou* 'all' (2).

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

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What if there is a relative clause environment

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.

Research question 1: NPI illusion effect

a relative clause creates an intruding licensing environment for polarity items (e.g., Parker & Phillips 2016).

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

What if there is a relative clause (RC) environment

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.

Research question 2: Subtriggering effect

A polarity item can be triggered by a subordinate clause (LeGrand 1975:54-69; Dayal 1998, 2004).

- (4) a. *She bought anything from Carson's.
- b. She bought anything [she needed] at Carson's. (LeGrand 1975: 54)

What about the licensing of *renhe* in a RC environment

Very few studies, however, have discussed these two research questions regarding *renhe* in Mandarin.

- ▶ Wang (1993) and Yang (2008) report that the matrix negation licenser can license *renhe* in RC (5), 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 RC, in particular, the NPI illusion effect.

(5) 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)

What about the licensing of *renhe* in a RC environment

- ▶ Wang (1993) and Giannakidou & Lin (2016) mention that *renhe* can be interpreted as an FCI when it is modified by a RC, even if it is a non-negative context.
 - (6) Wo xihuan renhe *(youqu de) shu.
I like any interesting REL book
'I like any book that is interesting.' (Wang 1993: 267)
 - (7) 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)
- ▶ However, supporting examples given in those papers involve other factors to consider, such as whether an adjective should be regarded as a RC (6), and whether the licensing of *renhe* is triggered by the modal *neng* 'can', instead of the RC (7).

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Research questions

The present experimental study explores the licensing effects of *renhe* in a RC environment to answer the following questions.

Question 1

Does there exist an illusion effect of licensing *renhe* when the negation licenser only linearly precedes *renhe* but does not c-command it?

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

Research questions

Question 2

Does the subtrigging effect still hold when other potential licensors (e.g. negation, modals) are absent?

- (9) 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.'

Methodology

Two untimed, offline acceptability judgment experiments were conducted in this study.

- ▶ through the Qualtrics online survey tool.
- ▶ acceptability judgment tasks using a 7-point scale. (0: least acceptable, 6: most acceptable).
- ▶ data were processed in R software (version: 3.4.0, R Development Core Team 2017) using lme4 package (version 1.1-15, developed by Ben Bolker, Steve Walker, and Martin Mächler).
- ▶ a linear mixed-effects model with a fixed factor 'Condition' and random effects 'participant' and 'set' was performed to check the statistical significance of differences among conditions (Winter 2013).

Experiment 1: Stimuli design

- ▶ two factors for the stimuli: the position of *renhe* (inside the RC or not) and the position of the sentential negation maker (NEG) *mei* (inside the RC, in the matrix clause, both, or neither).
- ▶ 8 conditions in total ($=2*4$)
- ▶ in all the stimuli, “renhe-NP” was in the object position of either the RC or the matrix clause.
- ▶ Abstract mass nouns for the NPs and past tense which favors an episodic interpretation (Parker & Phillips 2016).
- ▶ 8 sets of 8 sentences (one sentence for each condition in each set) were created 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

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Experiment 1: Stimuli design

Condition	Position of NEG	Position of <i>renhe</i>	Structure of the target sentence
CON1	Emb.	Emb.	NP V [_ NEG V <i>renhe</i> NP] <i>de</i> NP
CON2	Matrix	Emb.	NP NEG V [_ V <i>renhe</i> NP] <i>de</i> NP
*CON3	None	Emb.	NP V [_ V <i>renhe</i> NP] <i>de</i> NP
CON4	Both	Emb.	NP NEG V [_ NEG V <i>renhe</i> NP] <i>de</i> NP
*CON5	Emb.	Matrix	[_ NP NEG V] <i>de</i> DP V <i>renhe</i> NP
CON6	Matrix	Matrix	[_ NP V] <i>de</i> DP NEG V <i>renhe</i> NP
*CON7	None	Matrix	[_ NP V] <i>de</i> DP V <i>renhe</i> NP
CON8	Both	Matrix	[_ NP NEG V] <i>de</i> DP NEG V <i>renhe</i> NP

