Comprehension of the Demonstratives by Chinese-speaking Preschool Children

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Abstract

The current study investigates Chinese-speaking children's comprehension of demonstrative words, such as *zhe-ge* 'this' and *na-ge* 'that', in association with their cognitive development. Demonstrative words are deictic, and the appropriate comprehension of these words neccesites the understanding of the speaker's orientation point. Children are known to often fail to incorporate the speaker's orientation point when comprehending demonstrative words, resulting in 'egocentric' interpretation (e.g., [1]; [2]). A recent study on demonstrative comprehension by English-acquiring children has suggested that children's egocentric demonstrative interpretation may be associated with their still-developing cognitive abilitites ([3]). The current study cross-linguistically expands this line of research, taking Chinese-speaking children's demonstrative comprehension as a test case. Our results suggest that children's demonstrative comprehension is related with their development of cognitive abilitites, particularly that of Theory of Mind, replicating Chu & Minai's [3] findings with English-speaking children.

Keywords: Demonstrative words, first language acquisition, cognitive development

1. Introduction

A central issue in first language acquisition is to determine what factors affect children's acquisition of their first languages. One potential factor that has been widely discussed is children's cognitive development ([4]). Since children develop their first languages while their development of cognitive abilities is still underway, it is essential for researchers in first language acquisition to explore what role cognitive development may play in the course of children's language development. In the past decades, the interaction between children's cognitive development and language development has been discussed in many studies (e.g., [5]; [6]; [7]; [8]), with the authors suggesting that cognitive development is related to children's development of language. In those studies, researchers focused on different aspects of language development in relation to children's cognitive development. Among those different aspects of language, children's development of a pragmatically appropriate interpretation of context-dependent expressions is one particularly interesting domain in which to explore the potential impact of cognitive development on language acquisition. This is because the interpretation of context-dependent expressions requires not only an adult-like linguistic representation, but also the appropriate incorporation of the contextual information that is relevant to their interpretation. The incorporation of contextual information has been argued to recruit non-linguistic cognitive abilities; as such, it has been argued that this is likely to be a point of particular vulnerability in first language acquisition, since children's non-linguistic abilities are in development throughout childhood ([9]). To this end, the current study aims to investigate children's comprehension of those context-dependent expressions in relation to their cognitive abilities.

The acquisition of demonstratives, such as *zhe-ge* 'this' and *na-ge* 'that' in Mandarin Chinese, is an ideal testing ground to explore the interaction between language and cognition. The interpretation

of demonstratives is heavily context-dependent. Previous studies have shown that children show difficulties in demonstrative comprehension (e.g., [1]), and it has been proposed that such difficulties in children's demonstrative comprehension seem to be related to their still-developing cognitive abilities (e.g., [6]; [10]). However, only one previous study to date has investigated this hypothesized relationship directly ([3]). In this paper, we test this proposal by investigating Chinese-speaking children's demonstrative comprehension and provide evidence suggesting that children's demonstrative comprehension is associated with their cognitive development.

1.1. The mechanism of demonstrative interpretation

Demonstratives are a type of spatial deictic expression, the interpretation of which makes reference to the spatial location of the participants in the discourse ([11]). In the current paper, we focus on the exophoric use of demonstrative words as is exemplified below. Imagine the context as in Figure 1, where Speaker A and Speaker B are sitting far away from each other in a room, and each of them is holding a teddy bear. Now consider the dialogue as in (1) that took place in the situation depicted in Figure 1 below.

(1) A: I don't want ***this*** teddy bear anymore. Can I have ***that*** teddy bear?
B: ***This*** one? No, you already have ***that*** one.

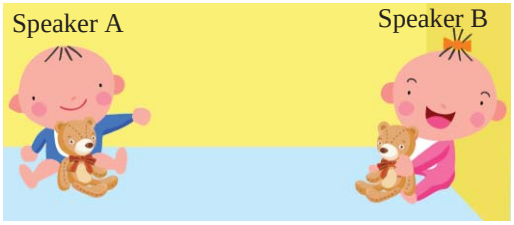

Figure 1. Visual context for dialogue in (1)

Both Speaker A and Speaker B used *this* to refer to the teddy bear right in front of them, respectively, and used *that* to refer to the teddy bear far from themselves/in front of each other. However, the actual referents of *this* and *that* in each utterance they meant are different. *This* teddy bear uttered by Speaker A refers to the teddy bear in front of Speaker A while *this* teddy bear uttered by Speaker B refers to the teddy bear in front of Speaker B. This example illustrates the three basic characteristics of demonstratives: (i) there is distal-proximal distinction between the two demonstrative words, in which *this* refers to the proximal object while *that* refers to the distal object in a given context, (ii) the speaker is the reference point to determine the speaker-object distance, and (iii) when the speaker changes, the reference point shifts accordingly. As shown in this example, the referents of a demonstrative vary depending on the context. The use of demonstratives presented here is referred to as exophoric, as it makes reference to physical properties of the context ([12]). The exophoric demonstratives are argued to be basic and are learned earlier than other uses of demonstratives ([13]). Due to the three characteristics of demonstratives listed above, in order for a listener to successfully comprehend demonstratives, he/she needs to know that demonstratives are used contrastively based on the distance between the object and the speaker and that the speaker's orientation point determines nearness/farness of the speaker-object distance, which varies from context to context. The listener thus needs to determine whether the speaker's orientation point may be the same as, or different from, the listener's own; if different, he/she needs to infer the speaker's orientation point and incorporate it into demonstrative comprehension.

