

THE ROLE OF NON-LINGUISTIC COGNITIVE DEVELOPMENT AND LANGUAGE-SPECIFIC MORPHOLOGICAL PROPERTIES IN THE FIRST LANGUAGE ACQUISITION OF DEMONSTRATIVES

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ABSTRACT

This dissertation investigates children's comprehension of demonstratives, such as *this* and *that* in English. As deictic spatial expressions, the interpretation of demonstratives is context-dependent: a proximal demonstrative (e.g., *this*) picks out the entity near the speaker, while a distal demonstrative (e.g., *that*) picks out the entity apart from the speaker; crucially, the entity-speaker distance is determined by the speaker's perspective, which varies across contexts. Studies have shown that children tend to be non-adult-like when comprehending demonstratives uttered by a speaker who has a different perspective from their own (e.g., Clark & Sengul, 1978; Zhao, 2007). To better understand children's comprehension of demonstratives, this dissertation explores (i) the cognitive factors which might hinder children's adult-like knowledge, and (ii) the language-specific factors which might improve children's demonstrative comprehension.

This dissertation first discusses Theory of Mind (ToM) and Executive Function (EF) and how the development of each may hinder children's comprehension of demonstratives. Successful comprehension of demonstratives requires the listener to incorporate the speaker's perspective, in which cognitive abilities may play a role. It has been suggested that children's non-adult-like demonstratives may be related to their still-developing ToM (de Villiers, 2007) and EF (Nilsen & Graham, 2012). Two experiments directly tested this hypothesis with English-speaking and Chinese-speaking children, respectively. Both experiments utilized two demonstrative comprehension linguistic tasks, and two cognitive tasks measuring ToM and EF, respectively. The results from both experiments suggest that children's successful comprehension of demonstratives may be related to their ToM development, but not EF.

This dissertation then examines whether a language-specific morphological representation of demonstratives may interact with children's comprehension in a way that

prevents them from committing non-adult-like comprehension. Demonstratives in Mandarin Chinese are of particular interest because they typically occur with *classifiers*. Classifiers are semantically dependent on their associated referents; interestingly, classifiers are known to facilitate adults' sentence processing (e.g., Hsu, 2006; Wu, Kaiser, & Andersen, 2009). Thus, this dissertation examined whether and to what extent the classifier may improve Chinese-speaking children's demonstrative comprehension. Results reveal that the classifier semantics improves children's demonstrative comprehension, particularly when the classifier semantics itself is sufficient to identify the referent.

In sum, the results of the studies discussed in this dissertation suggest that both cognitive factors and language-specific factors play an important role in children's demonstrative comprehension.

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Chapter 1. INTRODUCTION

The current dissertation investigates factors that interact with children's language comprehension. Young children often exhibit non-adult-like comprehension when computing the meanings of linguistic expressions. Two central goals in first language acquisition research are to understand why children's comprehension of some linguistic expressions are non-adult-like and to understand what can help children exhibit an appropriate interpretation of those challenging linguistic expressions. I explore these two goals by investigating extra-linguistic cognitive factors, which might be the factor that hinders children's adult-like knowledge, and factors internal to linguistic expressions, which might be the factors that rescue children's non-adult-like comprehension, with a particular focus on children's comprehension of *demonstratives* (e.g., *this* and *that* in English). Each factor will be discussed in depth.

Two accounts have been proposed to interpret children's non-adult-like comprehension. One claims that children difficulty is due to their lack of linguistic knowledge while the other one argues that children have the intact linguistic knowledge, but their adult-like comprehension is hindered by other factors such as their still-developing cognitive abilities. The current dissertation supports the first account. In particular, I would argue that children may need to have adult-like cognitive abilities to achieve adult-like comprehension, using their linguistic knowledge properly. As children are developing their language, their cognitive abilities are still under development as well. Therefore, children's non-adult-like interpretations may be hindered by their still-developing cognitive abilities. In an effort to support the argument discussed above, the first goal of the dissertation is to examine the interaction between language and cognition.

The second goal of this dissertation is to explore whether there may be specific linguistic factors that could potentially rescue children from errors in comprehension. The representation of a particular linguistic expression often varies cross-linguistically. This raises a question regarding how children may use linguistic properties in representations that are specific to the language they are acquiring as their first language, and whether these language-specific characteristics may facilitate children's comprehension or interact with children's comprehension in a negative direction. Hence, investigating how children use language-specific characteristics in their language comprehension may shed light on the potential linguistic factors that boost or hinder children's language comprehension, which may not be observed with children acquiring a language that doesn't have this specific linguistic property.

Taken together, the current dissertation assesses both cognitive factors (children's non-linguistic cognitive development) and linguistic factors (language-specific characteristics in representation of a linguistic expression) that may potentially impact children's language comprehension. To achieve the two goals, I investigated children's comprehension of *demonstratives* (e.g., *this* and *that* in English) as a testing case for the following reasons. First, the interpretation of a demonstrative is context dependent. Thus, successful comprehension of demonstratives requires not only the linguistic knowledge of the meaning of these words, but also the non-linguistic cognitive abilities to incorporate the necessary contextual information. Thus, investigating children's demonstrative comprehension speaks to whether and to what extent children's cognitive development may have an impact on their demonstrative comprehension. Second, the representation of demonstratives varies across languages. For example, in English the demonstrative *this* and *that* are monomorphemic words, while in Chinese the demonstratives are represented as a morphological complex, which contains the

words corresponding to *this* and *that*, and another set of morphemes called *classifiers*, morphemes that categorize the associated nouns based on the semantic domains the nouns denote. Because of this morphological complexity, I refer to Chinese demonstratives as *demonstrative phrases* throughout this dissertation. As Chinese demonstrative phrases (e.g., *zhe-ge* (this-CL_{gen} ‘this’) and *na-ge* (that-CL_{gen} ‘that’)) contain an additional linguistic device, investigating the role of classifiers in Chinese demonstrative comprehension allows me to explore whether and to what extent the language-specific properties interact with children’s comprehension of demonstrative phrases. In what follows, I will discuss these two research issues in detail.

1.1. The interaction between language and cognition

The relationship between language development and cognitive development has been the subject of debate for decades, since Slobin (1973). Recently, research has started to focus on the relationship between children’s language comprehension and cognitive development (Gopnik & Meltzoff, 1986; Y. T. Huang & Snedeker, 2009; Mazuka, Jincho, & Oishi, 2009). It has been suggested that children’s ability to utilize their linguistic knowledge may be related to their cognitive development. This recent discussion can refer back to the earlier works, such as Slobin’s (1973) framework, which proposed that the sequence of the acquisition of linguistic properties is constrained by children’s cognitive abilities. He first assumed that children have intact linguistic knowledge; however, due to the limitation of their cognitive abilities, their linguistic performances may still be non-adult-like. He argued that cognitive development is a “pacesetter” (p. 184) for language development and pointed out that there are three circumstances in which cognitive ability is prerequisite for language development. First, children mastering the semantics of the linguistic expressions interacts with their cognitive development.

Children need to develop the concept and understand it before they are able to express and comprehend the concept using linguistic expressions¹. The second circumstance in which cognition is a prerequisite is when children produce or process the linguistic expressions. The third circumstance is about the memory storage of the linguistic rules. Both the second and the third circumstances are related to the capacity and processing rules which children, as well as adults, possess in order to process and produce languages; these could also be conceptualized as “operating principles” (Slobin, 1973, p.194) or some universal strategies children need to follow to develop their grammatical structures. In sum, children’s ability to express cognitive concepts requires appropriate cognitive abilities, and their ability to process linguistic expressions rapidly also requires adult-like cognitive resources. Therefore, the interaction between language and cognition is described as the following: “the child ... scans linguistic input to discover meaning, guided by certain ideas about language, by general cognitive-perceptual strategies, and by processing limitations imposed by the constraints of operative memory” (Slobin, 1973, p.208).

There are three possibilities regarding how language and cognitive may interact with each other (c.f. Gopnik and Meltzoff, 1986): (i) general cognitive development might be related to the development of particular language development (e.g., Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979); (ii) general language development might be related to the particular sets of cognitive abilities (e.g., McCune-Nicolich, 1981); (iii) particular language development might be related to a particular sets of cognitive abilities (e.g., Gopnik & Meltzoff, 1984). Slobin’s framework of the interaction between language and cognition may belong to the third possibility,

¹ Note that Lust (2006) also suggests that children’s acquisition of semantics and pragmatics need to be discussed with their cognitive development.

in which a particular aspect of language such as semantics might be related to a particular set of cognitive abilities. The relationship between the two domains may resemble the following figure.