Figure: Stimuli Design of Experiment 1

Experiment 1: Stimuli design

A sample set of stimuli

- (10) CON1: 张三听说过 [没得到过任何官方认可的] 艺术家。
CON2: 张三没听说过 [得到过任何官方认可的] 艺术家。
*CON3: 张三听说过 [得到过任何官方认可的] 艺术家。
CON4: 张三没听说过 [没得到过任何官方认可的] 艺术家。
*CON5: [编辑们没推荐过的] 那本书得到过任何官方认可。
CON6: [编辑们推荐过的] 那本书没得到过任何官方认可。
*CON7: [编辑们推荐过的] 那本书得到过任何官方认可。
CON8: [编辑们没推荐过的] 那本书没得到过任何官方认可。

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*CON7: [编辑们推荐过的] 那本书得到过任何官方认可。
CON8: [编辑们没推荐过的] 那本书没得到过任何官方认可。

Experiment 1: Stimuli design

The display sample of the online survey

5. 可接受度判断测试题：请根据语感对下面这个句子的接受度作出判断。
0表示完全不接受，6表示完全接受，0到6接受程度逐渐提高。

Instructions

张三听说过没得到过任何官方认可的艺术家。

Target sentence

7-point
scale

0 完全不接受

1

2

3

4

5

6 完全接受



Experiment 1: Data analysis and results

- ▶ Among the fillers we included in this experiment, the mean acceptance rate of four completely well-formed *lian...dou...* ('even ... all...') sentences is 5.02; the mean acceptance rate of two completely ill-formed *lian...dou...* sentences is 0.79.
- ▶ The middle point 3 is chosen as the baseline for acceptance score.
- ▶ The statistical significance of differences between any two conditions was checked through the likelihood test **anova (fm.full, fm.reduced)** (Winter 2003).
 - 1 **fm.full** <- lmer(response ~ condition + (1|participant) + (1|set), data=data, REML=FALSE)
 - 2 **fm.reduced** <- lmer(response ~ (1|participant) + (1|set), data=data, REML=FALSE)

Experiment 1: Data analysis and results

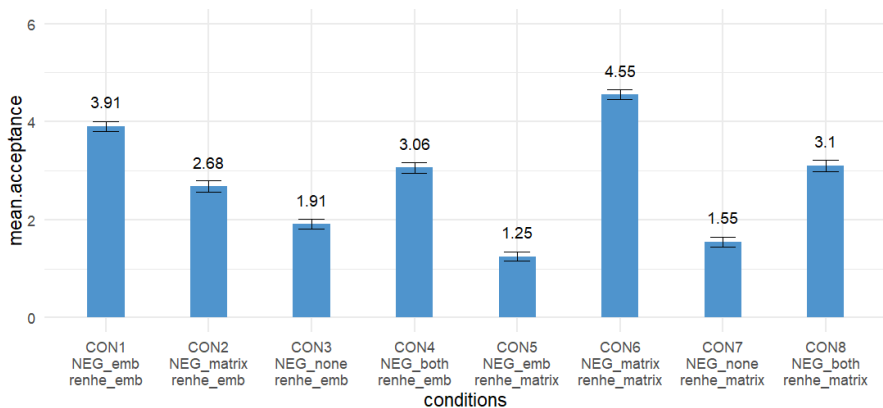
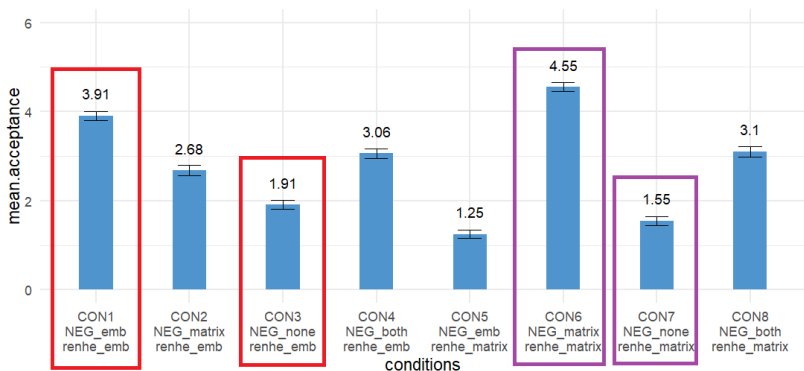


