TO EXHAUST, OR NOT TO EXHAUST: AN EXPERIMENTAL STUDY ON MANDARIN *Shi*-CLEFTS

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1 Introduction

Mandarin *shi*-clefts (henceforth SC) have long been recognized as the Mandarin counterpart of English *it*-clefts (Teng, 1979; Huang, 1982; Shi, 1994 among many others). Similar to English *it*-clefts, SCs also encode three meaning components: the existential presupposition, the identificational assertion, and exhaustivity, as illustrated in (1).

(1) Shi [Xiaogao he Xiaopang]_{CLEFT FOCUS} [chidao le.]_{CLEFT CLAUSE} SHI Xiaogao and Xiaopang late ASP
'It is Xiaogao and Xiaopang who were late.'¹
Existential presupposition: There is someone who was late. Identificational assertion: Xiaogao and Xiaopang were late.
Exhaustivity: Besides Xiaogao and Xiaopang, no one else was late.

It is generally agreed that the first two meaning components of clefts should be placed in presupposition and assertion respectively (e.g. É Kiss, 1998), but the status of exhaustivity triggers much debate. Two camps have been formed regarding this issue: the semantics camp, which first regards this meaning component as assertion (e.g. É Kiss, 1998) and later as presupposition (e.g. Percus, 1997; Velleman et al., 2012; and Križ, 2015), and the pragmatics camp, which considers exhaustivity as a conversational implicature (e.g. Xue and Onea, 2011; DeVeaugh-Geiss et al., 2015).

Back to Mandarin, although many have discussed the first two meaning components of *shi*-clefts (e.g. Teng, 1979; Lee, 2005; Cheng, 2008; Hole, 2011), the status of exhaustivity is less

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¹Glosses: ASP: aspectual marker, LOC: localizer, CL: classifier, DE: possessive marker (when used in the same sentence with *shi*, it marks the cleft clause), SHI: cleft-focus marker (*shi* can also be used as a copula, in which case the lexicon is glossed as *be*), $[\alpha]_{\rm F}$: focused constituent

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examined; some have even argued that *shi*-clefts are not exhaustive at all (Paul and Whitman, 2008).

This study, therefore, sets out to investigate the exhaustivity of *shi*-clefts with experimental methods. In what follows, we will first review the debate on the exhaustivity of clefts that motivate this study. Section 3 to 5 present three experiments targeting at the assertion, conversational implicature and presupposition hypotheses respectively. Finally, we conclude in Section 6.

2 Three Hypotheses on the Exhaustivity of Clefts

2.1 Assertion Hypothesis

Based on the similarities between clefts and exclusive particle *only*, É Kiss (1998) among others proposes that the exhaustivity of clefts is part of its assertion. Lee (2005) applies this analysis to Mandarin *shi*...*de* clefts, as illustrated in (2). If *shi* is the same as *shi*...*de*, then *shi* clefts should also assert the exhaustive inference.

(2) Shi [Zhangsan]_F da Lisi de. SHI Zhangsan beat Lisi DE
'It was Zhangsan that beat Lisi.' Presupposition: 'Someone beat Lisi.' Assertion: The 'someone' equals Zhangsan; Except Zhangsan, there are no other people who beat Lisi.' Lee (2005:p. 95)

2.2 Conversational Implicature Hypothesis

Observing the disparity between the exhaustivity of *it*-clefts and that of *only*, Horn (1981) proposes that this meaning component is a generalized conversational implicature, calculated from the Maxim of Quantity. This proposal finds support in recent experimental studies (e.g. Byram-Washburn et al., 2013; Destruel et al., 2015; DeVeaugh-Geiss et al., 2015). These studies show that (i) under certain contexts, cleft sentences give rise to non-exhaustive interpretation (Byram-Washburn et al., 2013; Onea and Beaver, 2009; DeVeaugh-Geiss et al., 2017 among others); (ii) contradicting clefts' exhaustivity is processed differently from contradicting the assertion or the presupposition of *only* (DeVeaugh-Geiss et al., 2015).