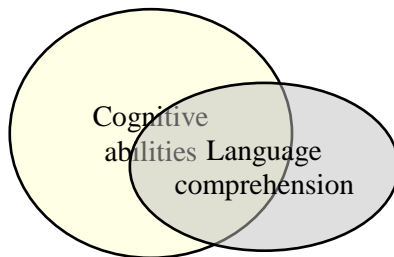


Figure 1. The interaction between language and cognition

Slobin stated that some cognitive ability is prerequisite for language comprehension. The argument is built on the basis of the assumption that children have the intact linguistic knowledge; however, children need to have the appropriate cognitive abilities to correctly utilize their knowledge when either producing linguistic expressions or comprehending the linguistic expressions.

Recently, Mazuka et al. (2009) and Huang and Snedeker (2009) elaborated on Slobin's proposal. Slobin proposed that (i) children need to grasp the concept before utilizing their linguistic knowledge, and (ii) children's linguistic performance is constrained by their cognitive processing limits, with a particular focus on memory issues. Mazuka et al. (2009) and Huang and Snedeker (2009) focused on the cognitive processing limits that hinders children's adult-like processing, but their view of cognitive abilities relevant to language processing is not necessarily limited to memory. They postulated that children's still-developing cognitive abilities may interfere with their language processing. That is to say, the reason that children exhibit non-adult-like language comprehension may be related to their still-developing cognitive ability, such as Executive Function that contains a set of cognitive abilities that controls a variety of processing capacities in addition to memory, to execute the processing procedure.

The first goal of the current dissertation is to investigate children's language comprehension in relation to their cognitive abilities, examining a set of cognitive abilities that may interact with children's language comprehension in a way that makes children's comprehension non-adult-like. In particular, I examined whether children's successful/non-successful language comprehension would be related to their cognitive ability that allows them to (i) understand the concept underlying the linguistic expression, and (ii) execute the meaning computation procedure when comprehending some linguistic expression that requires the incorporation of extra-linguistic information. The current dissertation focuses on children's demonstrative comprehension, which has been suggested as the domain in which children often exhibit non-adult-like interpretations (E. V. Clark & Amaral, 2010; E. V. Clark & Sengul, 1978; Tanz, 1980; Wales, 1984; Webb & Abrahamson, 1976).

Let me first review the basic characteristics of demonstratives. Demonstratives are place deixis that pick out an individual from the speech context with respect to the aspect of space (Diessel, 2012; Fillmore, 1997). English demonstratives, for instance, have two-way distance distinctions. The proximate demonstrative *this* picks out an object near the speaker while the distal demonstrative *that* picks out an object distant from the speaker (E. V. Clark & Sengul, 1978; Diessel, 1999; Lyons, 1975; Murasugi, 1986). Crucially, the speaker-object distance is determined by the speaker's perspectives, which vary across contexts (E. V. Clark & Sengul, 1978; Diessel, 1999, 2012; Lyons, 1977; Murasugi, 1986). The following dialogue exemplifies the contrastive use of demonstratives. Imagine a situation in which Speaker A and Speaker B are sitting apart from each other in a room, and a teddy bear is placed in front each of them (See Figure 2).



Figure 2. Situation demonstrating the contrastive use of demonstratives

Then, consider the following conversation as in (1) between Speaker A and Speaker B:

(1) A: I don't want *this* teddy bear anymore. Can I have *that* teddy bear? (Pointing at the teddy bear in front of B)

B: (Pointing at the same teddy bear) *This* one? But you already have *that* one. (Pointing at the teddy bear in front of A)

In (1), Speaker A uses *this* referring to the teddy bear in front of him, while he uses *that* referring to the teddy bear apart from him. Therefore, in order to successfully comprehend Speaker A's utterances, not only must Speaker B know that *this* is a proximate demonstrative and *that* is a distal demonstrative, but he must also know that the proximal-distal contrast that is created here is based on the perspective of Speaker A, the speaker of the utterance. If Speaker B fails to incorporate Speaker A's orientation, he may associate *this* with the object near himself and associate *that* with the object distant from himself, which does not match what Speaker A means to express. Indeed, the proximal-distal contrast based on Speaker B's perspective will associate *this* and *that* in a reversed way, as reflected in Speaker B's utterance. In Speaker B's utterance, the teddy bear in front of Speaker A is referred to as *that* teddy bear which was referred to as *this* teddy bear in Speaker A's utterance, while the teddy bear in front of Speaker B is referred to as

this teddy bear which was referred to as *that* teddy bear in Speaker A's utterance. As illustrated in this example, to appropriately interpret demonstratives, children not only need to understand the distance contrast between *this* and *that*, but also need to incorporate the speaker's perspective to calculate the distance of the object.

The discussion above is limited to the scope of the two-way distance distinction of a demonstrative system in English. Some other languages have three-way (e.g., Turkish; Özyürek, 1998) or even four-way distinction (e.g., Quileute; Diessel, 1999), and the distinction between the demonstratives is not always restricted to distance contrast (e.g., visibility, uphill/downhill, etc; Diessel, 1999; 2012). For instance, Turkish has three demonstratives: *bu*, *o*, and *şu*, in which *bu* is a proximal demonstrative and *o* is a distal demonstrative, but *şu* is neutral to distance yet requires the speaker to examine whether the listener's visual attention is fixated on the referents, as the use of *şu* needs to be under the circumstances in which the listener's attention is not allocated to the intended referent (Küntay & Özyürek, 2002, 2006). The additional feature of the third demonstrative *şu* may be challenging for children, as it did not encode distance; rather it requires the speaker to incorporate the listener's perspective. Indeed, Küntay & Özyürek (2002, 2006) have shown that even for 6-year-old Turkish-speaking children, their production of the third demonstrative *şu* is not like adults, whereas their production of the other two demonstratives is on par with adults'. This indicates that while children are able to use the two demonstratives *bu* and *o*, which encode a distance distinction, they did not seem to associate the absence of the visual attention on the referents with the production of the third demonstrative *şu*.

Although the third demonstrative *şu* seems to create extra difficulty in acquiring a three-way demonstrative system in Turkish, I argue that children's non-adult-like use of *şu* may be accounted for by the same hypothesis that attributes it to their development of the ability to

correctly infer others' mental states, including perspective and attention allocation. The challenges both come from the incorporation of the interlocutor's perspective, which is different from children's own. Importantly, demonstratives are place deixis in which the center of the referent point is located at the speaker's orientation. Therefore, the speaker's perspective is crucial to correctly comprehend demonstratives (Diessel, 2014), regardless of the semantic feature the demonstratives encodes in the languages. Thus, children acquiring two-way or three-way demonstrative systems may share the same difficulty incorporating the speaker's perspective.

Taken together, to better understand children's acquisition of demonstratives, this dissertation particularly focuses on children's comprehension of demonstratives, examining whether children's comprehension of demonstratives uttered by a speaker who has a different perspective from the children's own would be related to their cognitive development. Children's successful comprehension of the demonstratives requires the ability to establish the speaker's perspective appropriately, which may suggest an adult-like cognitive ability would play a role in children's demonstrative comprehension. Results of this study may advance the understanding of why children show difficulties in interpreting demonstratives and may reveal the source of the potential difficulty.

1.2. The interaction between language acquisition and language-specific properties

The second goal of this dissertation is to investigate how the language-specific characteristics may interact with children's language comprehension. To achieve this goal, demonstratives also provide an ideal ground to consider the language-internal factor that may interact with children's language comprehension. The premise is that demonstratives are

represented differently across languages (Diessel, 1999). Consider English demonstratives in (2a) and their translation in Mandarin Chinese in (2b), to start out:

(2) a. *This cat.*

b. *zhe zhi mao.*

this CL_{animal} cat

‘This cat.’

As illustrated in (2), demonstratives in English are represented by a single morpheme, whereas demonstratives in Chinese, such as *zhe* and *na*, typically are accompanied with an additional morpheme, *classifier* (C. T. J. Huang, Li, & Li, 2009), constituting a morphological complex that works on par with English mono-morphemic demonstrative as a whole phrase. I will refer to the words *zhe* and *na* as *demonstratives* and the morphologically complex expression of demonstratives in Chinese shown in (2) as *demonstrative phrase* throughout this dissertation.

The Chinese demonstrative phrase is an interesting testing case because of its characteristics shown in (2b). First of all, the classifier in the demonstrative phrase is obligatory in most of the contexts (C. T. J. Huang et al., 2009; Tang, 2007; N. N. Zhang, 2012). Second, and most importantly, the classifier needs to agree with the semantic category of the denotation of the following noun. Consider the example (3).

