

TESTING CONTEXTS' EFFECTS ON THE BLOCKING OF MANDARIN *ZIJI*'S LONG-DISTANCE REFLEXIVIZATION*

Peng(Benjamin) Han
University of Calgary

1. Introduction

The Mandarin *ziji* is often characterized as a reflexive. Just as the English reflexive *himself* in *John likes himself* is bound by the local antecedent *John*, *ziji* as a reflexive also allows an antecedent within the local clause containing *ziji*. In addition to the local binding, *ziji* can have an antecedent beyond the local clause, e.g. the matrix subject *Zhangsan* in (1). A reflexive form's coreferential potential beyond the local clause is widely known as Long Distance Binding (LDB) or Long Distance Anaphora (LDA).

- (1) Zhangsan_i shuo Lisi_j chang piping **ziji**_{i/j}.
Zhangsan say Lisi often criticize self
'Zhangsan_i said that Lisi_j often criticized self_{i/j}'
(Huang and Tang, 1991, p. 275)

Ziji's LDA potential is not available at all times. In sentence (2), *ziji*'s coreference with the matrix subject *Zhangsan* is blocked. According to Tang (1989), this blocking comes from the local subject and arises as the matrix subject and the local subject have different person specifications. Tang has thus proposed unlike person blocking, that is, blocking occurs when a higher potential antecedent of *ziji* has a different person specification from a lower one.

- (2) Zhangsan_i zhidao wo_j/ni_k juede Lisi_l dui **ziji**_{*i/*j/*k/l} mei xinxin.
Zhangsan know I/you think Lisi toward self not confidence
'Zhangsan_i knows that I_j/you_k think that Lisi_l has no confidence in self_{*i/*j/*k/l}.'
(Battistella, 1989, p. 996)

As pointed out in Xu (1993) and Pan (1997, 2001), there is a person asymmetry concerning the blocking effect, i.e. intervening 1st or 2nd person subjects can block long distance binding by 3rd person antecedents, but intervening 3rd person subjects do not necessarily block long distance binding by 1st or 2nd person pronouns. The contrast is demonstrated in the following sentences. In (3a), when the 1st/2nd person local subject

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intervenes, the binding by the 3rd person matrix subject *Zhangsan* is completely blocked. But when a 3rd person local subject intervenes, the binding by a 1st/2nd person matrix subject is marginally acceptable. Huang and Liu (2001) have suggested that 1st and 2nd person pronouns anchor reference to situational contexts (e.g. external speakers), disallowing coreference with 3rd person internal authors, which correspond to attitude holders represented as subjects of attitude predicates. Pan (2001) holds a similar proposal, in which 1st/2nd person pronouns are stronger in perspective taking so that the appearance of 1st/2nd person pronouns leads to obligatory perspective taking, banning coreference with 3rd person DPs. These accounts explain how a 1st/2nd person pronoun blocks the binding by a 3rd person matrix subject, but fail to account for why the binding by a 1st/2nd person matrix subject, crossing an intervening 3rd person DP, is only marginally acceptable, as seen in (3b) and (3c).

- (3) a. Zhangsan_i danxin wo/ni_j hui piping **ziji**_{*i/j}.
 Zhangsan worry I/you will criticize self
 ‘Zhangsan is worried that I/you might criticize myself/yourself/*him.’
- b. wo_i danxin Zhangsan_j hui piping **ziji**_{?i/j}.
 I worry Zhangsan will criticize self
 ‘I am worried that Zhangsan will criticize ?me/himself.’
- c. ni_i danxin Zhangsan_j hui piping **ziji**_{?i/j} ma?
 you worry Zhangsan will criticize self Q
 ‘Are you worried that Zhangsan will criticize ?you/himself?’
 (Huang and Liu, 2001, p. 146)

This paper proposes that the marginal acceptability in (3b) may derive from the fact that *ziji*’s coreference with a 1st person long distance pronoun may or may not obtain depending on contexts. In Li (1991), it is claimed that *ziji* produced in contexts of contemplation can refer to the corresponding contemplator. Suppose Jimmy is contemplating and has the internal monologue as in (4). Despite the lack of an antecedent within the sentence containing *ziji*, *ziji* resorts to the contemplator for reference.

- (4) Jimmy’s internal monologue:
ziji neng tongguo zhe-ci kaoshi ma?
 self can pass this-CL exam Q
 ‘Can self pass this exam?’

As the contemplator is also the speaker of the relevant internal monologue, a coreference between *ziji* and the first person pronoun *wo* is built irrespective of any of the aforementioned blocking. Following this line, if (3b) is produced under contemplation, this sentence should be perfectly acceptable, compared to the marginal acceptability in other contexts.