1.2. Comprehension of demonstratives and cognitive development

Given the nature of demonstrative comprehension discussed above, in order for children to successfully comprehend demonstrative words, not only do they need to understand that these expressions are contrastive in terms of the speaker-object distance, but they also need to know that the speaker-object distance needs to be measured from the speaker's perspective; crucially, when the speaker's orientation point is different, demonstratives will be interpreted differently from their own perspectives.

Indeed, children are known to be non-adult-like when comprehending demonstratives that are uttered by a speaker who has a different perspective ([1]; [14]; c.f., [15]). In particular, previous studies revealed that children tend to interpret demonstrative words based on their own perspectives. For example, in Webb and Abrahamson [14], when the speaker sat facing the child (i.e., the speaker's perspective was not the same as the child's own perspective) and told the child to 'pick up *this* toy', the child tended to pick up the toy in front of him/her (i.e., the toy apart from the speaker, which is not the toy that the speaker intended to point to by uttering '*this* toy'), failing to understand that the speaker's orientation is the reference point. However, when the speaker sat next to the child (i.e., the speaker and the child shared the same perspective), children were able to comprehend demonstratives correctly. This indicates that children understand the distance contrast between *this* and *that* when they share the same reference point with the speaker, i.e., based on their own perspective ([1]), but they were not able to comprehend the contrastive use of *this* and *that* based on a perspective different from their own; most importantly, children interpreted demonstratives based on their own perspectives, failing to incorporate another perspective even when it was required. The findings from the previous research on demonstrative comprehension are consistent with Piaget and Inhelder's [16] claim that children need to develop beyond this egocentric stage in order to master the spatial terms.

Children's egocentric comprehension of demonstratives is argued to be related with their still-developing cognitive development. One cognitive component that they pointed out to be associated with egocentric comprehension is Theory of Mind, that is, one's ability to understand that others may have a different perspective ([6]; [10]). As discussed above, when comprehending demonstratives, children need to determine whether their perspectives are different from the speaker's perspective. Theory of Mind is the ability that is required for such an evaluation. Thus, children must both know the distance contrast between *this* and *that* and possess the ability to interpret demonstratives based on a different perspective from one's own in order to comprehend demonstratives in an adult-like way.

In addition to Theory of Mind development, children's demonstrative comprehension may also be related to the development of Executive Function (EF), that is, a set of cognitive abilities that regulate one's thoughts and behaviours, including inhibition, shifting, and memory ([17]). Previous studies have revealed that how children track the knowledge of the interlocutors in conversation is related to their Executive Function ([18]; [19]; c.f., [20]). For example, Nilsen and Graham [18] tested English-speaking children's ability to take the speaker's perspective in communication in relation to their Executive Function skills. Children were given a series of Executive Function tasks, including tests of working memory, inhibition control, and cognitive flexibility, together with a referential communication task which measured children's ability to track the speaker's perspective. Their results showed that children who failed to consider the speaker's perspective also performed worse in the inhibition control tasks. Nilsen and Graham argued that children's ability to inhibit their own perspective allows them to use the speaker's perspectives. This argument is in line with Brown-Schmidt's [21] findings with adults. In particular, Brown-Schmidt suggests that one has to inhibit

his/her own perspective in order to take the interlocutors' perspective in conversations; thus, Executive Function plays a role in perspective-taking. On the basis of the discussions in the perspective-taking literature, Executive Function may also interact with children's comprehension of demonstratives, as children need to take the speaker's perspective in order to correctly comprehend demonstratives.

Interestingly, as suggested by many researchers (e.g., [22]), the development of Theory of Mind is likely to be related to the development of Executive Function. A recent meta-analysis study conducted by Devine and Hughes [23] has revealed that regardless of age and language background, children's development of Executive Function in general is related to their development of Theory of Mind. Moreover, children's language development has also been discussed with respect to Theory of Mind (e.g., [6]; [8]) and Executive Function (e.g., [7]; [24]; [25]). As Theory of Mind and Executive Function seem to co-develop, investigating both cognitive domains may provide us a fuller picture of children's difficulty in demonstrative comprehension.

Chu and Minai [3] was the first experimental study to test the relationship between children's demonstrative comprehension and their development of Theory of Mind and Executive Function. They measured children's comprehension of demonstratives in a context which required that the child interpret the demonstrative based on a perspective other than the child's own. Chu and Minai also assessed each child's Theory of Mind and Executive Function. The results of their study show that children who are successful in interpreting demonstratives based on a different perspective perform better in the Theory of Mind task, which indicates that English-speaking children's demonstrative comprehension, particularly the comprehension of *this*, is related to their development of Theory of Mind, but Executive Function development is possibly not related to children's demonstrative comprehension.