2.3 Presupposition Hypothesis

Drawing on the close relationship between definiteness and exhaustivity, the referential account (Percus, 1997; Hedberg, 1990) proposes that the exhaustivity of clefts is derived from the maximality presupposition of a definite expression formed by the cleft pronoun *it* and the cleft clause. Following this line of research, Büring and Križ (2013) analyze clefts as having a homogeneity presupposition similar to definite plurals, and thus violating exhaustivity leads to the same consequence as violating the homogeneity of definite plurals. For example, (3) presupposes that the plural entity [Peter and Tom] is not a proper part of the sum of all the individuals being late; i.e. either Peter and Tom are the only individuals being late or they are not late at all. Combined with the assertion *Peter and Tom are late*, the second conjunct is falsified, deriving the exhaustivity: Peter and Tom are the only people who were late.

From another perspective, the question-based account cuts the connection between definite descriptions and clefts (Velleman et al., 2012). Defining clefts as an inquiry terminating (IT) construction, Velleman et al. (2012) assign two focus-sensitive operators MAX (*no true answer is strictly stronger than p*) and MIN (*there is a true answer at least as strong as p*) to *it*-clefts. What *it*-cleft presupposes is the *max* operator, but the exhaustivity comes from the combination of both operators.

In summary, the assertion proposal draws an analogy between *zhiyou* and SC, which predicts that the exhaustivity affects the truth-conditions of these two structures in the same way. The conversational implicature hypothesis would predict that the exhaustivity of SC is cancelable. If the exhaustivity of SC is presupposed, it should pattern in the same way as the maximality presupposition of definite expressions. We will use three experiments to compare these three hypotheses.

3 Experiment 1

Experiment 1 aims at comparing Mandarin speakers' acceptance to exhaustive inference in *shi*-clefts (SC) with two other constructions: restrictive particles *zhiyou* (ZY) and plain focus sentences (PF). It has been acknowledged that ZY (4) asserts while PF (5) conversationally implicates exhaustivity.

- (4) Only $[Mary]_F$ was late. \rightarrow Besides Mary, no one else was late.
- (5) A: (Among Mary, Peter, and Susan,) who was late?
 B: [Mary]_F was late.
 → Besides Mary, no one else was late.

In a neutral context, speakers should assign a higher degree of acceptance to asserted exhaustivity than other types of exhaustivity, while conversationally implied exhaustivity may not even arise and thus should receive a relatively low score.

With this assumption, Experiment 1 aims to: (i) draw a general picture of how exhaustivity is perceived among these three constructions in Chinese; (ii) examine whether Mandarin SC encodes exhaustivity, and if the answer is yes then (iii) evaluate the above hypotheses (assertion, conversational implicature, and presupposition hypothesis) on the exhaustivity of *shi*-clefts.

3.1 Methods

This experiment employs an inference judgment task presented as a web-based questionnaire. Sixty-one speakers of Mandarin (age: 23 to 58, mean 31) were recruited.

In each trial, participants are first asked to read a short background description (6), and listen to a conversation between two people, the elicitation utterance (7) and the target utterance (8). After the audio ends, an inference on the conversation led by *Oh*, *I think I know what she/he meant*... appears on the screen, illustrated by (9). The task is to judge whether this inference is acceptable in the given scenario on a scale of 1 to 5, with 1 being the least acceptable. A fictional character David, who is a non-native speaker of Mandarin, is set up to deliver the target utterance, in order

to justify potential unacceptable inferences. The testing sentences are presented as audio stimuli to avoid ambiguities caused by different focus assignments.

(6) *Scenario*

David is consulting his colleague Bai Lili on the regulations about annual leave.

- (7) David: Wo ting-shuo zhezhou women xiaoshoubu de yuangong keyi qing nianjia.
 I hear-ASP this week us sales DE employee can apply annual leave
 'I heard that we employees from sales can apply for annual leave'
- (8) Testing Sentence
 Bai Lili: Zhezhou, shi [shichangbu de yuangong]_F keyi qing nianjia.
 this week SHI marketing DE employee can apply annual leave
 'This week, it is employees from marketing who can apply for annual leave.'
- (9) *Inference*David thinks: Oh, I think I know what she meant. The other people cannot apply for annual leave this week.