- (5) In discourses produced under contemplation,

[[*ziji*]]^{c,i} = AUTHOR(i) = Contemplator,
 and contemplators coincide with speakers (i.e. AUTHOR(c)) ,
 so [[*ziji*]]^{c,i} = AUTHOR(i) = Contemplator = Speaker = AUTHOR(c) = [[*wo*]]^{c,i}

While *ziji*'s coreference with the 1st person *wo* can be saved from blocking in a certain context, there is currently no known context that saves *ziji*'s coreference with a 3rd person DP, with the intervention of a 1st person pronoun. In this sense, there is an asymmetry between a 1st person pronoun and a 3rd person DP.

In this study, I conduct an experiment to test the validity of the aforementioned contextual effect and whether this effect can account for the person asymmetry between a 1st person and a 3rd person DP.

2. Methods

2.1 Materials and design

This experiment involves judging *ziji*'s likelihood of a certain reference. Participants face a computer screen and are presented with a stimulus sentence embedded in a picture, signalling the context in which the stimulus sentence is produced. Right beneath the picture is the instruction that asks participants to use a 7-Point Likert Scale to evaluate *ziji*'s potential to corefer with a specific antecedent, by pressing corresponding keys on the keyboard.

The stimuli sentences all follow the pattern “Matrix subject + matrix verb + local subject + local verb + *ziji*”, as exemplified in (6). The matrix subject is a potential long distance antecedent for *ziji*, and the local subject is a potential local antecedent. The matrix verbs are attitude predicates or speech verbs that can introduce clausal arguments. The local verbs are two place transitive verbs, which are neither self-directed nor other-directed. Self-directed verbs are verbs like *fanxing* ‘(self)-examine’, and the actions signified by these verbs can only be directed to the corresponding agents. If the local verb *tiaozhan* ‘challenge’ in (6) is substituted with the self-directed verb *fanxing* ‘self-examine’, *ziji* can only corefer with the local subject. Other-directed verbs are quite the opposite, as the relevant actions can be directed to anyone but the agents themselves, e.g. *kaojin* ‘approach’. ‘Approach’ is other-directed as one cannot physically approach themselves, so that *ziji* as an object cannot refer back to its co-argument local subject. Therefore, stimuli sentences with self-directed or other-directed verbs will constrain *ziji*'s interpretation, and the two types of verbs are avoided in stimuli sentences.

(6) ‘3rd-3rd’: 3rd person matrix subject and 3rd person local subject

John_i mingbai Mike_j hui tiaozhan **ziji**_{i/j}.

John understand Mike will challenge self

‘John_i understands that Mike_j will challenge self_{i/j}.’

The above sentence in (6) is an exemplar stimulus with both its matrix subject and local subject filled by 3rd person DPs (3rd-3rd), but this only represents one level of person arrangement. There are still two other levels of person specification arrangement (‘1st-3rd’

and ‘3rd-1st’), as shown in (7). The three levels constitute the factor Person Arrangement. Unlike in (6), *ziji*’s referential indices are not indicated in sentence (7a) or (7b). The arrangement ‘3rd-3rd’ in (6) represents a baseline situation where long distance binding is always possible (i.e. without blocking), so it is clear that *ziji* here can corefer either with a matrix subject or a local subject. But when it comes to the arrangements ‘1st-3rd’ and ‘3rd-1st’ shown in (7), the different person specifications may or may not result in blocking, depending on whether unlike person blocking or asymmetric person blocking is assumed. *Ziji*’s referential indices in (7) are thus left blank.

- (7) a. ‘1st-3rd’: 1st person matrix subject and 3rd person local subject
 wo caixiang jimū dangshi yiding hēnsi **ziji** le.
 I guess Jim then must hate-die self SFP
 ‘I guess that Jim must have detested self at that time...’
- b. ‘3rd-1st’: 3rd person matrix subject and 1st person matrix subject
 yuehan qidai wō nēng duō tantān **ziji**.
 John expect I can more discuss self
 ‘John expects that I can talk more about self.’

Recall that the possible blocking in (7b) may be saved if this sentence is produced under contemplation, which demonstrates a specified context. In light of this, this experiment has context as the other factor, to test contexts’ effects on *ziji*’s interpretation. Four different contexts are involved, including two primary test contexts and two secondary test contexts. The context contemplation is included as one of the two primary contexts. The other primary context is oral communication, as it represents one of the most common contexts for language use. Meanwhile, oral communication is a control context with almost zero interference from contemplative readings of *ziji*, as it occurs mainly for the purpose of communication rather than contemplation. The secondary test contexts are text messaging and public speaking, representing written communication and monologues respectively. They are introduced to diversify the contexts and hopefully reveal other contextual effects. With the factors person arrangement and context, the experiment has 6 primary conditions and 6 secondary conditions, as summarized in Table 1. The primary contexts/conditions and secondary contexts/conditions serve as filler contexts/conditions to one another, and there are no additional filler contexts/conditions.¹