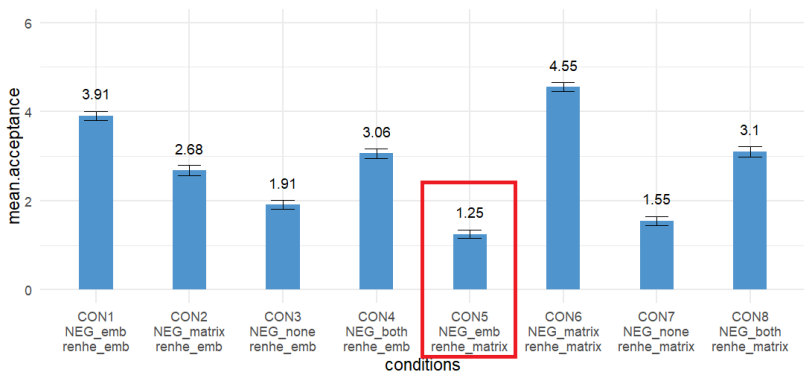
Figure: Mean acceptability rates of Experiment 1 (N=322, 196 female participants, avg. age: 25.6)

Experiment 1: Data analysis and results



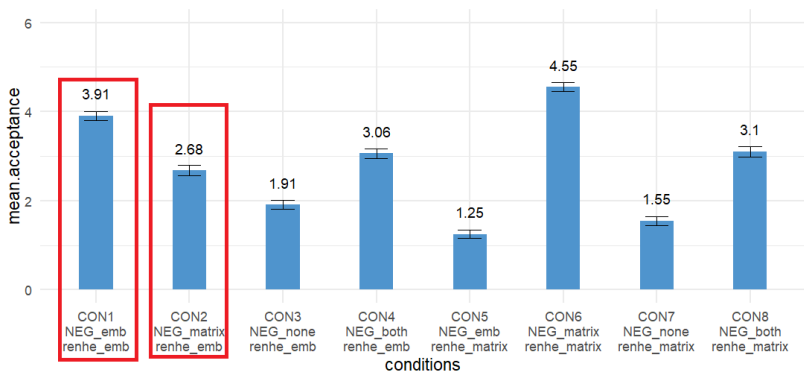
- The acceptance rates of the unlicensed conditions, CON3 and CON7, were significantly lower than their corresponding minimal pairs, CON1 and CON6, respectively ($p < 0.001$). Hence, a negation licenser is required (e.g. Wang 1993).

Experiment 1: Data analysis and results



- ▶ The acceptance rate of the illusive condition (CON5) was significantly lower than all other seven conditions ($p < 0.005$). Hence, in an untimed task, sentential negation and *renhe* do not elicit an illusory licensing effect.

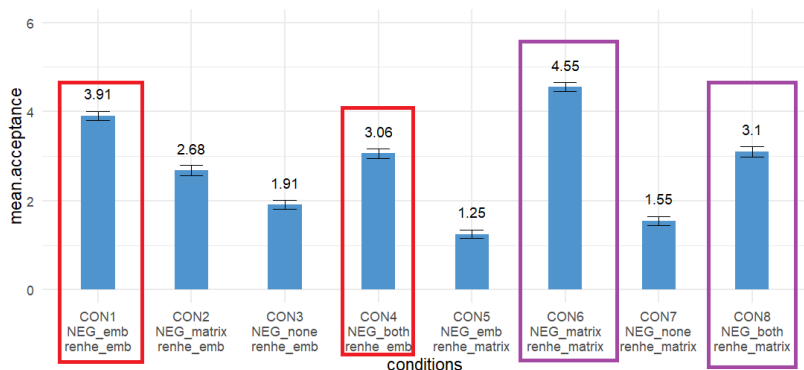
Experiment 1: Data analysis and results



- ▶ The acceptance rate of CON2 was significantly lower than CON1, although both of them were properly licensed by c-commanding negation ($p < 0.001$). It suggests that **long-distance licensing** results in high processing difficulty, even in an offline task.

Experiment 1: Data analysis and results

- ▶ The comparison between CON1 and CON4 ($p < 0.001$) suggests that structural complexity (esp. multiple negation) is another factor for processing *renhe*. Similarly for the contrast between CON6 and CON8.