In this experiment, twelve sets of scenarios are created. Each target utterance underwent four permutations: *zhiyou* 'only' sentences (ZY), *shi*-clefts (SC), plain focus sentences (PF), and simple SVO sentences (referred to as canonical sentences, CN), as illustrated by (10). Before the experiment begins, the participants were given three practice trials to familiarize them with the procedure. Four types of filler sentences were used: *cai* 'even,' double negation, universal quantifier, propositional attitude verb *yiwei* 'falsely believe.' Together, the 96 items were assigned to six lists in a Latin square fashion. The sixteen items in each list were pseudo-randomized with thirty-six filler items.²

| a. | Zhezhou, zhiyou [shichangbu de yuangong] _F keyi qing nianjia. | |
|----|-----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | this week only marketing DE employee can apply annual leave | |
| | 'This week, only employees from marketing can apply for annual leave.' | ZY |
| b. | Zhezhou, shi [shichangbu de yuangong] _F keyi qing nianjia. | |
| | this week SHI marketing DE employee can apply annual leave | |
| | 'This week, it is employees from marketing who can apply for annual leave.' | SC |
| c. | Zhezhou, [shichangbu de yuangong] _F keyi qing nianjia. | |
| | This week Marketing DE employee can apply annual leave | |
| | 'This week, employees from marketing can apply for annual leave. | PF |
| d. | Zhezhou, shichangbu de yuangong keyi qing nianjia. | |
| | this week marketing DE employee can apply annual leave | |
| | 'This week, employees from marketing can apply for annual leave.' | CN |
| | a. b. c. d. | a. Zhezhou, zhiyou [shichangbu de yuangong]_F keyi qing nianjia. this week only marketing DE employee can apply annual leave 'This week, only employees from marketing can apply for annual leave.' b. Zhezhou, shi [shichangbu de yuangong]_F keyi qing nianjia. this week SHI marketing DE employee can apply annual leave 'This week, it is employees from marketing who can apply for annual leave.' c. Zhezhou, [shichangbu de yuangong]_F keyi qing nianjia. This week Marketing DE employee can apply annual leave 'This week, employees from marketing can apply for annual leave.' d. Zhezhou, shichangbu de yuangong keyi qing nianjia. this week marketing DE employee can apply annual leave. 'This week, employees from marketing can apply for annual leave.' |

²All audio stimuli and inference sentences were verified as grammatical by two native Mandarin speakers so that participants' judgment would not be interfered by grammaticality.

3.2 Predictions

- (i) If *shi*-clefts are exhaustive, it is expected that the acceptability of exhaustivity inference is significantly higher than that to the baseline, canonical sentences;
- (ii) Following the assertion hypothesis, the acceptability of exhaustivity of SC should pattern with ZY;
- (iii) Following the conversational implicature hypothesis, the acceptability of SC's exhaustivity should pattern with PF;
- (iv) If exhaustivity of SC is encoded otherwise, its acceptability should pattern with neither constructions.

3.3 Results

Results from sixty complete questionnaires are included in the analysis. The mean acceptability ratings of exhaustive inference of the four types of probing constructions are presented in Fig. 1. One-way ANOVA reveals that the difference among the four probing constructions is statistically significant (F = 137.9, p < 0.001). A post-hoc Bonferroni test suggests that the mean acceptability to exhaustive inference of SC (mean = 3.95) is significantly lower than that of ZY (mean = 4.62, p < 0.001), while higher than that of PF (mean = 3.39, p < 0.001). These three constructions all receive a higher acceptability to exhaustivity than CN (mean = 2.90, p < 0.001).

Figure 1: Exhaustivity in four types of sentences (means with confidence intervals 95%)



3.4 Interim Discussion

This experiment helps paint a general picture of how well exhaustivity inference of various constructions is received among Mandarin speakers. While PF, SC, and ZY sentences all elicit an

exhaustive interpretation, the levels of acceptability vary, suggesting that the status of exhaustivity of these three types of sentences differs from each other. Results from our experiment then fail to support the assertion and conversational implicature analysis of SC's exhaustivity, as SC patterned with neither ZY nor PF regarding the acceptability of exhaustive inference.