Chu and Minai [3], like most previous studies, investigated demonstrative comprehension in English. The comprehension of demonstratives in Mandarin Chinese, in contrast, has been studied to a far more limited extent. Indeed, only one study to date examined Chinese-speaking children's comprehension of demonstratives. Zhao [2] particularly focused on the pronominal uses of demonstratives (e.g., I want *this*), where the noun is not overtly present. Zhao demonstrated that Chinese-speaking children also exhibit egocentric performance when comprehending demonstratives. However, there were no direct cognitive measurements made to examine the potential relationship between children's egocentric comprehension of demonstrative and their cognitive abilities in Zhao's study. Moreover, it remains unclear whether Chinese-speaking children and English-speaking children at the same age are indeed at similar levels of cognitive development as concerns Theory of Mind and Executive Function. Indeed, studies on children's cognitive development have reported equivocal developmental patterns within Theory of Mind (e.g., [26]; [27]) and Executive Function (e.g., [28]) between English-speaking and Chinese-speaking children. For example, Sabbagh et al. [28] revealed that Chinese-speaking children outperformed English-speaking children in all Executive Function Tasks, whereas there was no difference on the Theory of Mind tasks. Nonetheless, in Tsou [27], Chinese-speaking children seemed to have poorer performance as compared with their English-speaking peers. These findings together motivate a direct examination of the relationship between demonstrative comprehension and the non-linguistic cognitive abilities Theory of Mind and Executive function in Chinese-speaking children.

To this end, the current study investigates Chinese-speaking children's comprehension of demonstratives in light of their development of Theory of Mind and Executive Function. If Chinese-speaking children's egocentric demonstrative comprehension is related to their development of

Theory of Mind, but not Executive Function, we expect to replicate the findings from Chu and Minai [3].

2. The current study

In order to directly examine the potential interaction between Chinese-speaking children's comprehension of demonstratives and their cognitive abilities, the current study adopted Chu & Minai's [3] multi-task design. We utilized two linguistic comprehension tasks to examine children's demonstrative comprehension, i.e., Act-out Task and the Judgment Task (section 2.2), and two cognitive measurements, i.e., Hiding Game (section 2.3) and Dimension Change Card Sort (section 2.4). We translated the tasks used in Chu and Minai [3] into Chinese, and tested Chinese-speaking children.

2.1 Participants

A total of sixty Chinese-speaking children (4;4-6;3, mean=5;2) participated in our study, including 25 four-year-olds (4;4-4;11, mean=4;7), 26 five-year-olds (5;0-5;11, mean=5;5), and 9 six-year-olds (6;0-6;3, mean=6;1). Two additional children were tested but their data were excluded from the analysis because one could not complete all the tasks and the other failed to learn how to complete the tasks. In addition, a control group of 16 adult native speakers of Chinese (19;9-38;11, mean=33;8) were tested in the Judgment Task. The child participants were recruited in two preschools in Chiayi, Taiwan. The adult participants were recruited in Taipei, Taiwan.

2.2 Demonstrative comprehension tasks

The **Act-out Task** measured children's comprehension of the distance contrast between *zhe-ge* ('this') and *na-ge* ('that') when the child and the speaker shared the same perspective. In this task, children were given act-out instructions that contained demonstrative words and they were asked to execute the action by following the instructions. The rationale for this task was that whether children can correctly act-out the task requested in the instructions would indicate whether children could correctly interpret demonstratives that were included in those instructions. The setting of the Act-out Task is illustrated in Figure 2.

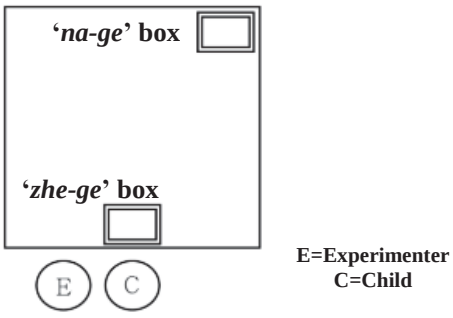

Figure 2. The setting of the Act-out Task

The child sat at a table with two boxes on it, one right in front of the child (see the '*zhe-ge'* box in Figure 2) and the other distant from him/her (see the '*na-ge*' box in Figure 2). The experimenter, serving as the speaker of the act-out instruction, sat right next to the child so that the experimenter and the child shared the same perspective. In each trial, the experimenter, handing a toy character (e.g., Winnie the Pooh) to the child, uttered an act-out instruction which included a demonstrative, as in (2).

(2) *ba* *weini-hsiung* *fun* *zai* ***zhe/na*** *ge* *hezi* *li*
BA Pooh-bear put in **this/that** $CL_{generic}$ box inside
'Put Pooh in *this*/*that* box'

Children's actual act-outs in response to the instruction were the measured responses. The adult-like responses were (i) putting the character in the box right in front of them ('*zhe-ge'* box in Figure 2) when the instruction was with *zhe-ge* ('this'), and (ii) putting the character in the box apart from them ('*na-ge'* box in Figure 2) when the instruction was with *na-ge* ('that'). There were six trials, three of which had *zhe-ge* ('this') in the instruction and three of which had *na-ge* ('that') in the instruction.