(3) *zhe/na zhi mao/* waitao*

this/that CL_{animal} cat/*jacket

‘This/that cat.’

-Zhi is the classifier that classifies ‘animals’; the noun that the classifier *-zhi* is associated with requires an animal as its denotation. As shown in (3), the demonstrative phrase with *-zhi* can properly accommodate the noun *mao* (‘cat’) that denotes a kind of animals, but not the noun *waitao* (‘jacket’) that denotes a kind of outfit, because the denotation of this noun is not semantically compatible with the semantic property of the classifier *-zhi*.

Such a semantic characteristic of classifiers may thus interact with the comprehension of demonstrative phrases in Chinese. There are two possibilities of how language-specific properties, such as the semantics of classifiers, may interact with children’s comprehension. One possibility is that the language-specific properties may facilitate children’s language comprehension, whereas the other is that the language-specific properties may hinder children’s successful language comprehension. Before explaining each possibility in more detail, it is worthwhile to note that Chinese-speaking children as young as three and four are known to acquire some basic classifiers. Many studies have shown that children have the knowledge of semantic dependency between a classifier and its associated noun (Chien, Lust, & Chiang, 2003; Erbaugh, 1986; Gong, 2010; Hu, 1993; H. Liu, 2008; I. Y. Tsai, 2008). Additionally, psycholinguistic studies on adults have revealed that classifiers are useful anticipatory cues for the semantic category of the upcoming nouns during sentence processing (C.-c. N. Hsu, 2006; Wu, Kaiser, & Andersen, 2009; Wu, Luo, & Zhou, 2014), indicating that classifiers may be a cue that facilitate sentence comprehension. Keeping this line of research in mind, let me now turn to each of the possibilities for the role the classifiers may play in demonstrative comprehension. On one hand, given that children acquire some of the basic classifiers, children may be very likely to take advantage of the classifier in the Chinese demonstrative phrase to successfully comprehend

demonstrative phrases even when the demonstrative phrases are uttered by a speaker with a different perspective. On the other hand, as classifier semantics is suggested to be available to children during language processing, the extra information provided by the classifier may require extra processing resources when comprehending demonstrative phrases in Chinese.

Consequently, the extra processing burden of classifiers in demonstrative phrases may potentially negatively affect children's demonstrative comprehension. In the current dissertation, I predict that when comprehending demonstrative phrases in Chinese, children may use classifier semantics to help them identify the correct referent for demonstratives.

On the basis of the discussion above, the second goal of the current dissertation is to explore the role of the classifier in Chinese demonstrative comprehension to shed light on whether and how the language-specific property may interact with children's language comprehension. Particularly, if children already have the intact knowledge of those language-specific properties, the dissertation seeks to determine whether children can take advantage of those properties to boost their language comprehension.

1.3. The organization of the dissertation

This dissertation is organized as follows. Chapter 2 presents the nature of demonstratives by reviewing theoretical literature. Chapter 3 presents the studies examining the first goal of the current dissertation. I will first review the acquisition studies on demonstrative comprehension and then discuss studies the relationship between language and cognition. Following the literature review, I will present two experiments that examined the relationship between children's demonstrative comprehension and their cognitive abilities. Chapter 4 presents the study examining the second goal of the dissertation. In this chapter, I will first review the

structure of demonstrative phrases in Chinese and then provide a detailed discussion on classifiers. I will also review studies showing children's acquisition of the semantics of classifiers. Following the review, I will report one experiment examining the role of classifier semantics in Chinese-speaking children's demonstrative comprehension. Last, Chapter 5 summarizes the experimental results reported in Chapter 3 and Chapter 4 and provides a broader discussion on how the results could shed light on the cognitive factors and linguistic factors that interact with language comprehension.

Chapter 2. THE NATURE OF DEMONSTRATIVES

The aim of this chapter is to discuss the theoretical background on demonstratives, and from these discussions to determine which characteristics of demonstratives children need to know in order to interpret demonstratives appropriately. The first section of this chapter concentrates on the characteristics of deixis. Demonstratives are place deixis that specify the location of an entity in the context of use. Thus, to better illustrate the characteristics of demonstratives, I will start with the definition of deixis and introduce issues semanticists deal with to present the meaning of deixis. The second section of this chapter will turn to the semantic and pragmatic analysis of demonstratives. I will show that in terms of semantic features, the distance distinction in demonstratives, such as the near and far distinction, is the most frequently used in world languages. For instance, one demonstrative picks out an entity near the speaker while the other picks out the entity apart from the speaker. With respect to pragmatic uses, I will focus on the discussion of the deictic uses. In the final section of this chapter, I will summarize the discussion points and present two components children need to know to successfully comprehend demonstratives. The studies in the current dissertation will examine children's ability to use those two components that interact with (i) their cognitive ability and (ii) their use of the language-specific linguistic properties.

2.1. Deixis

2.1.1. The definition of deixis

The term deixis² refers to the context-dependent linguistic expressions that are situated, or ‘anchored’ in Fillmore’s term, in the location and time of the speech (Fillmore, 1997; Rauh, 1983). Deixis picks out the referents within the domain (e.g., the location of the speech) in which it is uttered. Therefore, deixis is also called ‘indexical’ as it serves as a ‘pointing’ function linguistically. Some examples of deixis are listed in (4).

- (4) a. personal pronouns such as *I*, *he*, and *she*
 b. demonstratives such as *this* and *that*
 c. adverbial place deixis such as *here* and *there*

As stated by Lyons (1977):

“By deixis is meant the location and identification of persons, objects, events, processes and activities being talked about, or referred to, in relation to the spatiotemporal context created and sustained by the act of utterance and the participation in it, typically, of a single speaker and at least one addressee” (Lyons, 1977, p. 637).

Deixis serves as an ‘index’ to the referent, in which the referent could be identified or located within the ‘here-and-now’ spatiotemporal frame, where the speaker and his/her interlocutor are located at the moment of the utterance is being delivered.

² The terms deixis and deictic expressions are used interchangeably in the dissertation.

The speaker's location at the time of utterance plays a crucial role for the appropriate interpretation of deictic expressions. Typically, the deictic expressions are used to relate to things from the speaker's point of view. In a conceptual spatiotemporal coordinate system, the speaker's orientation is at the center of the system (Diessel, 2014; Lyons, 1977), or *deictic center* (Diessel, 1999, 2012). Therefore, in a canonical deictic context, the identification of the referent is determined in relation to the speaker's location at the time of utterance. Since the speaker is the center of the reference point, the referent does not remain constant across all uses. This aspect of deixis is also known as *shift of reference* (E. V. Clark, 1978). In language communication, the role of the speaker shifts from one participant to another as the conversation proceeds. Since typically the speaker is the reference point, the reference point needs to be reestablished when the speaker's role shifts. In such a case, if different speakers used the same deictic expression *I*, the referent each expression picks out may be different. For instance, if Speaker A said 'I like ice cream' and Speaker B said the same sentence, 'I like ice cream', 'I' uttered by Speaker A picks out Speaker A as the referent whereas the 'I' uttered by Speaker B refers to Speaker B rather than Speaker A. Therefore, from the listener's perspective, s/he needs to reconstruct the speaker's perspective as the uses of these expressions are dependent on the situation of the speaker in terms of where and what time they delivered the utterance (Rauh, 1983). It is also worthwhile to note that the deixis in the embedded clause also needs to refer back to the speech context. For instance, if a speaker uttered 'John said I like ice cream', the 'I' in the embedded clause refers to the speaker of this sentence instead of the subject in the matrix clause, which here is *John*. This example once again shows the importance of indexicals to find the referent in the speech context.

In addition, like the pointing gesture, deixis not only serves as the ‘indexical function’ that is used to point to objects, persons, events, and activities within the specific location and time (Rauh, 1983), but also serves to direct the interlocutor’s attention (Diessel, 2014; Kaplan, 1989; Lyons, 1977). Since deixis draws listeners’ attention to the intended referents, deixis also establishes the joint attention between the speaker and the listener. Thus, an appropriate interpretation of deixis requires the establishment of a shared perspective toward the intended referents. In other words, as an index that attempts to direct listener’s attention, the appropriate interpretation of deixis requires the listener to establish a shared representation of the spatiotemporal system with the speaker.

To summarize, the use of deixis is situated to the location of speaker at the time of the speech; crucially, the speaker’s perspective determines the reference point. This shows that the use of deixis is context dependent; in other words, deixis could not be interpreted without considering the context. Therefore, in order to understand the speaker’s ‘intention’ to the referent, the listener needs to establish shared view of the spatiotemporal system and reconstruct the message based on the speaker’s perspective.