The four different contexts are signalled with pictures, without using any linguistic means. This helps eliminate additional discourse effect and ensure a focus on situational contexts, as linguistic means of indicating contexts may introduce discursive antecedents and complicate the task. The pictures used are similar to those in comic books. Oral communication is signalled by pictures showing two people conversing, with one talking

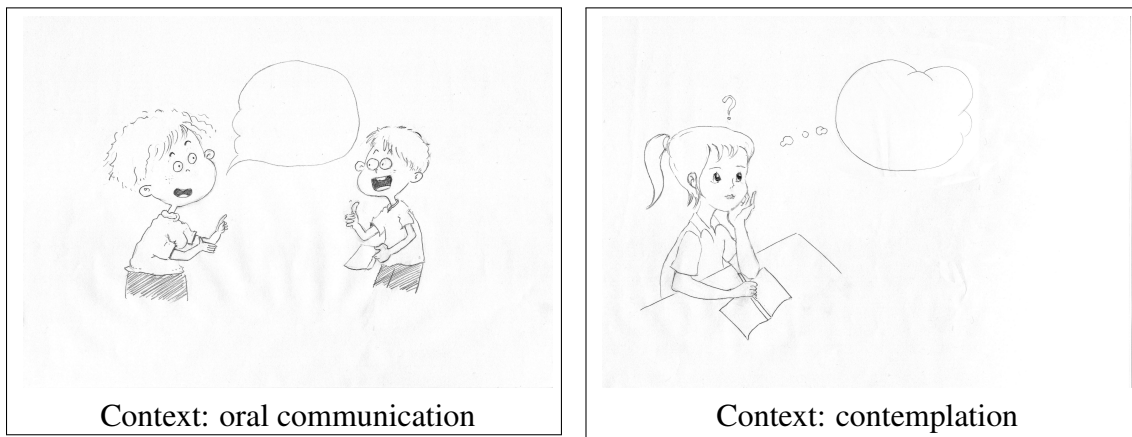
¹The secondary test contexts and relevant conditions were originally created as filler contexts and filler conditions respectively. However, after the analyses of filler items, it was found that the inclusion of filler items in the analyses produced meaningful results. Considering this, the filler contexts/conditions are re-categorized as secondary test contexts/conditions.

Table 1: Summary of the experiment design

	primary contexts		secondary contexts	
	oral communication	contemplation	text messaging	public speaking
1st-3rd	condition 1	condition 2	condition 7	condition 8
3rd-1st	condition 3	condition 4	condition 9	condition 10
3rd-3rd	condition 5	condition 6	condition 11	condition 12

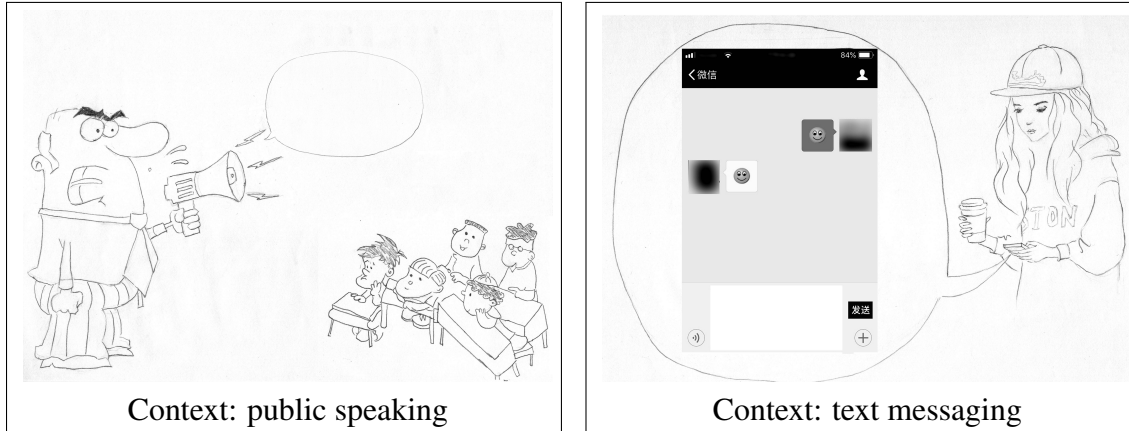
to the other; contemplation is indicated by pictures with one person meditating. The public speaking context is simulated by pictures showing one giving a speech to a crowd of people. The pictures for text messaging are relatively complicated, as each of these pictures depicts one person using a cell phone, along with a closeup of the phone's screen. The closeup shows the typical screen that a phone user sees when communicating with someone in a messaging application. The following are sample pictures, with each signalling one of the test contexts.