4 Experiment 2

Results from Experiment 1 suggest that exhaustivity of *shi*-clefts does not seem to be a conversational implicature based on the fact that it is perceived differently from that of *in-situ* PF, a prototypical conversational implicature. However, some have argued that this difference between SC and PF could be explained with independent reasons. One possibility is that the two constructions have different presuppositions (Zimmermann and Onea, 2011; Horn, 2016). A cleft has an existential presupposition, but *in situ* PF does not, and thus the former is associated with a stronger exhaustive effect. Another possible reason is the availability of focus projection. DeVeaugh-Geiss et al. (2015) suggest that, since clefts provide an ideal environment for information-enrichment, namely, they trigger a clearly designated QUD and a well-defined alternative set, cleft focus does not further project to other constituents. Lacking such conditions, focus in PF could project. If focus projects, the domain of alternatives becomes fuzzy; and thus PF is considered a "suboptimal environment for pragmatic enrichment" (DeVeaugh-Geiss et al., 2015:387).

With these two possible explanations in mind, we conducted a second experiment trying to further verify the pragmatic account. To this end, this experiment makes use of one of the hallmarks of conversational implicatures: cancelability, i.e. an implicature may be suspended in certain contexts (Grice, 1989). One such canceling context for conversational implicatures is a follow-up utterance that asserts the negation of the implicature (Grice, 1989). For example, in (11), the first utterance has an implicature *not all students came*, which is canceled by the second utterance which asserts that *all students came*.

(11) Some of my students came to the party. In fact, all of them came.

Following this logic, if the exhaustivity *no one else did p* can be canceled, an SC or PF utterance followed by *In fact, someone else did p too* would still be acceptable. As the exhaustivity of PF is recognized as an implicature, this experiment compares SC against PF. To avoid the aforementioned independent reasons, Experiment 2 adopts a different plain focus construction: answer to a *wh*-question. Similar to clefts, *wh*-elicited PF both carries an existential presupposition and has a clearly designated QUD that does not allow focus projection. As these independent reasons are controlled, if the results of SC still differ from PF, then the pragmatic account is not supported.

4.1 Method

This experiment adopts a felicity judgment task presented as a web-based questionnaire. Thirty-six Mandarin speakers (age: 21-36, mean: 25.7) were recruited.

In each trial, participants are asked to first read a short description of a scenario, and then listen to a short conversation consisting of a *wh*-question and its answer. To assist understanding, after the audio ends the written form of the answer part of the conversation appears on screen,

and the participants judge how acceptable the answer is on a scale from 1 to 5, with 1 being least acceptable. Before the experiment starts, the participants are given two practice trials to familiarize them with the procedure.

This task consists of 9 sets of testing scenarios, each with three permutations on the target sentence: ZY, SC, and PF. Each target sentence is composed of two conjuncts: the first varies with constructions, and the other is the follow-up in the form *In fact, someone else did it too*. The *wh*-question also contains two conjuncts: the first identifies all the alternatives *between A and B*. This conjunct is followed by a *wh*-question about the status of each alternative. An example is given in (12). All items were evaluated by two native speakers to make sure that the first conjunct of each target sentence is a felicitous answer to the *wh*-question. The testing and filler scenarios are then assigned to three lists in a Latin square fashion, such that each list displays nine testing scenarios and nine filler scenarios in a pseudo-randomized order.

(12) a. Bai Lili: Between Mo Yan and Yu Hua, who has published a new book?

Wh-question lead-in

 b. David: Shi Mo Yan chu-le xinshu; shishishang, Yu Hua ye chu-le xinshu. SHI Mo Yan publish-ASP new book; in fact, Yu Hua also publish-ASP new book 'It is Mo Yan who has published a new book; in fact, Yu Hua also has published a new book.'

4.2 Results

Thirty-five completed questionnaires are included in the analysis. The mean acceptability ratings of the three types of sentences are presented in Fig. 2. There is a statistically significant difference among constructions as determined by one-way ANOVA (F = 76.345, p < 0.01); a Bonferroni test reveals that the acceptability to cancelation continuation of PF (*mean* = 3.4) is significantly higher than that of SC (*mean* = 2.4, p < 0.001) and ZY (*mean* = 1.6, p < 0.001); SC and ZY also differ (p < 0.001).

4.3 Interim Discussion

This experiment shows that SC differs from ZY and PF regarding the cancelability of exhaustivity, which challenges the pragmatic account. As the current experiment uses PF elicited by *wh*-questions, which have existential presupposition in Horn's and Zimmerman and Onea's analyses, the difference between the two constructions cannot be explained by the presence/absence of existential presupposition. The second explanation from the pragmatic account, namely that SC differs from PF because the former is less optimal for pragmatic enrichment due to its clearly designated QUD, is also challenged. In this current experiment, all testing sentences are paired with *wh*-questions, so the domain of alternatives is clearly designated for both PF and SC. Therefore, we can conclude that our results challenge the conversational implicature hypothesis. Next, we move on to the presupposition hypothesis.