2.1.2. The meaning representation of deixis

As discussed above, deixis is a context-dependent expression that serves as an index to the person, location or time within the situation the speaker is situated. Thus, unlike proper names, the referent of deixis is not constant; rather, it is anchored to the context to pick out a concrete referent. However, the incorporation of contextual information to represent the meaning of deixis has long been a challenging issue in semantics. The traditional analysis suggests that deixis is an incomplete expression which presents as a free variable that picks out the individual

each time (cf. Burge, 1974). With this analysis, it may be possible to take the context into account as deixis will point to different individual depending on the context. However, the analysis cannot distinguish between the two sentences below, as discussed in Kaplan (1977, 1989) and Burge (1974). In particular, the truth value of these two sentences may not be equal.

(5) *I am here now.*

(6) *Joleen is in Lawrence on December 4, 2014.*

Between (5) and (6), sentence (5) is true in all situations. The speaker who utters sentence (5) will be in all circumstances at the place of the time of utterance. Suppose I am the speaker who uttered (5), then sentence (5) can be rephrased as in (6) by replacing the deixis ‘I’, ‘here’ and ‘now’ with ‘Joleen’, ‘Lawrence’, and ‘December 4, 2014’. However, (5) does not have the same meaning as (6). Although (6) describes the situation at this very moment, the truth value of (5) and (6) may not be equal. As (5) is always true in any circumstances, rephrasing (5) as in (6) may not remain true all the time as one of the propositions of (6) may be easily falsified if it does not exist. As pointed out by Levinson (2004), the problem of deixis is that sentences containing deixis does not have proposition because proposition is the meaning a sentence that does not change over the context.

Kaplan (1977, 1989) attempts to address this issue. He proposed two different concepts to represent meanings, namely ‘content’ and ‘character’. ‘Content’ refers to the proposition of the sentence dependent on the context. ‘Character’ refers to the basic properties of the sentence that does not change over the context; to put it differently, the definition of ‘character’ is the semantic *rules* or *functions* that guide the identification of the referent in all contexts. He argues that

‘content’ and ‘character’ are better representations of meaning in dealing with the traditional definition of sense and denotation. The classic example for sense and denotation is the ‘morning star’ and ‘evening star.’ These two expressions have different sense in that one might think that the morning star is the star that rises in the morning, while the evening start is the star that rises in the evening; however, they have the same denotation, in that they both refer to the planet Venus. However, when applying sense and denotation to indexicals, the issue illustrated in (5) and (6) emerges. Consider (5) again. The denotation of ‘I’ is ‘Joleen’, me as the speaker. However, ‘I’ could have a different denotation in different contexts, which creates problems with the sense of ‘I’, because the sense in this case could not determine its referent. The ‘content’ and ‘character’ then can accommodate this issue, in which ‘content’ replaces ‘sense’ while ‘character’ replaces ‘denotation’. The character is a function or semantic rule that applies to the context to get the content of the sentence. For instance, the ‘character’ for the personal pronoun ‘I’ is the speaker; that is, the personal pronoun always picks out whoever is speaking as the referent. Then, as a function, when fitting in the context (for instance, the context of the utterance (5) above), the function would return the content, or the referent of ‘I’, which is ‘Joleen’. But as the speaker may change across situations, the ‘content’ would be different depending on the different situation. That is, ‘I’ may pick out different individuals in different situations. As demonstrated in this example, the character thus accommodates the phenomenon in which the deixis picks out different referents in different contexts. In other words, the character and the content incorporate the context appropriately when representing the meaning of deixis.

Although this account was later criticized thoroughly (see review in Starr, 2010), this is one example showing that what the semanticists and philosophers are trying to capture is the context-dependent meaning of deixis. The current study does not attempt to address this

theoretical challenge. The crucial argument within this analysis is that the semantics of deixis is largely depends on the speech situation or the context.

2.1.3. The categories of deixis

Fillmore (1997) identified five types of deixis, including *person deixis* (e.g., personal pronouns such as I, you, and s/he), *place deixis* (e.g., adverbial place deixis such as here, there, and demonstratives such as this, that), *time deixis* that express the time of delivering utterance and/or time of receiving the utterance (e.g., today, tomorrow), *discourse deixis* that picks out individuals within prior/subsequent linguistic context (e.g., deixis that is used anaphorically), and *social deixis* that encodes the social relationships. Among the five types of deixis, the current study particularly focuses on place deixis. In English, as well as Chinese, there are two kinds of place deixis. One is the adverbial place deixis such as *here* and *there* in English or *zhe-li* (this-inside) and *na-li* (that-inside) in Chinese. The adverbial place deixis points to the place, or the location. The other one is demonstratives such as *this* and *that* in English or *zhe-ge* (this-CL_{gen}) and *na-ge* (that-CL_{gen}) in Chinese. Demonstratives are slightly different from adverbial place deixis in that demonstratives point to the object located in the location rather than the place itself. Therefore, H. H. Clark (1973) suggested that each demonstrative could be further rephrased as ‘the object here’ and ‘the object there.’ Between the two kinds of place deixis, demonstratives are the particular interest in the current study.

2.2. Semantic-pragmatic analysis on demonstratives

2.2.1. Semantic distinctions of demonstratives

Demonstratives as place deixis have two crucial features. First, as discussed above, for all deictic expressions including demonstratives, the uses of demonstratives are situated to the here-and-now context with the speaker's location of the utterance at the time as the deictic center. The second important feature of demonstratives as place deixis is that they encode space information. Diessel (1999) conducted a typological analysis regarding how space information is encoded in world languages. He categorized the semantic distinctions of demonstratives into four categories, (i) distance, (ii) visibility, (iii) elevation (e.g., up/down), (iv) geographical (e.g., uphill/downhill, upriver/downriver), and (v) movement (e.g., toward). Among these distinctions, distance distinction is most frequently used in world languages and is suggested to be acquired earliest (Diessel, 2006). Typically, the distance distinction has a two-way distinction, which is proximal and distal. Some languages, such as Spanish and Japanese, have three-way distinction, and some have even more ways (e.g., four-way distinction in Quileute, Diessel, 1999). The current dissertation focused on languages that have two-way distinction, such as English and Chinese.

English has two demonstratives: *this* and *that*. According to the Oxford English Dictionary Online, *this* is defined as a thing or a person that is nearby or nearer than other things in the space and time or even in thoughts whereas *that* is defined as “properly denoting the more distant of two things, but often vaguely indicating one thing as distinguished from another.” This indicates that although *that* is a distal demonstrative, it may also vaguely refer to objects in the context. I will come back to this point when discussing the meaning representation of demonstratives in the next section. Like English, Chinese also has two demonstratives, a proximal demonstrative and a distal demonstrative. In the Chinese WordNet online dictionary

(C.-R. Huang & Hsieh, 2009-2010), *zhe-ge* is defined as a subject that is relatively closer to the speaker while *na-ge* is defined as a subject that is relatively distant from the speaker. It is also worthwhile to note that like the English *that*, *na-ge* in Chinese could also pick out any entity within the contexts. In sum, based on the definitions discussed above, both English and Chinese have two demonstratives and these two languages implement the two-way distance distinction. Thus, the two demonstratives are distinguished from each other based on the distance of the entity to the speaker. One demonstrative is proximal and the other is distal, but the distal demonstrative is also argued to vaguely indicate an entity in the physical context.

In what follows, I will review the theoretical analysis of demonstratives regarding how the meaning of demonstratives is represented. Since the theoretical analyses were mainly conducted on English, I will provide the analysis of English only. As Chinese, like English, also has two-way distinction in demonstratives, I assume that the theoretical aspects of Chinese demonstratives are the same as English.

2.2.2. Theoretical analysis

As mentioned previously, the meaning representation of deixis requires the incorporation of the context regarding the speaker's location of the time of speech event. As spatial deixis, demonstratives also require the incorporation of the speaker's orientation to represent its meaning, and particularly for demonstratives, the meaning representation requires the incorporation of the distance information in order to tease apart the two demonstrative words. Lyons (1975) represents the meaning of demonstratives by means of the semantic features. Five features were identified, including [+D], [\pm entity], [\pm person], [\pm proximate], and [\pm distal]. [+D] stands for deictic, which aims to represent the context information; in this case, the context is the

physical context that at the speaker's orientation point. Both [\pm entity] and [\pm person] are used to describe the particular category of deixis. The distance distinction is represented by [\pm proximate] and [\pm distal]. Using these features, Lyons represented the meaning of *this* and *that* as in (7).