Figure 1: Sample pictures for primary test contexts



As shown, each picture (in Figure 1 and Figure 2) contains a bubble or box where a stimulus sentence can be embedded. The bubbles are explicitly connected with specific individuals in the pictures, to help identify the corresponding contemplators or speakers. With regard to the text messaging context, a stimulus sentence is not embedded in the bubble, but in the rectangular box within the bubble. In the picture for text messaging in Figure 2, there is already a round of communication with emojis between the two chatting companions; beside the rectangular box is a button with two characters meaning 'send'. It is thus clear that the stimulus sentence in the rectangular box simulates a new message that the phone user (i.e. the girl in the picture) has just typed, after the round of communication with emojis. In this way, a stimulus sentence in the context text messaging will not be taken as a sentence initiating the texting, and meanwhile no extra discourse information is

Figure 2: Sample pictures of secondary test contexts



introduced.

As participants are asked to complete evaluation tasks using a 7 Point Likert Scale, a judgement question is also asked when a stimulus sentence is presented along with its relevant context. Judgement questions take the form in (8). The symbol “***” represents a blank to be filled by the matrix subject in the corresponding stimulus sentence. For instance, the judgement question for sentence (6) is “how likely do you think it is for *ziji* to refer to John?”

(8) How likely do you think it is for *ziji* to refer to ***?

Combining a stimulus sentence, a picture and a judgement question, each trial is presented on a single screen all at once. The stimulus sentence is presented in the bubble within the picture; the judgement question is provided right below the picture. Participants are instructed to answer the question with a score, i.e. press a number from 1 to 7 as their answer. The higher the score is, the more likely it is for *ziji* to embrace the reference in question. Apart from the judgement scores, participants’ reaction times are also automatically. Reaction time measures the time span from the outset of each trial (i.e. the moment that a screen appears) to the moment that a participant presses a key to answer the relevant judgement question.

2.2 Participants and procedure

The experiment was conducted on a Macbook using Psychopy (Pierce, 2009). Participants would sit in front of the Macbook, and first saw 2 practice trials. Each trial follows a layout specified above. Adequate time was left for participants to make judgements. After finishing a trial, they would need to press the spacebar to move on to the next trial. After familiarizing themselves with the experiment through practice trials, each participant would see 30 primary test trials (five per condition) and 30 secondary test trials (five per condition). All these trials use different stimulus sentences, though the context-indicating

pictures repeat five times for each participant. Moreover, the trials are pseudo-randomized so that participants would not see two consecutive trials with identical person arrangements or identical contexts.

33 native speakers of Mandarin Chinese participated in this experiment. The participants were all recruited from Zhengzhou Institute of Technology (China), with their ages ranging from 18 to 22. All participants had normal or corrected-to-normal vision, and there were no known learning difficulties or hearing impairments in their own reports. They were paid 50 yuan (around CAD 10) each for their participation. This research was reviewed and approved by Conjoint Faculties Research Ethics Board of University of Calgary, with the approval number REB18-0602.

2.3 Predictions

The predictions are concerned with *ziji*'s potential for long distance anaphora with different person arrangements in different contexts, which highly depends on whether there is blocking incurred by an intervening DP. The more intense the blocking is, the less potential *ziji* will have for long distance reference, and the lower scores participants will give.

The two hypotheses concerning blocking are unlike person blocking and asymmetric person blocking. The blocking levels by each hypothesis are provided in Table 2. Unlike person blocking predicts that there is no blocking in '3rd-3rd', but there are roughly equal levels of blocking in '1st-3rd' and '3rd-1st'. When asymmetric person blocking is assumed, the blocking level in '1st-3rd' should be less than that in '3rd-1st', but no specific claim is made whether the blocking level in '1st-3rd' can be lessened to the degree in '3rd-3rd'. That is why the blocking in '1st-3rd' is greater than or equal to that in '3rd-3rd'. When the blocking levels are transformed to referential scores, there is a new table 3 for predicted score comparisons.

Table 2: Predictions of blocking levels with different person arrangements

unlike person blocking	$B(3rd-3rd) < B(1st-3rd) \approx B(3rd-1st)$
asymmetric person blocking	$B(3rd-3rd) \leq B(1st-3rd) < B(3rd-1st)$

Table 3: Predictions on score comparisons with different person arrangements

unlike person blocking	$S(3rd-3rd) > S(1st-3rd) \approx S(3rd-1st)$
asymmetric person blocking	$S(3rd-3rd) \geq S(1st-3rd) > S(3rd-1st)$

Note that the above predictions do not include any contextual effect, and that the referential scores are also subject to extra-sentential contexts. It is hypothesized that the context contemplation can affect *ziji*'s potential for long distance reference. Under contemplation, *ziji* and the 1st person pronoun *wo* 'I' can co-refer due to the equation in (9).