Experiment 2: Stimuli design

- ▶ 8 conditions depending on three main factors: whether there is a 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 RC, 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.

Experiment 2: Stimuli design

- ▶ Different kinds of verbs were used depending on the gap type of the RC.
 - 1 RC gap-object:

action verbs such as *du* 'read' and *dedao* 'receive' associated with a perfective aspect marker *guo*, to make the stimuli consistent with the typical subtriggering example first mentioned in LeGrand (1975).
 - 2 RC gap-subject:

to make the stimuli sound pragmatically natural and avoid the potential influence of *dou* and modals, 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)

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Experiment 2: Stimuli design

- ▶ The two kinds of verbs for the conditions without RCs were balanced for two reasons:
 - 1 to incorporate the two kinds of verbs used for conditions where there is an RC
 - 2 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.

Experiment 2: Stimuli design

	Condition	RC gap	Position of NEG	Matrix verb	Structure of the target sentence
1	P1	Obj.	Emb.	perfective	NP V [NP NEG V _] <i>de renhe</i> NP
2	P2	Obj.	Matrix	perfective	NP NEG V [NP V _] <i>de renhe</i> NP
3	P3	Obj.	None	perfective	NP V [NP V _] <i>de renhe</i> NP
4	D1	Sub.	Emb.	declarative	NP V [_ NEG V NP] <i>de renhe</i> NP
5	D2	Sub.	Matrix	declarative	NP NEG V [_ V NP] <i>de renhe</i> NP
6	D3	Sub.	None	declarative	NP V [_ V NP] <i>de renhe</i> NP
7	P4	/	Matrix	perfective	NP NEG V <i>renhe</i> NP
	D4	/	Matrix	declarative	NP NEG V <i>renhe</i> NP
8	P5	/	None	perfective	NP V <i>renhe</i> NP
	D5	/	None	declarative	NP V <i>renhe</i> NP

Experiment 2: Stimuli design

A sample set of stimuli

- (11) P1: 高梅读过 [唐玲没读过的] 任何科幻小说。
P2: 高梅没读过 [唐玲读过的] 任何科幻小说。
P3: 高梅读过 [唐玲读过的] 任何科幻小说。
D1: 法国总统赞成 [不限制亲属移民的] 任何提案。
D2: 法国总统不赞成 [限制亲属移民的] 任何提案。
D3: 法国总统赞成 [限制亲属移民的] 任何提案。
P4: 高梅没读过任何科幻小说。
P5: 高梅读过任何科幻小说。
D4: 法国总统没赞成任何提案。
D5: 法国总统赞成任何提案。

Experiment 2: Stimuli design and procedure

- ▶ The stimuli consisted of 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 same procedure from Experiment 1 was used.
- ▶ This experiment was launched two weeks after the data collection for Experiment 1.

Experiment 2: Data analysis and results

- ▶ Data were processed in the way as in Experiment 1.

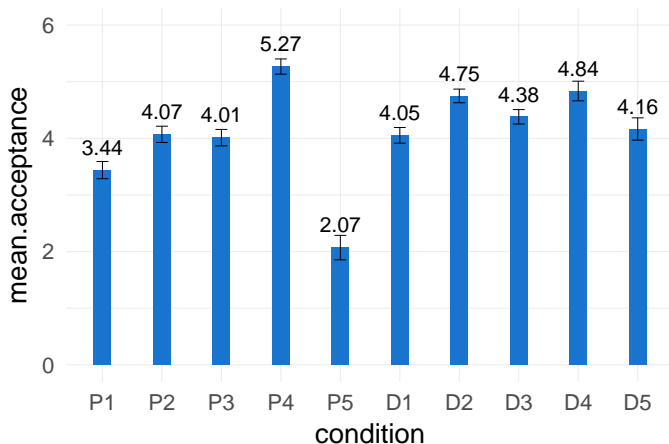


Figure: Mean acceptability rates of Experiment 2 (N=177, female participants: 122, avg. age: 24)