The **Judgment Task** was administered to examine whether children could correctly comprehend *zhe-ge* ('this') and *na-ge* ('that') when the speaker's perspective was different from their own; thus, this task measured whether children were able to incorporate others' perspective into their demonstrative comprehension. The task was administered as a series of visually-presented stories with two characters, the King and the Servant (See Figure 3a). One of them, the King, served as the speaker of utterances containing a demonstrative word, and his utterances were presented as demands to the Servant. The Servant, in response to the demand of the King, executed the demanded action, sometimes appropriately but other times inappropriately. The children's task was to judge whether the Servant action was indeed appropriate or inappropriate, based on what the King demanded.

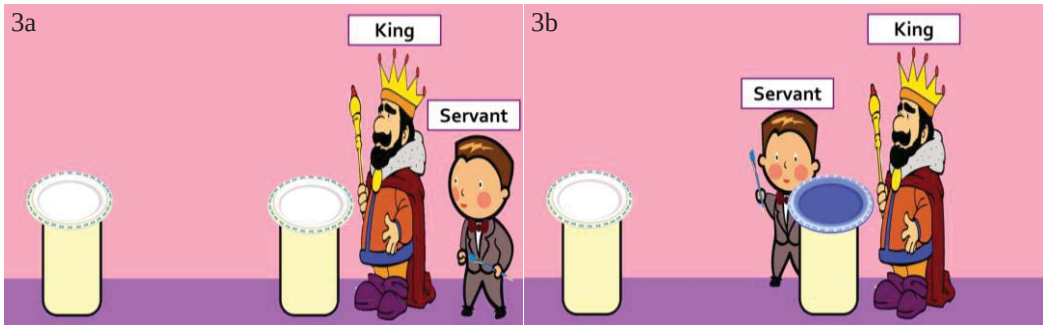

Figure 3. Sample pictures in the Judgment Task

Figure 3 above presents the visual scene setting for the Judgment Task. As illustrated there, we presented two identical objects, e.g., two plates, one of which was located near the King, while the other of which was located far from the King. In each trial, the King demanded the Servant to paint one of the objects, by a sentence with a demonstrative, as in (3).

(3) *ba* ***zhe-/na-ge*** *panzi* *tu* *cheng* *lanse*
BA **this-/that-**$CL_{generic}$ plate paint as blue
'Paint this/that plate blue.'

The Servant tried to fulfil the King's demand by painting one of the plates. The child was asked to judge whether the Servant painted the correct plate. There were four Conditions depending on (i) which of the demonstrative words was used in the demand (*zhe-ge* vs. *na-ge*), and (ii) whether the Servant painted the appropriate object that the King demanded, with respect to the distance between that object and the King (Match vs. Mismatch). When the King told the Servant to paint "*zhe-ge* ('this') plate", the Servant was supposed to paint the plate near the King (*zhe-ge* Match Condition), in which the child was expected to accept the painting outcome; but if the Servant painted the plate far from the King in the same situation (*zhe-ge* Mismatch Condition), then the child was expected to

reject the painting outcome. When the King told the Servant to paint *na-ge* (‘that’) plate, the Servant was supposed to paint the plate apart from the King (*na-ge* Match Condition), in which the child was expected to accept the painting outcome; but if the Servant painted the plate right by the King in the same situation (*na-ge* Mismatch Condition), then the child was expected to reject the painting outcome. In total, there were 8 items in the Judgment Task.

2.3 Theory of Mind task

The ‘**Hiding Game**’ ([29]; [30]) was used to measure children’s Theory of Mind. In the task, children watched picture stories about a series of hiding events, and were asked to find the hidden objects following the hints given by the characters in the stories. As shown in the sample picture in Figure 4, three characters were introduced in the stories: the Hider, the Knower and the Guesser.