$$(9) \quad \llbracket ziji \rrbracket^{c,i} = \text{AUTHOR}(i) = \text{Contemplator} = \text{Speaker} = \text{AUTHOR}(c) = \llbracket wo \rrbracket^{c,i}$$

With the assumption that a 3rd person intervening DP can block *ziji*'s long distance binding by a 1st person pronoun (i.e. the person arrangement '1st-3rd'), the coreference derived under contemplation can save the long distance binding from being blocked. That is, the context contemplation is predicted to see higher referential scores with the person arrangement '1st-3rd', but no contextual effects are predicted for the arrangements '3rd-3rd' and '3rd-1st'. After incorporating the contextual effect from contemplation, Table 4 provides revised predictions on score comparisons. The first two rows are associated with predictions in contemplation, and the uparrow symbols beside S(1st-3rd) are used to suggest improved referential scores in '1st-3rd'. The improvement is especially noticeable if unlike person blocking is assumed, because it changes the ' \approx ' sign between S(1st-3rd) and S(3rd-1st) to '>'. As oral communication is a control context demonstrating no effect from contemplative uses of *ziji*, it should follow the predictions with no contextual effect, as in Table 3. In terms of the two secondary contexts text messaging and public speaking, contemplative uses of *ziji* are again not as easily obtained as under contemplation. Here I temporarily hypothesize the two secondary contexts do not license contemplative uses, so contextual effects from *ziji*'s contemplative readings do not exert their influence and the predictions in Table 3 should continue to apply in the two secondary contexts. As the three contexts oral communication, text messaging and public speaking have identical predictions, they are represented as 'other contexts' in the last two rows in Table 4.

Table 4: Predictions on score comparisons (person arrangement \times context)

unlike person blocking (contemplation)	$S(3rd-3rd) \geq S(1st-3rd) \uparrow > S(3rd-1st)$
asymmetric person blocking (contemplation)	$S(3rd-3rd) \geq S(1st-3rd) \uparrow > S(3rd-1st)$
unlike person blocking (other contexts)	$S(3rd-3rd) > S(1st-3rd) \approx S(3rd-1st)$
asymmetric person blocking (other contexts)	$S(3rd-3rd) \geq S(1st-3rd) > S(3rd-1st)$

3. Results and analyses

33 participants were recruited, but the data from 3 participants was excluded from calculations and analyses, i.e. only 30 participants' data was analyzed. The exclusion was performed based on the mean scores that each participant gives to stimuli with '3rd-3rd' person arrangement. As both unlike person blocking and asymmetric person blocking predict no blocking for the person arrangement '3rd-3rd', stimuli with '3rd-3rd' should have high referential scores and serve as the touchstone for reliable and consistent judgements. Two participants' data are ruled out because the mean scores for '3rd-3rd' stimuli are unexpectedly low (1.35 and 2.2 respectively). There is still one more participant's data removed because the reaction times across all trials with '3rd-3rd' stimuli vary dramatically, possibly suggesting some unpredicted interference. In consequence, the data to be analyzed is retrieved from the remaining 30 participants' data points.

3.1 Mean scores

The mean scores for each condition are summarized in the table below. For easy labelling, the contexts oral communication, contemplation, text messaging and public speaking are labelled as talking, thinking, texting and loudspeaking respectively.

Table 5: Mean scores under all conditions

	3rd-3rd		1st-3rd		3rd-1st	overall
Oral communication (Talking)	4.43	>	3.72	>	2.99	3.71
Self-reflection (Thinking)	5.05	>	4.43	>	3.19	4.22
Text messaging (Texting)	5.28	>	3.77	>	3.05	4.04
Public speaking (Loudspeaking)	5.36	>	4.19	>	3.05	4.20
overall	5.03	>	4.03	>	3.07	4.04

Firstly, comparisons are made among different person arrangements. As shown by the ‘>’ sign between each pair of comparisons in Table 5, the scores under ‘3rd-3rd’ person arrangement are higher than those under ‘1st-3rd’ person arrangement, which in turn exceed those under ‘3rd-1st’ person arrangement. This trend of decreasing scores applies within each specific context and the various contexts as a whole. The score comparisons suggest that the blocking exerted by a 3rd person DP to a 1st person pronoun (i.e. with the arrangement ‘1st-3rd’) is not as strong as the blocking from a 1st person pronoun to a 3rd person DP (i.e. ‘3rd-1st’), which is more consistent with asymmetric person blocking.