(7) *this* [+D, +entity, -person, +proximate]

that [+D, +entity, -person, -proximate, +distal]

The meaning representation as shown in (7) captures the meaning of *this* as a deictic expression that picks out an entity that is nearby, whereas the meaning of *that* is a deictic expression that picks out an entity that is not nearby, but instead some distance away. The main distinction between *this* and *that* is in the proximity contrast, that is, whether the entity is proximate or not. In other words, the difference between *this* and *that* is proximal and non-proximal rather than proximal and distal or distal and non-distal. The reason Lyons used proximity contrast is because the non-proximal term also implies a distance with respect to the speaker, while keeping the distal contrast to distinguish between the two different meanings of *that*. Recall that according to the Oxford Dictionary, *that* denotes an entity apart from the speaker but may also vaguely indicate an entity's presence in the context. Lyons argues that there are indeed two different meanings for *that*, which provides an account for the dictionary meaning defined in the aforementioned Oxford Dictionary. Among the two meanings *that* represents, one is referred to as *strong*, which is argued to contrast with the meaning of *this*, and the other is referred to as *weak*, which points to entities vaguely without making a distance contrast with *this*. The strength of the term is labelled with subscript. *That*₁ is the weak term and *that*₂ is the strong term. The meaning representation of each *that* is shown in (8).

(8) Weak term: *that*₁[+D, +entity, -person, -proximate, -distal]

Strong term: *that*₂ [+D, +entity, -person, -proximate, +distal]

As presented in (8), the strong term *that*₂ contrasts with *this*, in which the meaning representation is the same as in (7). Recall that the main difference between *this* and *that*₂ is the proximate feature. While *this* has [+proximate] feature, *that*₂ has [-proximate] feature. The additional feature [±distal] is used to distinguish between the two different meanings of *that*. As presented in (8), while the strong *that*₂ has [+distal], the weak *that*₁ has [-distal]. The combination of the two features [-proximate] and [-distal] to represent the weak *that*₁ illustrates that the use of weak *that*₁ only serves as a deixis which picks out an entity in the physical context without indicating the distance of the entity relative to the speaker. In other words, the weak *that*₁ does not imply a contrast with *this*.

In addition to Lyons' (1975) analysis, Webb and Abrahamson (1976) also provided their own semantic analysis of demonstratives based on adults' use and children's developmental trajectory on demonstratives. They identified three features, [+Demonstrative], [±Far], and [+Speaker = Reference Point]. [+Demonstrative] refers to the lexical entry for the two demonstrative words that includes the definiteness of the lexical items. In other words, the feature [+Demonstrative] functions similarly to the [+D] feature in Lyons' term, in which [+Demonstrative] indicates that *this* and *that* pick out an entity in the context. The feature [±Far] captures the proximity distinction. [-Far] is assigned to *this* and [+Far] is assigned to *that*. Webb and Abrahamson (1976) stated *that* is unmarked because the use of *that* can apply to a wider range of distance domain regardless of the distance relative to the speaker; in contrast, the use of

this must go with the object near the speaker. On the basis of this reasoning, Webb and Abrahamson argued to use [\pm Far], instead of [\pm Proximate], based on the markedness of the two demonstratives. This analysis is in line with the definition of *that* from the Oxford Dictionary and Lyons' analysis. It is thus clear that the meaning representation of *that* may be more complex than the meaning representation of *this*. The last feature [+Speaker = Reference Point] captures the deictic uses of demonstratives. This feature refers to the idea that the speaker is the deictic center to evaluate the distance to the object. Using the three features, Webb and Abrahamson (1976) represented the meaning of *this* and *that* as in (9)

(9) *this* [+Demonstrative, -Far, +Speaker = Reference Point]

that [+Demonstrative, +Far, +Speaker = Reference Point]

As in Lyons (1975), (9) demonstrates that the difference between the two demonstratives is the proximity or distance contrast, in which Webb and Abrahamson used [\pm Far] feature here while Lyons used [\pm proximate]. Although the feature used is different, the idea that *this* is a proximal demonstrative while *that* is a distal demonstrative is the same; however, *that* could also be used to pick out entities in the context without considering the speaker-object distance.

Both Lyons (1975) and Webb and Abrahamson (1976) used semantic features to represent the meanings of English demonstratives. As discussed above, the meaning representation for *this* is straightforward as it is a proximal demonstrative that only picks out entities near the speaker. However, the meaning representation for *that* is more complex because it is ambiguous (Lyons, 1975), in that it has two different meanings, and because it is unmarked (Webb & Abrahamson, 1976), which implies *that* could have a wider range of uses. Both

analyses point to a less straightforward interpretation of *that*, which is also suggested by Levinson (2004). This led the current research to focus on the comprehension of *this*, the proximal demonstrative.

In the next section, I will review the pragmatic uses of demonstratives in both English and Chinese.

2.2.3. Pragmatic analysis: the use of demonstratives

The pragmatic uses of demonstratives can be divided into two categories: deictic and non-deictic. The deictic uses refer to the situation in which demonstratives pick out referents within the context whereas the non-deictic uses refer to other situations which include the uses of anaphoric, empathetic, and recognitional demonstratives (Levinson, 2004). Anaphoric demonstratives are used to refer to an antecedent in the prior text whereas empathetic and recognitional demonstratives both refer to elements outside the discourse (see detailed review in Levinson, 2004). The central issue in the current study is the deictic demonstratives, rather than the non-deictic demonstratives. The following discussions will be limited to the deictic uses of demonstratives.

Levinson (2004) proposed two categories regarding the deictic uses of English demonstratives, namely *exophoric* and *discourse* deictic. The exophoric uses are tied to the uses in which the entity referred to is located within the speech context, which is the type of use that has been under discussion in the previous sections in this chapter. An example for exophoric use of demonstrative is shown in (10).

(10) *Give me **that** book.* (book available in the physical context)(Levinson, 2004, p. 108)

The context in which (10) would be exophoric requires the referent ‘book’ to be located in the speech context, the situation in which the speaker was physically present and uttered this sentence. The exophoric demonstrative is hence situated in the here-and-now context referring to an object available in the physical context. Some other exophoric uses of demonstratives may require gestures such as pointing.

(11) *I hurt this finger.* (Levinson, 2004, p. 108)

For instance, (11) required the gestural demonstration of which finger the speaker is referring to. As the pointing gesture is required, this type of exophoric use also requires the referent to be located in the physical context. Considering the contexts where (10) and (11) are used, I can conclude that the basic context for exophoric demonstratives is that the object mentioned must be within the speech context.

With respect to the discourse deictic uses, demonstratives within this category are used to refer to objects within the verbal discourse³; in other words, the referent is inside the text. Importantly, the referent is not a specific entity but rather it is the proposition expressed in the prior text. Let me take (12) as an example.

³ Note that discourse deictic is very similar to the anaphoric demonstrative in that both of them locate its referent within the verbal discourse. The distinction between anaphoric demonstratives and discourse deictic demonstratives is that while anaphoric demonstratives referred to a noun phrase in the prior discourse, discourse deictic referred to a proposition. This is illustrated in the following quotation from Diessel (1999), “anaphoric demonstratives ... keep track of discourse participants. Discourse deictic demonstratives ... link the clause in which they are embedded to the proposition to which they refer (Diessel, 1999, p.93).”

(12) *'You are wrong'*. ***That's*** exactly what she said. (Levinson, 2004, p. 108)

In (12), *that* referred to the whole sentence 'You are wrong'. As demonstrated in the example, the discourse deictic demonstrative finds its referent, which is a proposition of the prior text, within the discourse.

Unlike Levinson (2004), Diessel (1999) proposed a slightly different categorization of the use of demonstratives, targeted at world languages. Instead of deictic and non-deictic at the highest categorization branch, he proposed exophoric and endophoric, and categorized all uses except exophoric uses into the endophoric uses, which include discourse deictic and other non-deictic uses discussed above. Deissel's argument for distinguishing exophoric uses from the others, including the discourse deictic demonstratives, is that the exophoric uses are the most basic uses of demonstratives from a typological perspective (Deissel, 2014). The current dissertation does not attempt to contribute to the categorization model. The focus under discussion is that both frameworks identify the exophoric uses and Deissel (2014) even suggested that the exophoric uses are the basic uses of demonstratives among all the world languages.