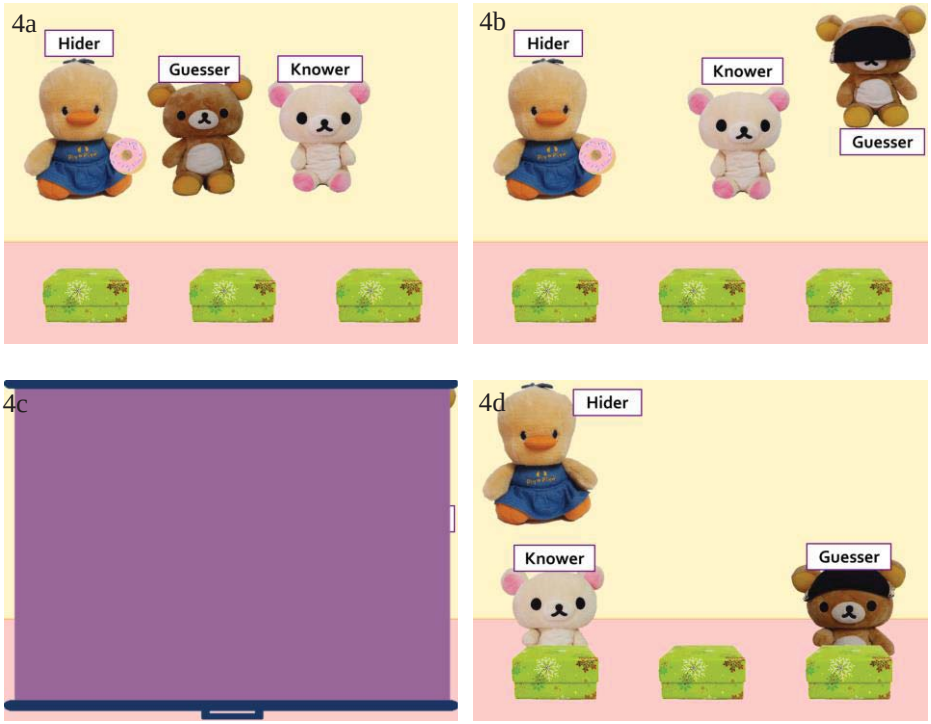

Figure 4. Sample pictures in the Hiding Game

The basic hiding plot is as follows. The Hider first told the child, the Knower, and the Guesser that she is going to hide an object (e.g., a donut) in one of the three boxes presented in the visual scene (see Figure 4a). Before the hiding started, the Guesser was blindfolded (see Figure 4b), while the Knower was told to watch the whole hiding event. During the hiding event, a screen blocked the scene, so the child was not able to observe the hiding (see Figure 4c). After the hiding event was completed, the screen was removed, and the Guesser’s blindfold was also removed. The Knower and the Guesser were told to select the box each of them thought has the object inside (see Figure 4d). Crucially, the Knower always selected the right box since he witnessed the hiding event and thus has the right ‘knowledge’ about the hiding outcome, while the Guesser always selected an incorrect box because he did not witness the hiding event and thus does not know the outcome. The child was asked to determine which of the boxes he/she thinks has the object inside.

Note that, with respect to the final outcome of the hiding event, the Knower and the Guesser have different knowledge status, with the Knower *witnessing* and thus *knowing* where the object was finally hidden, and the Guesser *guessing* where it was hidden without witnessing the event. The Guesser and the child, however, shared the same knowledge status in that they both did not witness

the hiding event and would not know which box has the object. Therefore, children need to know that the Guesser has the same status as they do while the Knower has a different status which is helpful in finding the object. Based on this assumption, if the child correctly selected the Knower's box, it was interpreted as an adult-like response, as the child could correctly infer that the Knower, not the Guesser, has reliable knowledge about the position of the hidden object. There were five hiding events in the task, with one practice story.

2.4 Executive Function task

The **Dimensional Change Card Sort (DCCS)** ([31]) was utilized to measure children's Executive Function. Particularly, DCCS measured one component of Executive Function, mental flexibility or shifting ability. Mental flexibility is the ability to flexibly switch between different perspectives. In the task, the child was given sorting cards with pictures which can be classified based on two dimensions, color and shape (e.g., a blue car and a yellow bear). The child was asked to sort cards based on one dimension, e.g., color, for the first six trials; this is also called Pre-switch Phase (see Figure 5a and 5b). After the Pre-switch Phase, the child was asked to sort the same set of cards according to the other dimension, e.g., shape; this is called Post-switch Phase (see Figure 5c and 5d).

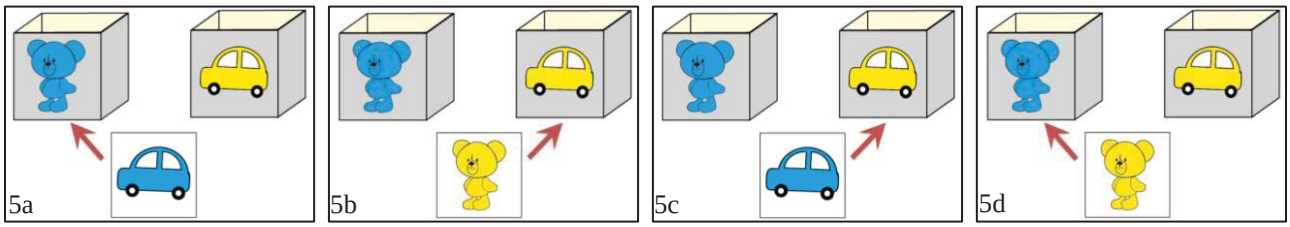

Figure 5. Sample trails in DCCS

2.5 Procedure

The testing was conducted in a quiet room at a preschool (N= 58) or at the child's house (N = 2) for children, and in a conference room for the adult control participants. Both child participants and adult participants were invited to the testing room one by one. All child participants were asked to complete all four tasks in the following order: the Act-out Task, the Judgment Task, the Hiding Game, and the DCCS. Adult participants only participated in the Act-out Task and the Judgment Task.

3. Results and discussion

3.1. Act-out Task

The Act-out Task was used to assess children's ability to interpret demonstrative words contrastively based on their own perspective. We examined participants' act-out responses to the instruction that included a demonstrative word. The overall results are presented in Table 1.