The context contemplation is predicted to play a role by increasing the score under ‘1st-3rd’ arrangement, but this role is not noticeable in score comparisons of different person arrangements, as the predicted increment in ‘1st-3rd’ is not great enough to change the inequality ‘ $S(3rd-3rd) > S(1st-3rd) > S(3rd-1st)$ ’. Another way to validate the increment is to compare the mean scores for ‘1st-3rd’ stimuli in different contexts, i.e. between contemplation and all the other contexts. As highlighted with a grey background, the context contemplation has the highest score in the column ‘1st-3rd’, conforming to the predicted contextual effect from contemplation. Besides, the score increment is manifested in the overall mean score under contemplation (i.e. 4.22), which exceeds the overall mean score in all the other contexts. In sum, the data of mean scores supports asymmetric person blocking and reflects the predicted contextual effect of contemplation.

3.2 Analyses of referential scores

All analyses in this research are conducted using the linear mixed-effects models in R (R Core Team, 2018), and they are realized through the *lme4* package (Bates et al., 2015) and the *lmerTest* package (Kuznetsova et al., 2017), which take into account the random and the fixed effects manifested in all data points. In terms of referential scores, I first analyzed the scores in primary test contexts. In fitting the best model, referential scores are made as a function of person arrangement and context, with participant and item as random effects.

After necessary model comparisons, it turned out that the best model is the one involving both person arrangement and context but without an interaction between them.² The results from the best model are summarized in Table 6, with the arrangement ‘1st-3rd’ and the context oral communication serving as the respective baselines. The analysis suggests main effects of person arrangement and context. Compared to the scores under ‘1st-3rd’ arrangement, the scores in ‘3rd-1st’ are significantly lower but the scores in ‘3rd-3rd’ are significantly higher. When it comes to contextual effects, the scores in contemplation are significantly higher than those in oral communication.

Table 6: Summary of the statistical analysis of primary test scores

	Estimate	SE	<i>t</i>	<i>Pr</i>
(Intercept)	3.82	0.27	14.35	< 0.001 ***
3rd-1st	-0.98	0.26	-3.75	< 0.001 ***
3rd-3rd	0.66	0.26	2.52	0.02 *
Self-reflection (Thinking)	0.51	0.21	2.39	0.02 *

Significance levels: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

The above findings provide evidence for the overall roles of person arrangement and contextual difference, but it is also meaningful to examine how the two factors function in the two secondary test conditions. An analysis similar to the previous one is thus performed, but this time the data from both the primary and the secondary test conditions are included. The best model emerging from this comparison is still the one with person arrangement and context as fixed effects without interactions, and with participant and item as random effects. As shown in Table 7, the main effects of person arrangement and context are also confirmed in this extended analysis that incorporates secondary test conditions. The significant differences found in the previous analysis also appear in the extended analysis, confirming the validity of the previous analysis. Furthermore, the extended analysis also compares the scores in oral communication with those in text messaging and those in public speaking. The additional finding from the extended analysis is that like contemplation, the context public speaking can also increase the referential scores of long distance binding, though it is still unclear whether the effect from public speaking applies to stimuli with a specific person arrangement or all stimuli indiscriminately. The same problem also happens to the effect from person arrangement and the effect from contemplation. The two analyses above confirm the overall effects from person arrangement and context, but further pairwise analyses are needed to decide where these effects apply exactly, that is, to which person arrangement or to which context. An answer to this question is important to fully

²The most complex model (i) and the best model (ii) concerning analyses of primary test conditions are provided below.

- (i) $\text{Score} \sim \text{Person arrangement} * \text{Context} + (1|\text{Participant}) + (1|\text{Item})$
- (ii) $\text{Score} \sim \text{Person arrangement} + \text{Context} + (1|\text{Participant}) + (1|\text{Item})$

support the hypothesis that the context contemplation enhances the long distance binding in stimuli with ‘1st-3rd’ arrangement.

Table 7: Summary of the extended statistical analysis of all test scores

	Estimate	SE	<i>t</i>	<i>Pr</i>
(Intercept)	3.82	0.27	14.35	< 0.001 ***
3rd-1st	-0.96	0.17	-5.75	< 0.001 ***
3rd-3rd	1.00	0.17	6.00	< 0.001 ***
Text messaging (Texting)	0.32	0.19	1.68	0.10
Contemplation (Thinking)	0.51	0.19	2.66	0.01 *
Public speaking (Loudspeaking)	0.49	0.19	2.55	0.01 *

Significance levels: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

3.2.1 Pairwise analyses of person arrangement

The data of mean scores in Table 5 suggests that in each separate context, the scores decrease when the person arrangement changes from ‘3rd-3rd’ to ‘1st-3rd’ and finally to ‘3rd-1st’, with the inequality ‘ $S(3rd-3rd) > S(1st-3rd) > S(3rd-1st)$ ’. However, the inequality is still to be validated by statistic analyses, so pairwise analyses come in. After rounds of model comparisons and analyses, the results of significance levels between pairs of person arrangement in each context are summarized in Table 8.