The above discussions on the pragmatic uses of demonstratives mainly focus on English demonstratives (Levinson, 2004) and demonstratives in languages other than Mandarin Chinese (Deissel, 1999). Regarding the demonstrative uses in Mandarin Chinese, S. Huang (1999) also identified the same categories as in Levinson (2004) and Deissel (1999), but added Chinese-specific non-deictic uses. Huang proposed eight uses of demonstratives in Mandarin Chinese: situational, endophoric (anaphoric, cataphoric), unavailable use, identifying, referent-introducing,

discourse marking, connective use, and pause marking. Among the eight uses, the situational use corresponds to the deictic use discussed above.

(13) *zhe shi zhongguang liuxing wang* (Huang, 1999, p.79)

this is Proper Noun fashion world

ni suo shouting de jiemu shi ... xingheyeyu

you suo receive DE program is ... starlit chat

“This is Zhongguang's fashion world network. You're tuning to Starlit Chat.”

In (13), *zhe* (‘this’) referred to the radio station in which the speaker was at the time of speech. As shown in the following context, it is clear that the sentence is spoken by the host of the Starlit Chat program on the radio; thus, the speaker was at the radio station as he/she uttered the sentences. Based on the context, the demonstrative *zhe* is used to refer to the radio station where the speaker’s orientation was. From the example, Huang claims that the situational use is identified by whether the referent is located at the time of speech in the physical context. Recall that Levinson (2004) defines the exophoric demonstratives as the uses that locate the referents within the speaker’s spatialtemporal orientation, which is exactly the same as Huang’s situational use. As the definition of situational use in Huang is the same as the exophoric uses, the situational use identified by Huang could also be categorized as the exophoric use in Chinese, which will be the focus of the current study.

In sum, both English and Chinese demonstratives have exophoric uses, which are suggested to be the most basic deictic use from a typological survey conducted by Diessel (1999).

The current study aims to test whether children are able to comprehend the exophoric demonstratives appropriately. In the next section, the discussions on what children need to know about demonstratives will be presented.

2.3. What children need to know about demonstratives

Taking all the above discussions together, demonstratives, as one of the place deixis, pick out entities in the speaker's location at the time of utterance; this particular deictic use is called the exophoric use (Levinson, 2004; Diessel, 1999). The current study focuses on the exophoric use of demonstratives, particularly the use that does not require gestural to identify the correct referent.

Like other deixis, the reference point of demonstratives is usually the speaker's location. That is, the speaker is the deictic center to relate the referents in the context (Lyons, 1977; Rauh, 1983; E. Clark, 1976). The speaker's orientation, or the speaker's *perspective*, is the center that determines the referents. Thus, as language learners, children need to be able to establish a shared perspective, or shared spatial representation of the situation, in order to interpret exophoric demonstratives appropriately.

In addition, demonstratives also encode different semantic distinctions (Diessel, 1999). For the two languages the current study focused on, English and Chinese, demonstratives encode distance distinction (H. H. Clark, 1973; C. T. J. Huang et al., 2009; Lyons, 1975; Webb & Abrahamson, 1976). Lyons (1975) used both [\pm Proximate] and [\pm Distal] features to represent the meaning of *this* and *that*. When the two demonstratives are used contrastively, *this* carries the feature [+Proximate] while *that* has [-Proximate, +Distal]. This allows *this* to pick out the object near the speaker and *that* to pick out an object that is not near the speaker in a contrastive context

such as ‘I want *this* bear not *that* bear.’ Note that one may argue *that* could also be used to pick out an object near the speaker; that is, the use of *that* could be neutral to the distance. This neutral use of *that* is not ruled out from Lyons’ analyses as Lyons suggested that there are two different meanings of *that*. In fact, all the analysis shown above suggest that the demonstrative ‘*that*’ could be either (i) used as a neutral term to serve as an indexical without pointing out the distance relative to the speaker or (ii) used to specify an object that is distant from the speaker, which is also listed entry for *that* in the Oxford Dictionary. This particular aspect allowed the demonstrative ‘*that*’ to be used in a wider distance domain as compared with ‘*this*’. The domains of the appropriate uses of each demonstrative are illustrated in Figure 3.

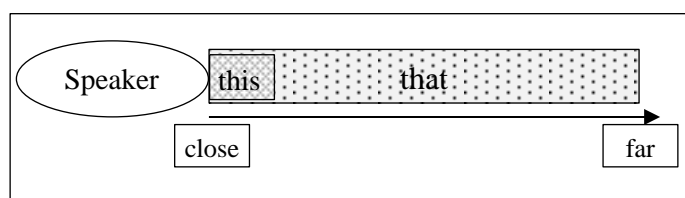


Figure 3. The domains of the appropriate uses of each demonstrative

As shown in Figure 3, the appropriate domain to use *this* is more restricted than the appropriate domain to use *that*. *This* only picks out entities that are in the ‘close’, or proximate, domain whereas *that* can pick out entities that fall into both ‘close’ and ‘far’ domains; in other words, *that* can refer to any entity within the context. Given that *this* and *that* has different levels of restriction in the appropriate uses, Levinson (2004) suggested that the interpretation of *that* is less straightforward than *this* because the domain that *that* could use may overlap with *this*. Due to the vagueness of the use of *that*, the present study primarily focused on the comprehension of the proximal demonstrative *this*.

In order to interpret demonstratives successfully, the listener needs to evaluate the distance of the object relative to the speaker's location. In other words, the listener needs to reconstruct the speaker's message for demonstratives, associating *this* with 'the entity near the speaker' and *that* with 'the entity apart from the speaker'.

To summarize, the two key components children need to know in order to correctly interpret demonstratives are as follows:

- (14) i. **Speaker's perspective:** speaker is the center of the orientation.
- ii. **Proximal-distal distinction:** *this* points to the entity near the speaker while *that* points to the entity apart from the speaker.

In order to appropriately pick out the referent for demonstratives, children first need to interpret demonstratives based on speaker's perspective rather than their own. Second, children need to have the knowledge of proximal-distal distinction between the two demonstratives. Note that although languages do not only feature distance as the only semantic distinction that differentiate the two demonstratives, the proximal-distal differences seem to be the most productive and universal distinctions among all languages (Diessel, 1999; 2014). Thus, the current dissertation focused on the proximal-distal distinction of demonstratives to understand children's acquisition of demonstratives.

In short, in order for children to correctly interpret demonstratives, they need to know that the proximal demonstrative picks out the object near the speaker while the distal demonstrative picks out the object apart from the speaker; crucially, the speaker's perspective determines the speaker-object distance. In the next chapter, I will show that children's difficulty in interpreting demonstratives lies in the incorporation of the speaker's perspective. I will show

that since implementing the speaker's perspective requires extra-linguistic abilities, children's still-developing cognitive abilities may interact with their demonstrative comprehension.

Chapter 3. DEMONSTRATIVE COMPREHENSION AND COGNITIVE DEVELOPMENT: CROSS-LINGUISTIC INVESTIGATION

In the previous chapter, I reviewed the meaning representation of demonstratives proposed by several scholars and discussed what children need to know in order to interpret demonstratives appropriately. To summarize the points in the previous chapter, I argued that children need to know that (i) the proximal demonstrative such as *this* points to an entity near the speaker while the distal demonstrative such as *that* points to an entity relatively apart from the speaker, and (ii) the speaker's perspective determines the speaker-object distance.

In the current chapter, I will first review studies that have revealed that children tend to exhibit non-adult-like demonstrative comprehension particularly when the speaker has a different perspective from the children's own, and these studies suggest that children's non-adult-like performances may be related to whether children are able to incorporate the speaker's perspective. I hypothesize that children's difficulty in incorporating the speaker's perspective may be related to their still developing Theory of Mind (De Villier, 2007; Diessel, 2012) and Executive Function. I will report the studies with English-speaking children and Chinese-speaking children to directly examine this hypothesis. In what follows, reviews on the relevant lines of research are presented following the two experiments with English-speaking children and Chinese-speaking children, respectively.

3.1. The acquisition of demonstratives

Children are known to exhibit non-adult-like performance when interpreting demonstratives (E. V. Clark & Amaral, 2010; E. V. Clark & Sengul, 1978; H. H. Clark,

Schreuder, & Buttrick, 1983; P. A. de Villiers & de Villiers, 1974; Murasugi, 1986; Tanz, 1980; Webb & Abrahamson, 1976; Zhao, 2007). Research to date has shown that children's non-adult-like performance on demonstratives falls into two different types of response patterns. The first type of response pattern is analyzed with respect to children's egocentrism while the second response pattern suggests that perceptual saliency affects children's responses. In the following sections, each type of response will be discussed at length.