Experiment 2: Data analysis and results

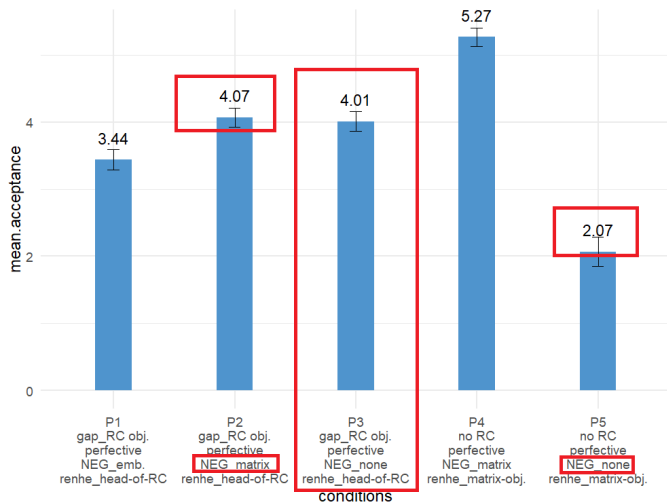


Figure: Mean acceptability rates of conditions with a perfective marker in Experiment 2 (for P1, P2, and P3, N=171; for P4 and P5, N=86)

Experiment 2: Data analysis and results

- ▶ The acceptance rate of P5 was significantly lower than that of any other condition ($p < 0.001$).
- ▶ Compared with P5, the mean acceptability rate of P3 was significantly higher ($p < 0.001$). Hence, *renhe* improves when modified by a relative clause and confirms the existence of the subtriggering effect of *renhe*.
- ▶ 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.

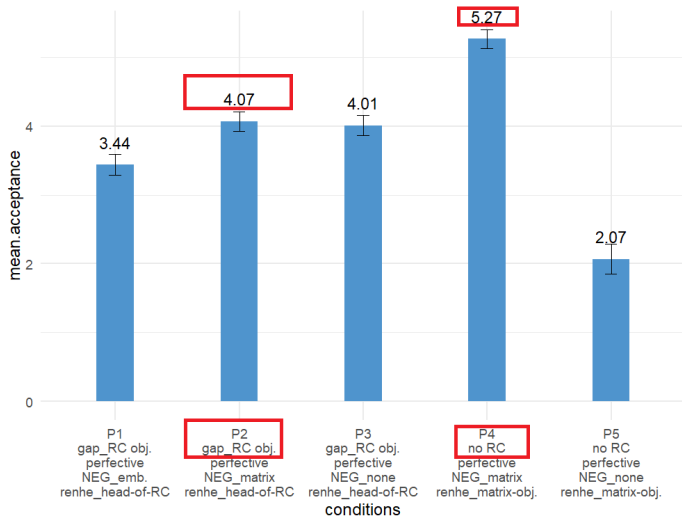
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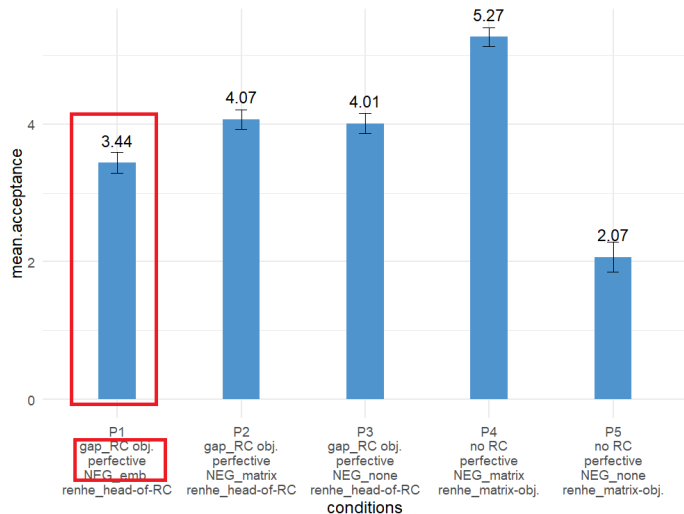
Experiment 2: Data analysis and results



Experiment 2: Data analysis and results

- ▶ The influence of structural complexity on the acceptance rate is also shown in the comparison between P2 and P4 ($p < 0.001$).
- ▶ For sentences in P2 and P4, there was a negation licenser c-commanding *renhe*. But sentences in P2 are structurally more complicated than those in P4, because *renhe* in P2 is modified by a RC.