Table 1. Percentages of correct responses in Act-out Task by children and adults

	Trials with *zhe-ge* 'this'	**Trials with *na-ge* 'that'**
Children (N = 60)	88.89%	70.00%
Adults (N=16)	95.83%	100.00%

The adults' performance is at ceiling and children overall exhibited above-chance correct interpretations. Recall that the main goal of the current study is to explore the relationship between children's cognitive development and their comprehension of demonstratives, particularly when demonstratives are uttered by a speaker who has a different perspective. The Act-out Task is thus used in order to first ensure children's ability to comprehend *zhe-ge* ('this') and *na-ge* ('that') contrastively based on their own perspective. Therefore, we categorized children's performance as either 'pass' or 'fail' in this task. Children who gave adult-like responses in (i) two out of three trials with *zhe-ge* "this" and (ii) two out of the three trials with *na-ge* "that" were categorized as 'pass' group (N = 47); otherwise, they fell into 'fail' group (N = 13). The accuracy of each group is presented in Table 2.

Table 2. Percentages of correct responses in the Act-out Task by act-out passers and failers

	Trials with *zhe-ge* 'this'	**Trials with *na-ge* 'that'**
Act-out Passers (N=47)	88.74%	83.69%
Act-out Failers (N=13)	89.79%	20.51%

As presented in Table 2, children in the 'pass' group were overall near-adult-like, given that their accuracy is above 80%; while children in the 'fail' group performed poorly in the trials with *na-ge*, but were adult-like in trials with *zhe-ge*. Within the 'fail' group, we can further categorize children into two groups based on their response pattern: *This*-box-only group (N = 7) and Random group (N = 6). In *This*-box-only group, children put all the toy figurines in *zhe-ge* 'this' box, which is the box right in front of the child and the experimenter. This response pattern has been reported in previous literature (e.g., [32]; [14]). Children who exhibit this type of response pattern are proposed to have no contrast for demonstratives. In the Random group, excluding children who simply select the boxes with no specific pattern, there are three children who consistently selected *zhe-ge* 'this' box for at least three times in a row and then switched to *na-ge* 'that' box; particularly, these children explicitly stated that they switched to *na-ge* 'that' box simply because the space in the *zhe-ge* 'this' box is not enough for more toy figurines. To sum up, children in the non-adult-like group did not seem to understand that demonstrative words are used contrastively based on distance, and the differences in accuracy between *zhe-ge* and *na-ge* does not entail that children understand the meaning of *zhe-ge* but not *na-ge*; in fact, they do not understand the distance contrast between the two demonstrative words. Therefore, only children in the 'pass' group will be further analyzed in the other three tasks to test (1) whether their successful interpretation of demonstrative words based on their own perspective can be further extended to the cases where they need to incorporate a different perspective; (2) if yes, whether their successful demonstrative comprehension is related to their performance in the Theory of Mind task and the Executive Function task.

3.2. The Judgment Task

In order to examine whether children who could comprehend demonstratives based on their own perspective can also correctly comprehend demonstratives based on others' perspectives, we focused on the Act-out 'pass' children's responses in the Judgment Task. We calculated the percentage of correct responses in each condition for both children and adult controls. As shown in Table 2, adults are at ceiling for each condition, whereas children show different patterns. Overall, children did not have problems accepting the Match conditions both with *zhe-ge* ('this') and *na-ge* ('that'). However, children performed poorly in Mismatch conditions, suggesting that they were not able to reject painting outcomes that did not match the demand by the King.

Table 2. Percentages of correct responses in the Judgment Task by children and adults

	Match with *zhe-ge*	**Mismatch with *zhe-ge***	**Match with *na-ge***	**Mismatch with *na-ge***
Children (N = 47)	95.74%	38.30%	91.49%	40.43%
Adults (N =16)	100.00%	100.00%	100.00%	100.00%

We further examined individual responses in Mismatch trials. Twenty out of 47 children failed to reject Mismatch trials consistently, by accepting all the trials throughout. Two potential reasons may underlie such a response pattern. One explanation might be that children are not able to determine the speaker's perspective from the speaker's orientation. Given the visual setting that we provided in the task, the two objects in the picture are assumed to be equally distant to the child. Both objects could be potentially either *zhe-ge* or *na-ge* if the child cannot determine the distance. The objects were presented on the screen in front of the child and they were within the arm-reach distance to the child; thus children can easily point to the object or "touch" the object on the screen. Therefore, for children, the objects can be indicated by using *zhe-ge* because both of them are 'near' the child. Regarding the interpretation of *na-ge*, the interpretation of *na-ge* is suggested to be vague, that is, *na-ge* can also be used when the object is near the speaker ([12]). We will discuss the interpretation of *na-ge* in more detail below. The other explanation is that children may simply be reluctant to reject the mismatch painting outcomes. Children in the task were asked to judge whether the Servant was correct or not while considering the Servant was taking a test, and children may hesitate to judge the outcome as wrong. In fact, two children who failed to reject the outcome were able to point to the correct item before the painting happened. This suggests that some children can evaluate the King's perspective on the distance of the objects; however, when they were asked about the painting outcome, they may be showing sympathy to the Servant and may have judged the outcome as correct.