3.1.1. Egocentric bias

Children tend to be egocentric while interpreting demonstratives. In particular, when children are interpreting demonstratives that are uttered by a speaker who has a different perspective, children still tend to interpret demonstratives based on their own perspective. For instance, if a speaker who sat far apart from a child and thus had a different perspective uttered sentences with demonstratives such as *this*, children usually failed to reach for the object near the speaker as the response; instead they tended to reach for the object near themselves. This particular response pattern has been revealed by two studies, Webb and Abrahamson (1976) and Clark and Sengul (1978), which will be reviewed in detail in the following.

Webb and Abrahamson (1976) studied English-speaking children whose ages ranged from 3;6 to 7;6 and grouped children in two age groups: four-year-olds (3;6-4;6) and seven-year-olds (6;6-7;6). They have shown that even seven-year-old English-speaking children exhibited egocentric demonstrative comprehension. Act-out Tasks were used to examine children's demonstrative comprehension based on their own perspective as well as a different perspective. The experimental workspace of their Act-out Tasks is presented in Figures 4a and 4b.

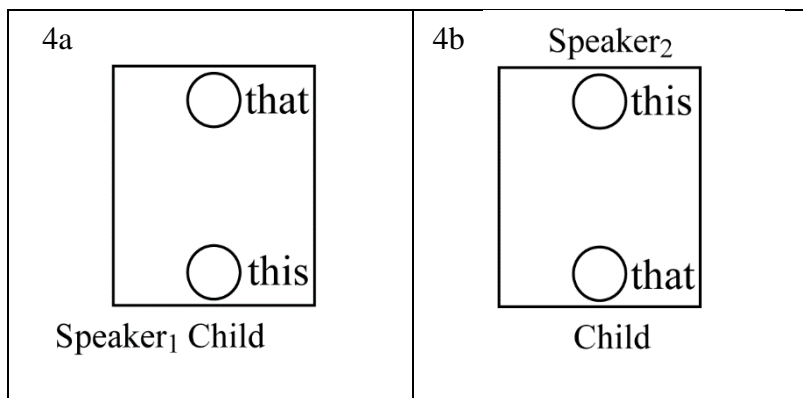


Figure 4. The task setting used in Webb and Abrahamson (1976): Fig. 4a presents the Same Perspective condition while Fig. 4b presents the Different Perspective condition.

As shown in Figure 4, children sat at one end of the table while the experimenter, who was the speaker, sat at different ends of the table depending on the condition. In the Same Perspective condition (Figure 4a), the speaker sat right next to the child and thus the speaker and the child shared the same perspective. In the Different Perspective condition (Figure 4b), the speaker sat on the opposite end of the table and thus the speaker had a different perspective to the child in terms of the orientation of the objects. In the task, children were shown two toys, one of which was located near themselves and the other of which was apart from them. Then they were asked to pick up one of the toys following the instruction, “Would you pick up *this/that* toy?” Note that while giving the instructions, the experimenters did not provide any gestural cues such as pointing and eye-gaze; instead the experimenters looked at the child directly. Thus, children need to rely on their knowledge of demonstratives to respond correctly. Table 1 summarizes the results of the study.

Table 1. Percentages of the correct comprehension on *this* and *that* with different perspective setting

	Same Perspective		Different Perspective	
	<i>this</i>	<i>that</i>	<i>this</i>	<i>that</i>
4-year-olds	82.5	52.5	34.3	81.8
7-year-olds	83.3	82.5	61.8	74.3

Results of the Act-out Tasks shown in Table 1 revealed that four-year-olds are still non-adult-like in both conditions in that they seem to select the box near themselves regardless of the condition. This is observed from the asymmetrical accuracy on *this* and *that* in the two conditions because the accuracy on items of *this* is higher in the Same Perspective condition, while the accuracy on items of *that* is higher in the Different Perspective condition. These response patterns indicate that the four-year-olds did not seem to understand the distance contrast between *this* and *that*. The seven-year-olds were near-adult-like in the Same Perspective condition, however their accuracy in the Different Perspective condition was still around 60% to 70%. These results suggest that seven-year-olds may have the knowledge of distance contrast, but they may not be so successful at using the knowledge in the Different Perspective condition.

Another study that has reported children's egocentric bias was conducted by Clark and Sengul (1978), who studied English-speaking children aged 3;1 (age range: 2;7-3;5), 3;11 (age range: 3;6-4;4), and 4;11 (age range: 4;5-5;3). They also utilized Act-out Tasks, the settings of which are illustrated in Figure 5, to assess children's demonstrative comprehension. In the tasks, the child sat at a table and the experimenter, who was the speaker, sat either beside the child

(Speaker Beside condition; Figure 5a) or opposite to the child (Speaker Opposite condition; Figure 5b). Two discs were placed on the table, one on the same side of the table as the child and the other on the opposite side; furthermore, the discs were equidistant⁴ from the child.

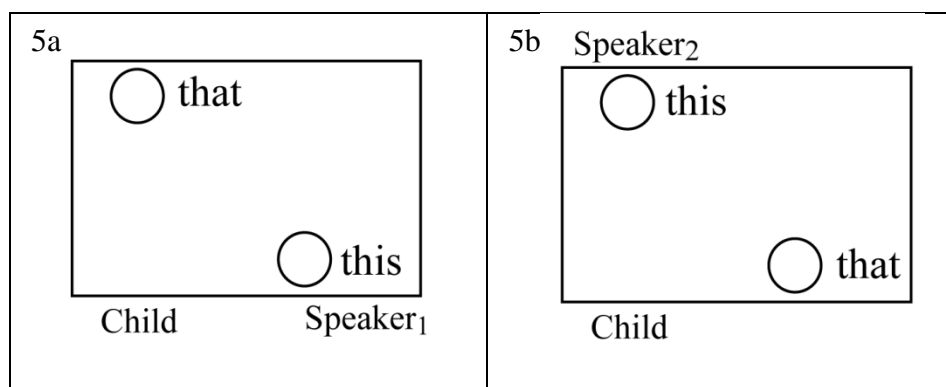


Figure 5. Task setting used in Clark & Sengul (1976): Fig. 5a illustrates the Speaker Beside condition while Fig. 5b illustrates the Speaker Opposite condition.

In the tasks, two identical toy animals were placed on each of the discs and the child was asked to make one of the animals move by following an instruction such as ‘Make *this/that* chicken hop’ given by the speaker. Like Webb and Abrahamson (1976), no eye-gaze cues or gestural cues were given when the speaker uttered the instructions. Table 2 presents the results of the tasks.

⁴ The distance between the child and the discs was about the child’s arm reach distance in which is around 30-40 centimeters.

Table 2. Percentages of the correct responses on *this* and *that* with different perspective setting

Age groups (age range)	Speaker Beside		Speaker Opposite	
	<i>this</i>	<i>that</i>	<i>this</i>	<i>that</i>
3;1 (2;7-3;5)	81	25	31	77
3;11 (3;6-4;4)	85	38	56	88
4;11 (4;5-5;3)	83	62	67	90

As shown in Table 2, the high accuracy of items on *this* and relatively lower accuracy on *that* in the Speaker Beside condition, as well as the high accuracy of items on *that* and relatively lower accuracy on *this* in the Speaker Opposite condition, are also observed throughout the age groups, indicating that children aged from two to five may have exhibited egocentric demonstrative comprehension.

Note that, according to the findings discussed above, children will not become adult-like in comprehending demonstratives until they reach six or seven years. These two studies suggest that children develop from egocentric non-adult-like responses to adult-like responses when interpreting demonstratives based on a different perspective. Interestingly, these findings were not consistent with the earlier experimental study in demonstrative comprehension conducted by de Villiers and de Villiers (1974), who studied English-speaking children aged 2;6 to 4;6. De Villiers and de Villiers (1974) did not elicit an egocentric response pattern from children aged three and above, arguing that children as young as three can be non-egocentric when comprehending demonstratives. However, Webb and Abrahamson (1976) argued that children's successful performance in de Villiers and de Villiers's (1974) study could be related to the task. Let me first review the task and the results of de Villiers and de Villiers's (1974) study. De

Villiers and de Villiers used a ‘Hide-and-see’ game to examine children’s demonstrative comprehension based on a different perspective. In the experimental workspace, the experimenter sat at the opposite position to the child and a 15 cm high wall was placed between them. On each side of the wall, there was a cup. In the task, children were asked to find the candy under ‘one of the cups,’ following the instructions such as ‘The M&M is on *this/that* side of the wall.’ Each term only appeared once and if the child failed to find the candy, it would be fed to a greedy monster. Results are provided in Table 3.