Experiment 2: Data analysis and results



Experiment 2: Data analysis and results

- ▶ 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 ($p < 0.001$).

Experiment 2: Data analysis and results

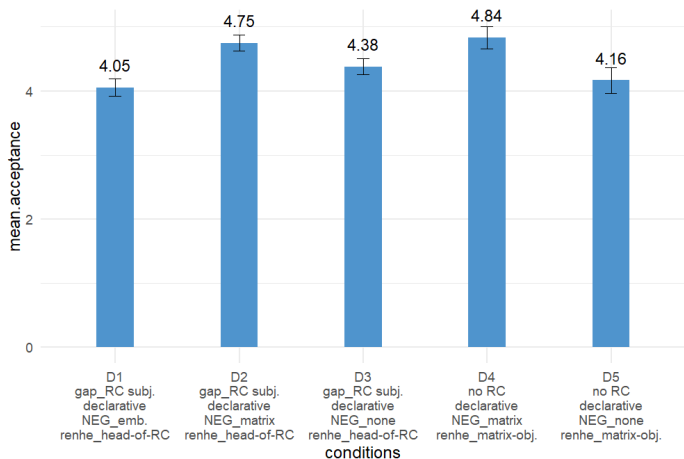


Figure: Mean acceptability rates of conditions with declarative verbs in Experiment 2 (for D1, D2, and D3, N=171; for D4 and D5, N=85)

Experiment 2: Data analysis and results

- ▶ The mean acceptability rate of D5, the condition without a RC modifying *renhe*, was 4.16 , 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**.
- ▶ Different from what has been claimed in the literature:
 - ▶ Cheng & Giannakidou (2013): *renhe* cannot co-occur with directive intentional verbs (such as *jianchi* ‘insist’) or epistemic intentional verbs (such as *yiwei* ‘think’).
 - ▶ Lin & Giannakidou (2015): no usage of *renhe* in the complement of non-factive predicates (including intentional verbs) is found in the Chinese Internet Corpora.
- ▶ *renhe* can be in the scope of a non-factive predicates (more precisely, declarative verbs).

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- ▶ *renhe* can be in the scope of a non-factive predicates (more precisely, declarative verbs).

- ▶ D5 was mostly judged as well-formed; thus, it is unclear the role of RC environment in D3. It could be the case that the declarative verbs and the RC environment together contribute to the proper licensing of *renhe* in D3.
- ▶ Similarly for D1. The licensing of *renhe* in D1 is not from the negation maker (no c-commanding relation), but rather comes from the relative clause environment and/or the matrix declarative verbs.

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.

- 1 No illusion effect of *renhe* was found in an offline task.
- 2 Locality and structural complexity affect processing of *renhe*.
- 3 The existence of the subtriggering effect of *renhe* was confirmed.
- 4 The declarative verbs can license *renhe*.

No illusion effect in an offline task

- ▶ 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.
 - ▶ NPI illusion effects may be elicited in online processing in English (Drenhaus et al. 2005; Vasishth et al. 2008; Xiang et al. 2009; Parker and Phillips 2016).
 - ▶ 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 (Yun et al. 2017).

Further research

whether the NPI types, the negation types, and the task types are responsible for the existence of NPI illusion in Mandarin.

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Locality and structural complexity affect processing

- ▶ In Ex.1, the lower acceptance rate of the non-local licensing condition (CON2) compared with the acceptance rate of the corresponding local licensing condition (CON1) is consistent with the findings of a recent ERP study on Turkish NPI processing (Yanilmaz & Drury 2018). Hence, **locality** plays a crucial role in the processing of NPI licensing, even in an offline task.
- ▶ Sentences with double negation (CON4 and CON8) were rated much lower than the sentences with single negation (CON1 and CON6), which is expected under the argument that negation by itself increases processing difficulty (Kaup, Zwaan & Ludtke 2007; Tian & Breheny 2016).