5 Experiment 3

In the previous experiments, we have entertained the assertion and conversational implicature hypotheses regarding the exhaustivity of SC; both hypotheses are rejected. Next, we will turn

Figure 2: Canceling exhaustivity in three structures (means with confidence intervals 95%)



to the presupposition hypothesis: exhaustivity is part of the presuppositional content of SC. To this end, a variant of the *Covered Box* paradigm (c.f. Huang et al., 2013) is conducted.

The Covered Box paradigm was first introduced to test participants' understanding of scalar implicatures (Huang et al., 2013). In this paradigm, participants are given two boxes or pictures and asked to choose the one that matches the testing sentence. Different from the prototypical forced-choice sentence-picture evaluation task, in this paradigm, one of the boxes is covered. By using such a decoy, if subjects assign a richer interpretation to a construction than its asserted content (e.g. the meaning *not all* to the scalar item *some*), they will be compelled to choose the covered box. This paradigm has since been used in testing non-truth-conditional meaning components, such as presuppositions (Bill et al., 2016; Schwarz et al., 2016; Zehr et al., 2016; Schwarz, 2015). Studies have also shown that this paradigm is sensitive to the differences between presuppositions and implicatures, since participants choose the covered box more often when the overt box violates a presupposition than when the overt box violates an implicature (Bill et al., 2016).

As the exhaustivity of clefts is narrowed down to the presupposition hypothesis and the converational implicature hypothesis, the Covered Box paradigm suits perfectly with our current purposes. Previously, Boell and Deveaugh-Geiss (2015) employ a modified Covered Box design to verify the presupposition hypothesis of cleft exhaustivity. They took up the assumption that to interpret a sentence with exhaustivity, we need to gather information about the status of all members of the alternative set. For example, to assign the correct interpretation to the sentence *only Tom put on a pullover*, we need to know whether the alternatives to Tom in the context, i.e. Max, Ben, and Jens, put on a pullover. In their experiment, subjects are asked to judge whether they need more information than "Tom put on a pullover" to verify a cleft sentence *It is Tom who put on a pullover*. They find that half of time people decide to ask for more information to judge the truthfulness of cleft sentences and definite descriptions like *He who put on a pullover is Tom*, whereas for *only*, they always seek more information to make a judgment. From these results, they

conclude that exhaustivity of clefts are perceived in the same way as the uniqueness presupposition of definite descriptions.

Boell and Deveaugh-Geiss's experimental design addresses the question that when the information entailed by the presupposition is absent, do speakers seek the information? However, their results are ambiguous with regard to whether speakers assign exhaustive interpretation: when speakers stop seeking information, it is equally likely that they have already accommodated exhaustivity or they do not interpret the construction with exhaustivity at all. In the latter case, we cannot assume that speakers presuppose exhaustivity, because for them, clefts are simply not exhaustive. Therefore, it will be interesting to test the presupposition hypothesis in another setting: whether it will be accommodated when the meaning is apparently violated. If speakers accommodate the violation of exhaustivity the same way as they accommodate for the uniqueness presupposition of definite description, then we can add more weight to the presupposition hypothesis.

In this study, then, we adopt the Covered Box paradigm in a different form, with a covered picture (a black box) and an overt picture of a scenario where exhaustivity is violated. If speakers accommodate exhaustive presupposition, they would choose the covered box. If they do not assign exhaustivity to clefts, they would go for the overt picture. Since they do not have to judge the non-exhaustive scenario as a clear-cut "False," we bypass the issue that violating presupposition is sometimes assigned a third value. Also, since Covered box is sensitive to the distinction between presupposition and conversational implicature, we could pinpoint the status of exhaustivity by pitching it against PF.