Let us now discuss the similarities and differences between each age group. Table 3 illustrates the age effect on the interpretation of demonstratives, particularly in the mismatch conditions.

Table 3. The percentages of correct responses in each condition from children across age group

	Match with *zhe-ge*	**Mismatch with *zhe-ge***	**Match with *na-ge***	**Mismatch with *na-ge***
4 yr (N=19)	100%	26.32%	97.37%	31.58%
5 yr (N=20)	92.5%	35%	87.5%	45%
6 yr (N=8)	93.75%	75.00%	87.50%	50%

As shown in Table 3, children's accuracy on mismatch conditions, particularly mismatch with *zhe-ge*, increased as age increased. Nonetheless, even the six-year-old children's overall performance on the mismatch conditions is still not like adults'. This finding replicates the findings in the previous literature (e.g., [14]; [33]). Clark and Amaral [33] suggested that the full mastery of demonstrative interpretations will emerge at age six or even older. Our results suggest that six-year-olds performed much better compared to four- and five-year-olds; however, they are still not adult-like. In particular, their performance on items that mismatch with *na-ge* is still at chance level.

3.3. Theory of Mind Task

We analysed children's performance in the Hiding Game based on whether the children knew the hidden object should be in the Knower's box. Based on Schick et al. [30], children were categorized into passers if they found the hidden object 4 out of 5 times and 3 times in a row. Out of 47 Act-out

'passers', 29 children were categorized as ToM passers in the Hiding Game. Eighteen children who failed to meet the criteria were categorized as ToM failers. Note that 5 out of 18 failers were categorized as failers because they did not find the hidden object 3 times in a row, but found the hidden object 4 out of 5 times. More specifically, these children were wrong only in the third trial among the five trials. According to Gale et al. [29] and Schick et al. [30], this response pattern is interpreted as that children were simply guessing rather than relying on the Theory of Mind reasoning.

Table 4. The percentage of passers and failers in the Hiding Game (numbers of children/total number of children)

	ToM Failers	ToM Passers
4 yr (N=19)	47.37% (9/19)	52.63% (10/19)
5 yr (N=20)	35% (7/20)	65% (13/20)
6 yr (N=8)	25% (2/8)	75% (6/8)
Total	38.30% (18/47)	61.70% (29/47)

Regarding the age group differences, as can be seen in Table 4, half of the 4-year-olds and the 5-year-olds passed the task and only two 6-year-olds failed the task. These differences across age group are predicted based on previous studies ([29]; [30]).

3.4. Executive Function Task

We examined whether children can follow the sorting rule to correctly sort cards in both Pre-switch Phase and Post-switch Phase in the DCCS. In particular, we focused on whether the child can successfully sort cards in the Post-switch Phase, which reflected whether the child was able to flexibly shift from one sorting dimension to the other. Children's responses were categorized based on 'pass' vs. 'fail' category, following Zelazo [31]. In order to 'pass' the task, children need to first sort cards correctly for 5 out of 6 trials in the Pre-switch Phase, and then sort cards correctly for 5 out of 6 trials in the Post-switch Phase; otherwise, the child would be placed in the 'fail' category. In the Pre-switch Phase, all 47 children were able to correctly sort cards for 6 out of 6 trials, which indicate that all children were able to follow the sorting rules. In the Post-switch Phase, 30 out of 47 children were able to correctly sort cards in 5 out of 6 trials; these children were categorized as passers. The remaining seventeen children who failed to correctly sort the cards on at least 5 of 6 trials in the Post-switch Phase were thus categorized as failers.

Table 5. The percentage of passers and failers in the DCCS (numbers of children/total number of children)

	EF Failers	EF Passers
4 yr (N=19)	52.63% (10/19)	47.37% (9/19)
5 yr (N=20)	30% (6/20)	70% (14/20)
6 yr (N=8)	12.5% (1/8)	87.5% (7/8)
Total	36.17% (17/47)	63.83% (30/47)

Table 5 demonstrates children's 'pass' and 'fail' rates from different age groups. As presented in Table 5, the number of passers increased while the age increased. In the four-year-old group, only half of the children passed the task which was unexpected based on findings of Zelazo et al. [34] with English-speaking children. Zelazo et al. reported that 60% of the three-year-olds had difficulty in switching to new rules in the Post-switch Phase; yet, 90% of the four-year-olds already are successful switching to the new rule in the Post-switch Phase. Intriguingly, in the current study,

Chinese-speaking children seem to have had more difficulties as compared with English-speaking children reported by Zelazo et al. [34]. In particular, half of the four-year-olds still struggled to switch to the new rule in the current study. In Sabbagh et al. [28], when comparing the same age group, Chinese-speaking children outperformed their counterpart peers of English-speaking children in all of the Executive Function tasks, including DCCS. However, a similar ratio between the passers and failers was found in Chu and Minai [3] with English-speaking children.

3.5. Cross-task analysis: Is development of Theory of Mind and Executive Function related to children's comprehension of demonstratives?