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Locality and structural complexity affect processing

- ▶ 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) ($p < 0.01$).
- ▶ CON1 (embedded negation and embedded NPI) were rated significantly lower than sentences in CON6 (matrix negation and matrix NPI), which suggests an asymmetry between embedded relative clause environment and matrix clause environment for NPI licensing processing (c.f. Yanilmaz & Drury (2017)).

The subtriggering effect exists

This suggests that the claim that *renhe* must be licensed in non-veridical environments is too strict (cf. Cheng & Giannakidou 2013).

- ▶ **Further research:** whether the subtriggering effect can also be found in adjectives and prepositional phrases (Dayal 1998, 2004; Jayez & Tovenà 2005); whether subtriggered sentences of *renhe* are derived from conditional meanings (LeGrand 1975; Quer 1998; Giannakidou 2001).

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One may argue that the proper licensing of *renhe* in the subtriggering cases like (12) results from the property of the perfective marker *guo*, based on a proposal made in Cheng & Giannakidou (2013).

- (12) Zhangsān chī-guō Lisi chī-guō de rēnhe dōngxi.
 Zhangsān eat-PFV Lisi eat-PFV REL any thing
 'Zhangsan ate anything that Lisi ate.'
- (13) a. *Rēnhe-rēn dōu jìn-lái-lē.
 any-person all enter-come-PFV
 'Anyone came in.' (Cheng & Giannkidou 2013: 134)
- b. Rēnhe-xuēshēng dōu jìn-lái-guō.
 any-student all enter-come-PFV
 'Anyone has come in (at least once before).' (Cheng & Giannkidou 2013:137)

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 Zhangsan eat-PFV Lisi eat-PFV REL any thing
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- (13) a. *Renhe-ren dou jin-lai-le.
 any-person all enter-come-PFV
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- b. Renhe-xuesheng dou jin-lai-guo.
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The subtriggering effect exists

According to Cheng & Giannakidou (2013: 137), *guo* can create a non-episodic and non-veridical environment for *renhe*. Because it “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)”.

But, the proposal suggested in Cheng & Giannakidou (2013) cannot explain why participants rejected sentences like (14) where *guo* was present. The acceptability of (15) can not be explained by this proposal either.

(14) *Gaomei du-guo renhe kehuan xiaoshuo.
 Gaomei read-PFV any scientific fiction
 ‘Gaomei read any science fiction.’

(15) 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.’

The subtriggering effect exists

Further research

- ▶ whether the subtriggering effect can also be found in adjectives and prepositional phrases (Dayal 1998, 2004; Jayez & Tovena 2005);
- ▶ whether subtriggered sentences of *renhe* are derived from conditional meanings (LeGrand 1975; Quer 1998; Ginnakidou 2001).
- ▶ how the subtriggering effect of *renhe* is triggered, including a comparative study of the Mandarin *renhe* and the English *any* with respect to their subtriggering effects.

The declarative verbs can license *renhe*

The results provide experimental evidence showing 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 (Wang 1993; Cheng & Giannakidou 2013; Lin & Giannakidou 2015).

- (16) Ta zancheng renhe ti'an.
he approve any proposal
'He approves any proposal.'

The declarative verbs can license *renhe*

Two conjectures on declarative verbs licensing *renhe*

- 1 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, section 4.4.4.3; Xiang 2016: chapter 4)
- 2 the absence of aspect markers in sentences like (16) also contributes to the proper licensing of *renhe*:
 - ▶ habitual rather than a specific individual event, hence providing a non-veridical context.
 - ▶ (16) is degraded if we add a perfective maker (e.g., Duffley & Larrivéé 2019: usage of *any* in veridical factive contexts and the licensing of *any* is based on at-issue content)

Main results of the experiments

- ▶ NPI illusion effects do not appear in Mandarin in untimed offline text processing;
- ▶ the subtriggering effect of *renhe* holds when *renhe* is modified by a relative clause, even in a veridical context;
- ▶ *renhe* can be licensed by certain types of declarative verbs, such as *tongyi* 'agree', *zancheng* 'approve'.

Theoretical implications

- 1** 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*.
- 2** non-veridical contexts provide licensing environments for *renhe* (Cheng & Giannakidou 2013). This study extends the relevant non-veridical contexts to the declarative verbs that have not been previously discussed.
- 3** 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.

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