Besides SC, ZY and PF, this experiment uses another construction as a comparison: pseudoclefts (PC), as in (13). The structure of PC can be decomposed into two parts: the cleft clause in the form of a headless relative clause, and the cleft focus. *Shi*, interpreted as a copula here, connects these two parts. According to den Dikken (2006), PC with a copula and a referring cleft focus in (13) denotes a sepcificational relation, with the cleft clause interpreted as a definite DP (see also Hedberg, 2000). Thus, the headless relative clause in PC is definite and shares the same maximality presupposition of definite expression. When paired with a scenario where there are more than one person being late, the maximality presupposition is violated, rendering (13) less acceptable. If the exhaustivity of SC is a presupposition, speakers should treat this meaning component in the same way as the maximality of PC. Therefore, by comparing the two constructions, we would be able to test the presupposition hypothesis of exhaustivity.

 (13) [Chidao le de]_{CLEFT} CLAUSE shi [Zhangsan]_{CLEFT} FOCUS· late ASP DE SHI Zhangsan
 '(The person) who was late is Zhangsan.'
 → Maximality: There exists a maximal entity that satisfies the predicate "being late."

5.1 Method

This experiment adopts a variant of Covered Box paradigm. The task is designed as a guessing game between two fictional children, Xiaoxiao and Taoqi, and the participants. The participants are given two pictures and asked to guess which picture is described by Xiaoxiao and Taoqi. Different from forced-choice tasks, one of the two pictures is not visible to the participants, so their judgment is based on information from only one picture.







Figure 4: Test screen for an SC trial







Each testing trial consists of two screens: a context screen (Figure 3) and a testing screen (Figure 4). In the context screen, the boy Taoqi introduces the characters common to the two testing pictures, as in (14). After finishing reading the context sentences, the participant is asked to press a button to continue to the testing screen (Figure 4). In this screen, the boy Taoqi utters a sentence like (a) to introduce the existential presupposition of the following testing sentence (b). The purpose of Taoqi's lead-in utterance is to meet the felicitous condition and existential presupposition of cleft sentences. The testing sentence is presented as an audio file.³ As the audio finishes, a booklet containing a picture and a black box representing a covered picture appears on screen, as in (Figure 4). Taoqi then poses a question "Which of the two pictures are we describing?" For the testing items, the overt pictures always depict a non-exhaustive scenario, such as two out of three cats caught a fish. If subjects associate a richer interpretation "no one else did x" to the clefts, they should not choose the overt picture.

50 subjects participated in the experiments (34 female and 16 male). Two of which were excluded due to low accuracy of filler sentences. The mean participant age is 28.1, ranging from 23 to 52. All participants speak Mandarin from birth.

- (14) Taoqi: Xiaohuimao, Xiaobaimao, he Xiaohuangmao qu diaoyu, tamen dou hen kaixin. Grey Kitty, White Kitty, and Yellow Kitty go fishing they DOU very happy 'Grey Kitty, White Kitty and Yellow Kitty went fishing; they were all very happy.'
- (15) a. Taoqi: Xiaohuimao, Xiaobaimao, he Xiaohuangmao li, youren diao-dao le yu. Grey Kitty, White Kitty, and Yellow Kitty among someone fish-get ASP fish 'Among Grey Kitty, White Kitty and Yellow Kitty, someone caught a fish.'
 - b. Xiaoxiao: Shi Xiaohuimao diao-dao le yu. SHI Grey Kitty fish-get ASP fish

'It is Grey Kitty who caught a fish.'

5.2 Material

This experiment contains 12 sets of testing sentences, each with four permutations: *zhiyou* "only" sentences (ZY), *shi*-clefts (SC), definite pseudo-clefts (PC)and *wh*-elicited plain focus sentences (PF). Examples of the testing stimuli are presented in (16). As discussed above, each testing sentence is presented as an audio file preceded by a short lead-in satisfying the felicitous conditions of the two types of clefts. Five types of filler items are added to keep the four permutations of testing sentences separated and to counterbalance for the choice of covered box. They are sentences with: 1) *youxie* "some"; 2) *suoyou* "all"; 3) conjunction; 4) simple SVO sentences. All items were assigned to 4 lists, each of which contained 12 testing and 24 filler items, which was presented in a pseudo-randomized manner. Before the testing phase, each participant is given one example and five practice trials.

(16) a. Zhiyou [Xiaohuimao]_F diaodao le yu.
 Only Grey Kitty fish-get ASP fish
 'Only Grey Kitty caught a fish.'