Recall that the aim of the current study is to explore the potential relationship between children's demonstrative comprehension based on the speaker's perspective, rather than one's own perspective, and their development of Theory of Mind and Executive Function. In order to examine the relationship between the three domains, we conducted a cross-task analysis using a one-tailed Spearman's Rho test. The variables that were included in the analysis are (i) the percentages of correct responses for each condition in the Judgment Task, (ii) the pass/fail category in the Hiding Game (Theory of Mind task), and (iii) the pass/fail category in the DCCS (Executive Function task).

Table 6. Spearman's Rho Correlation coefficient for cross-tasks analysis (*p*-value shown in parentheses)

	Match with *zhe-ge*	**Mismatch with *zhe-ge***	**Match with *na-ge***	**Mismatch with *na-ge***
ToM pass/fail	.230(.060)	.249*(.046)	-.175(.119)	.208(.080)
EF pass/fail	-.071(.318)	.150(.157)	-.034(.411)	-.017(.456)

Note. * indicates a significant effect ($p < .05$)

As shown in Table 6, only the correct rejection rate in the Mismatch conditions for *zhe-ge* is significantly correlated with children's performance in the Hiding Game. However, children's correct responses in *na-ge* conditions did not significantly correlate with their performance in the Hiding Game. Additionally, regarding the development of Executive Function, we did not find any significant correlation between the correct responses for each condition in the Judgment Task and the performance in DCCS. The results thus suggest that children's comprehension of demonstrative word, particularly *zhe-ge* is related to children's development of Theory of Mind, whereas the development of Executive Function is not related to children's comprehension of demonstrative word. The results of the cross-task analysis support our prediction that demonstrative comprehension is related to Theory of Mind development, replicating and extending the findings of Chu and Minai [3].

Let us now turn to the discussion on why Executive Function did not correlate with children's demonstrative comprehension and why the comprehension on *na-ge* did not show parallel results to *zhe-ge*. Regarding the role of Executive Function, our results together with Chu and Minai's [3] results are in line of De Mulder's [20] findings. De Mulder investigated the relationship between children's referential communication and their development of Theory of Mind and Executive Function. In contrast to previous studies that have reported a relationship between children's referential communication and their Executive Function (e.g., [18]; [19]), De Mulder found that only Theory of Mind is the good predictor of children's successful referential communication. She further suggests that understanding other's mental states is the most crucial cognitive ability for children to correctly use referring expressions.

However, although our results on Executive Function are consistent with De Mulder's findings which suggest that children's perspective-taking ability is not related with Executive Function, the relationship between children's comprehension of demonstratives and Executive Function is still

unclear as tested in the current study. One potential reason that no significant correlation was found in our study may be due to the Executive Function component we are measuring. DCCS was selected to measure the mental flexibility. Our hypothesis is that children need to flexibly switch between their own perspectives and the speaker's perspective when comprehension demonstratives. However, some previous studies argue that inhibition control is the most important component to be associated with one's perspective-taking in communication. In particular, Nilsen and Grahman [18] used tasks that measures children's inhibition control and mental flexibility respectively; yet, only the performance in the inhibition control tasks was related with children's referential communication ability. Some researchers argue that DCCS could also be measuring inhibition control ([35]). They claim that children fail to switch the rule in the Post-switch Phase because they cannot inhibit the first rule they followed. However, Nilsen and Grahman [18] used the DCCS to measure cognitive flexibility and did not find a correlation between children's ability of perspective-taking and performance in DCCS. Therefore, it is possible that DCCS may not be the best measurement for Executive Function when we seek for its relation with one's perspective-taking skills. Thus, in future research, we plan to include other types of inhibition control measurement. If inhibition control is indeed related with perspective-taking, we would expect to see correlation between children's demonstrative comprehension and their inhibition control abilities.

With respect to children's comprehension of *na-ge* 'that', Levinson [12] suggested that *that* can be used in more contexts than *this*; in other words, the uses of *this* are more restricted. For example, if an object is located near the speaker, the speaker can use either *this* or *that* to indicate the object whereas if the object is located far from the speaker, he/she can only use *that* to refer to the object. This analysis may predict that the interpretation of *that* could be more challenging than that of *this*. This prediction seems to be true if we take a look at children's performance in the Judgment Task. As presented in Table 3, even children at age six were not rejecting the Mismatch condition with *na-ge* 'that'. They were only rejecting the outcome at 50% of the time, whereas they were rejecting the Mismatch conditions with *zhe-ge* 'this' at 75%. Additionally, children's rejection rate of the Mismatch conditions with *zhe-ge* 'this' increased from age five to age six; however, their rejection rate of the Mismatch condition with *na-ge* 'that' only increased about 5%, which means that there is virtually no development from age five to six regarding the interpretation of *na-ge* 'that'. Children's performance in the Judgment Task thus is consistent with what would be predicted from Levinson's analysis.

4. Conclusion

The findings of the current study suggest that children's successful comprehension of demonstrative words is related to their Theory of Mind development, although the potential relationship between demonstrative comprehension and Executive Function remains unclear. Our findings on Chinese-speaking children provide converging evidence with Chu and Minai's [3] findings on English-speaking children. Indeed, children's development of pragmatically appropriate interpretation is related to their non-linguistic cognitive abilities.

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