Table 8: Summary of pairwise comparisons in each context

	<i>p</i> -value (3rd-3rd vs. 1st-3rd)	<i>p</i> -value (1st-3rd vs. 3rd-1st)
Oral communication	0.005 **	0.004 **
Contemplation	0.14	0.008 **
Text messaging	< 0.001 ***	0.002 **
Public speaking	< 0.001 ***	< 0.001 ***

Significance levels: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

The results suggest significant differences in all comparisons except between ‘3rd-3rd’ and ‘1st-3rd’ in contemplation. In other words, the inequality ‘ $S(3rd-3rd) > S(1st-3rd) > S(3rd-1st)$ ’ applies in each context except in contemplation, where no significant difference is found between $S(3rd-3rd)$ and $S(1st-3rd)$. In Table 9, I present the revised score comparisons, based on statistical analyses of significance levels.

As oral communication is assumed to be a control context only subject to the effect from person arrangement, the score comparison in oral communication should represent how the factor person arrangement alone affects the long distance binding potential. It is seen in Table 9 that oral communication demonstrates an inequality ‘ $S(3rd-3rd) > S(1st-3rd) > S(3rd-1st)$ ’, which suggests that the blocking from a 3rd person DP to a 1st person

Table 9: Summary of comparisons based on statistical analyses

	3rd-3rd	1st-3rd	3rd-1st	comparisons with statistical evidence
Oral communication	4.43	3.72	2.99	$S(3rd-3rd) > S(1st-3rd) > S(3rd-1st)$
Contemplation	5.05	4.43	3.19	$S(3rd-3rd) \approx S(1st-3rd) \uparrow > S(3rd-1st)$
Text messaging	5.28	3.77	3.05	$S(3rd-3rd) > S(1st-3rd) > S(3rd-1st)$
Public speaking	5.36	4.19	3.05	$S(3rd-3rd) > S(1st-3rd) > S(3rd-1st)$

pronoun is not as strong as the blocking from a 1st person pronoun to a 3rd person DP, supporting the asymmetric blocking effect.

With regard to contemplation, this context is predicted to increase $S(1st-3rd)$. But as the factor person arrangement alone already produces the inequality ' $S(1st-3rd) > S(3rd-1st)$ ', the increasing will not be found in the comparison between $S(1st-3rd)$ and $S(3rd-1st)$. Then I turn to the comparison between $S(3rd-3rd)$ and $S(1st-3rd)$, and there is no significant difference between them in contemplation (cf. the row corresponding to contemplation in Table 9), as opposed to the comparison in oral communication where $S(3rd-3rd)$ is significantly greater than $S(1st-3rd)$ (cf. the row corresponding to oral communication in Table 9). This suggests that the context contemplation does improve the score of $S(1st-3rd)$, even to the same level as $S(3rd-3rd)$. The predicted contextual effect of contemplation is thus validated here.

The two secondary test conditions show a pattern similar to that in oral communication, i.e. $S(3rd-3rd) > S(1st-3rd) > S(3rd-1st)$. The similarity indicates that text messaging and public speaking are more like oral communication, and that the contextual effect from *ziji*'s contemplative readings is at least not as strong as in contemplation, if this effect is not fully excluded in the two secondary contexts. For now, the temporary assumption still holds that stimuli in text messaging and public speaking are only subject to the effect from person arrangement.

3.2.2 Pairwise analyses of context in '1st-3rd'

Under the person arrangement '1st-3rd', the referential scores for each context are 3.72 (oral communication), 3.77 (text messaging), 4.19 (public speaking) and 4.43 (contemplation) respectively. Table 10 provides the significance levels of differences between each pair of contexts. First compare the target context contemplation and the control context oral communication. This person arrangement '1st-3rd' is the exact one and the only one where the contextual effect from *ziji*'s contemplative readings is supposed to play a role. In '1st-3rd', the context contemplation should invoke contemplative readings of *ziji*, circumvent the blocking from intervening 3rd person DPs and gain higher scores of long distance binding. This prediction is borne out by the comparison of mean scores between oral communication and contemplation, and the significant difference between the two contexts ($p = 0.003$).

As for the two secondary test contexts in '1st-3rd', they are temporarily assumed not to

Table 10: Summary of pairwise comparisons under the person arrangement ‘1st-3rd’

comparison pairs	relation	<i>p</i> -value
Oral communication vs. Text messaging	<	0.822
Oral communication vs. Public speaking	<	0.047 *
Oral communication vs. Contemplation	<	0.003**
Text messaging vs. Public speaking	<	0.077
Text messaging vs. Contemplation	<	0.005**
Public speaking vs. Contemplation	<	0.329

Significance levels: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

license *ziji*’s contemplative readings and their scores should be approximately equivalent to that in oral communication. While the context text messaging’s approximateness to oral communication is obvious (3.77 vs. 3.72) and validated in Table 10, the other secondary context public speaking has a higher score than the control context oral communication (4.19 vs. 3.72), reaching a significant level ($p = 0.047$). It seems that like contemplation, public speaking can increase the long distance referential score as well. Text messaging’s likeness to contemplation is manifested in mean scores (4.19 vs. 4.43) and the corresponding pairwise analysis ($p = 0.329$).