ZY

³Audio stimuli were used to present the testing sentence in order to control the placement of focus in these sentences. Since the placement of focus is not crucial for our purposes in the context sentences, they are presented in written form. Similar to the previous two experiments, the audio stimuli were recorded and sliced by a native speaker of Mandarin.

| b. | Shi [Xiaohuimao] _F diaodao le yu. | |
|----|--------------------------------------------------|----|
| | SHI Grey Kitty fish-get ASP fish | |
| | 'It Grey Kitty who caught a fish.' | SC |
| c. | Diaodao le yu de shi [Xiaohuimao] _F . | |
| | Fish-get ASP DE SHI Grey Kitty fish | |
| | '(The one) who caught a fish is Grey Kitty.' | PC |
| d. | (Who caught a fish?) | |
| | [Xiaohuimao] _F diaodao le yu. | |
| | Grey Kitty fish-get ASP fish | |
| | '[Grey Kitty] _F caught a fish.' | PF |
| | | |

5.3 Predictions

- (i) If exhaustivity of *shi*-clefts is presupposed, participants should perceive this meaning component in the same way as the maximality presupposition of definite pseudo-clefts;
- (ii) If *shi*-clefts is not presupposed, it should not be perceived in the same way are perceived differently from definite pseudo-clefts.

5.4 Results

The percentage of covered box choices in the four conditions are presented in Fig 5. A logistic regression analysis shows that a model with the four construction types as fixed effect against a constant only model is statistically significant, indicating that participant's choice of covered and overt picture differs among the four constructions ($\chi^2 = 44.06$, p < 0.001 with df = 3). Additional χ^2 test comparing participants' choice in definite pseudo-cleft condition and SC cleft condition found no difference ($\chi^2 = 0.17$, p = 0.68). While a statistically significant difference is found between ZY and SC conditions ($\chi^2 = 21.28$, p < 0.001), and between plain focus sentences and SC clefts ($\chi^2 = 8.11$, p < 0.001).





5.5 Interim Discussion

The above results from the Covered Box paradigm help us confirm the conclusions from previous experiments, namely, the exhaustivity of SC is neither encoded as part of assertion nor as an implicature. Moreover, as SC patterns on a par with PC, the presupposition hypothesis is supported: the maximality of PC is perceived in the same way as the exhaustivity of SC. Since maximality is presupposed in PC, SC presupposes exhaustivity.

6 General Discussion

This study presents three experiments probing into the exhaustivity of *shi*-clefts (SC) in Mandarin. Through an inference judgment task, we first established that SC indeed encodes exhaustivity, but differs from restrictive particle *zhiyou* and plain focus sentences (PF). Then we tested the cancelability of the exhaustive inference, and found that the exhaustivity of SC is harder to cancel than that of PF, suggesting that this meaning component of SC is not conversationally implicated. Finally, with a Covered Box task, we compared the maximality presupposition of PC and the exhaustivity of SC, and discovered that speakers perceive these two meaning components in the same way, providing support for the presupposition hypothesis.

These three experiments touch upon a long-standing debate, i.e. what is the status of exhaustivity of cleft sentences. Previously, intuition data on the exhaustive interpretation of *shi*-clefts varies from study to study. For example, Paul and Whitman (2008) argue that only when combined with *de* do *shi*-clefts carry exhaustivity. By using experimental data, not only are we able to capture the exhaustive reading of *shi*-clefts, but also the subtle differences or similarities between the exhaustive interpretation of SC and other constructions.

Even though this study provides support for the presupposition hypothesis, we need more data to further discern between the referential account and the question-based account. As we have seen in Section 2, both accounts analogize exhaustivity to maximality. One feature of *shi*-clefts is that other constituents such as the predicate can also be clefted:

- (17) A: Did Zhangsan went out for food or went to the bathroom?
 - B: Zhangsan shi [qu chi-fan]_F le, #ye qu cesuo le.
 Zhangsan SHI go eat-meal ASP #also go bathroom ASP (Intended: 'What Zhangsan did was to go out for food; but he also went to the bathroom.')

If this type of *shi*-cleft is also exhaustive as illustrated above, the referential account which relies on maximality of the denotation of the cleft focus (Hedberg, 2000; Büring and Križ, 2013; Križ, 2015) cannot account for the exhaustivity of (17), since the cleft focus is not referential. As the next step, we wish to examine the exhaustivity of predicate-focused *shi*-clefts, to tease apart the referential and the question-based account.

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