4. Discussion

This experiment tests *ziji*’s potential for LDA. With the three types of person arrangement ‘1st-3rd’ ‘3rd-1st’ and ‘3rd-3rd’, the target antecedent for each person arrangement should be 1st, 3rd and 3rd respectively. When a stimulus sentence with the arrangement ‘1st-3rd’ is produced under contemplation, *ziji* can co-refer with the 1st person antecedent irrespective of any potential blocking. This demonstrates the contextual effect from *ziji*’s contemplative readings, which is validated from three aspects. First, look at the mean scores under the person arrangement ‘1st-3rd’; the mean score in contemplation is significantly higher than that in the control context oral communication. This serves as the direct evidence for the effect from contemplation. Second, compare the inequalities of mean scores under different person arrangements. The inequality for the context contemplation is $S(3rd-3rd) \approx S(1st-3rd) > S(3rd-1st)$, but the inequality for the control context oral communication is $S(3rd-3rd) > S(1st-3rd) > S(3rd-1st)$. This means that in contemplation, $S(1st-3rd)$ has been increased to such a degree that there is no significant difference between $S(3rd-3rd)$ and $S(1st-3rd)$. Third, the contextual effect is also noticed in the mean score difference between contemplation and oral communication, regardless of the distinction in person arrangement. The mean score in contemplation is 4.22, which is significantly higher than the mean score in oral communication. The general improvement of mean scores in contemplation should, at least partially, come from the increased scores under ‘1st-3rd’. With all the supporting evidence, the contextual effect from *ziji*’s self-reflective readings is verified.

A pairwise analysis of context in ‘1st-3rd’ has an unexpected finding. Like the context contemplation, public speaking also has a significantly higher mean score than oral communication. A possible cause is the enhanced prominence bestowed on speakers. The greater prominence reinforces *ziji*’s reference to speakers, which coincide with the long distance antecedents in ‘1st-3rd’. There are at least three aspects that manifest speakers’ enhanced prominence. First, speakers in public speaking are more prominent than speakers in oral communication, because in public speaking, a fixed speaker undertakes the production of most of the discourses. In oral communication, speakers are fluid and participating parties may take turns to play the roles of speakers and addressees. Second, speakers in public speaking are contextually more outstanding than addressees, but in oral communication, they are relatively balanced. In public speaking, the speakers are few in number but addressees generally come in groups. As the only people speaking in a crowd of people, speakers easily stand out in contexts. When it comes to speakers and addressees in oral communication, they do not show much difference in number; moreover, neither party is more distinguished than the other. This distinction is also seen in the experiment pictures (Figure 2) used to indicate oral communication and public speaking. Moreover, a close look at the context pictures helps reveal the third aspect of speakers’ enhanced prominence. In all test pictures for public speaking, the speaker is portrayed as an adult whose figure takes up about a third of the whole picture, but the addressees are depicted as children with much smaller figures. The differences in terms of age and figure size may further suggest a difference in social status, with the speaker more authoritative than the addressees (e.g. a headmaster vs. students). As for the pictures for oral communication, there is no discernible difference in figure size or social status between the two discourse participants. With the enhanced prominence demonstrated above, *ziji* thus has more potential to refer to a speaker. When the speaker happens to be the long distance referent (e.g. in ‘1st-3rd’), the referential scores are improved.

5. Concluding remarks

This experiment attempted to sort out the blocking facts and verify the contextual effect from *ziji*’s contemplative readings. The results do provide empirical evidence for *ziji*’s contemplative readings and the contextual effect from such readings, but the clarification of blocking facts still requires more research. For *ziji* in a sentence with a 3rd person local subject and a 1st person matrix subject (e.g. ‘1st-3rd’), its LDA potential is context-dependent. Compared to the context oral communication, the sentence presented in contemplation has more potential for LDA, indicating contexts’ effect and giving proof to contemplative uses of *ziji*.

This experiment also finds that the context public speaking is similar to contemplation in increasing *ziji*’s LDA potential in ‘1st-3rd’. Speakers may be rendered more prominent in public speaking, making the long distance reference to 1st person speakers more favoured in this context. With that in mind, it is doubtful that the context oral communication is fully exempt from contextual effects, as 1st person referents as discourse participants are almost

always more prominent than 3rd person referents. Therefore, the blocking facts from pure conflicting person specifications are still to be determined.

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