Table 3. Percentages of the correct responses on *this* and *that* from de Villiers and de Villiers (1974).

	Different Perspective	
	<i>this</i>	<i>that</i>
2;6-3;0 years	50.0	80.0
3;0-3;6 years	80.0	90.9
3;6-4;0 years	87.5	87.5
4;0-4;6 years	90.0	90.0
Adults	100.0	100.0

As can be seen in Table 3, only children younger than three years old showed non-adult-like responses. Particularly, children in this age group tended to choose the item near them resulting in the high accuracy in items on *that* and lower accuracy on *this*. Recall that the experimenter is sitting on the opposite side to the child, thus, when the experimenter said ‘*that*’, the ‘*that*’ indicated the cup near the child. Children aged three and above were successful. De

Villiers and de Villiers (1974) argue that children in their study were successful because the task was not as complex as others; additionally, these demonstratives are highly frequent in terms of input and daily usage by the children themselves.

Keeping in mind that these results were inconsistent with the other two studies (Clark & Sengul, 1978; Webb & Abrahamson, 1976), Webb and Abrahamson (1976) reviewed de Villiers and de Villiers' study and argued that children's successful performances occurred because the experimenters might have been more considerate to the children, providing gestural or eye-gaze cues while the other two studies controlled the extra-linguistic cues when giving instructions. The speaker's eye-gaze has been suggested to be helpful in identifying objects for adults (e.g., Stevens & Zhang, 2013); thus, providing such extra-linguistic cues to enhance the joint attention between the speaker and the child is suggested to facilitate children's ability to identify the object being mentioned (e.g., Tomasello & Farrar, 1986). In addition to the potential extra-linguistic cues, the experimental design may potentially cause an interpretation problem for the results. De Villiers and de Villiers (1974) only tested children's comprehension of demonstratives based on a different perspective; thus, whether these children understood the distance contrast between *this* and *that* based on their own perspective is not clear. Without knowing whether children have the knowledge to distinguish between *this* and *that*, the claim that these children can step into the speaker's perspective when comprehending demonstratives is weakened. The potential factors from the task itself and the results show that children as young as 2;6 to 3;0 still exhibit non-adult-like responses as well, revealing that children are not able to consider the speaker's perspective. This indicates that younger children in their study may still be egocentrically biased when comprehending demonstratives based on a different perspective.

Based on the results of the studies presented above, it seems that children may go through several stages to become adult-like when interpreting demonstratives. Webb and Abrahamson (1976) as well as Clark and Sengul (1978) proposed a three-stage developmental trajectory for children's demonstrative comprehension. In the first stage, children treat both *this* and *that* interchangeably; more specifically, children only attribute *this* and *that* as demonstratives that refer to certain objects but do not distinguish between the two demonstrative words. This means that there is no contrast between *this* and *that* to children in this first stage. Therefore, in the Act-out Task, children would consistently use position strategy, which means that they would choose the object near them, far from them, or far from the speaker, regardless of whether the speaker had a same perspective as them. Then, moving into the second stage, children are able to distinguish between *this* and *that* in terms of the object's distance relative to themselves, but not relative to the speaker's. Children in this stage are still the center of the reference point regardless of whether the speaker has a different orientation point. Thus, children are not able to incorporate a speaker's perspective that is different from their own when comprehending demonstratives; rather they tend to comprehend demonstratives based on their own perspective resulting in an egocentrically biased interpretation. In other words, they only have the partial knowledge of distance contrast between *this* and *that*. That is, they can only utilize the knowledge of the distance contrast when demonstratives are uttered by a speaker who shares the same perspective with them, whereas they fail to use the knowledge when the demonstratives are uttered by a speaker who has a different perspective. Therefore, in the Act-out Task, children would be able to correctly comprehend demonstratives when the speaker shares the same perspective with them, but may be unsuccessful when the speaker has a different perspective. Lastly, in the final stage, children are able to get rid of the egocentric bias and exhibit adult-like

performance by employing both the distance contrast and speaker's perspective when comprehending demonstratives. Therefore, in the Act-out Task, children can correctly comprehend demonstratives when the speaker has the same perspective and when the speaker has a different perspective.

It is also worth noting that Clark and Sengul (1978) proposed two routes, child-centered and speaker-centered, that diverge in the second stage. The two routes differ in terms of the reference point children anchored to. In the child-centered route, which is the model discussed above, children view themselves as the center of the reference point, whereas in the speaker-centered route, children view the speaker as the center of the reference point. Interestingly, Clark and Sengul reported that most children fall into the child-centered route, however although cases are rare, there are still children who took the speaker-centered route. This indicates that most children are egocentrically biased. However, for those who are speaker-centered, this route may be explainable from the perceptual saliency, which will be discussed in the next section.

To sum up, children seem to go through the egocentric stage before they achieve adult-like performance in comprehending demonstratives, although the period of being egocentric when comprehending demonstratives varies across studies. In the egocentric stage, children know that the distance between themselves and the object determines the uses of *this* and *that*, but they are not able to establish the reference point from the speaker's orientation. Then, they move on to the adult-like stage, in which they are able to consider the speaker's perspective as the reference point.

On the other hand, it is not clear how children develop from one stage to another and what the potential mechanism is that is needed for children to be able to take the speaker's perspective when comprehending demonstratives. One potential mechanism might be related to

children's cognitive development, such as their development of Theory of Mind, as was pointed out by De Villiers (2007) and Diessel (2012). In the current dissertation, I hypothesize that the development of Theory of Mind may be the underlying mechanism that influences egocentric demonstrative comprehension, which will be discussed in more detail in section 3.3.

3.1.2. Salience bias

Another type of non-adult response pattern in children's demonstrative comprehension that has been observed is the salience-biased response pattern. When comprehending demonstratives, some children tend to pick up objects that may possibly create perceptual salience relative to the presence of the speaker. Therefore, instead of picking up objects near themselves, children may tend to pick up objects near the speakers. Tanz's (1980) study is the only study that reported a robust salience-biased response pattern. In this section, Tanz's study will be reviewed and discussed.

Tanz (1980), who tested English-speaking children aged from 2;6 to 5;3, also used an Act-out Task to measure children's demonstrative comprehension. As illustrated in Figure 6, in the experimental workspace, two identical plates were located equidistant to the child. Notice that instead of using the real experimenter as the speaker, Tanz used two dolls serving as the speakers. Each doll stood beside each of the plates throughout the task.

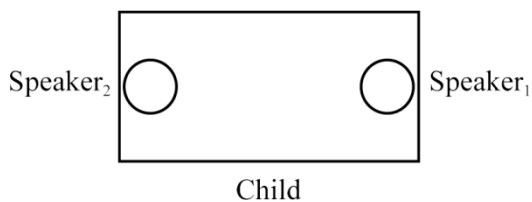


Figure 6. The task setting used in Tanz (1980)

In the task, the child was told to close his/her eyes while the experimenter was hiding a penny under one of the plates. After the hiding was completed, the child was told to open his/her eyes and to find the penny following the instruction such as ‘*This/that* plate has the penny under it’. The doll moved while speaking, thus, children would be able to identify who was speaking. The results are presented in Table 4, which showed the number of subjects that achieved adult-like performance.

Table 4. The number of subjects who achieved adult-like performance

	Correct on <i>this</i> only	Correct on <i>that</i> only	Correct on both <i>this</i> and <i>that</i>
2;6-3;4 (N=9)	2	2	1
3;5-3;11 (N=9)	4	0	3
4;1-4;8 (N=10)	1	1	6
4;9-5;3 (N=9)	4	0	5

As can be seen, children overall were much more accurate on the items of *this*. Intriguingly, even at about five years old, half of the children still tended to be accurate only on items of *this*. This led Tanz to further analyze children’s response patterns and propose that children were using a ‘perceptual strategy’ when interpreting the act-out instruction. In her task setting, in order to highlight the speaker’s role, one of the two dolls who served as the speaker was moving while it was speaking. As a result, the child may have paid more attention to the doll, and the plate beside the doll may have received extra perceptual accessibility. The plate beside the doll would then be perceptually more salient as compared with the other plate. In order to

exhibit adult-like interpretation of demonstratives, children thus need to inhibit their desire to select the more salient plate, which is considered difficult to children. Tanz thus suggested that if children failed to redirect their attention to the correct object being mentioned, children would consistently select the object near the speaker.

It is worthwhile to note that Tanz attributed children's non-adult-like comprehension of demonstratives to perceptual salience. Children first need to be able to inhibit their attention to the perceptually salient object and then to the correct object the demonstrative picks out in the context. This proposal leads me to predict that children's ability to inhibit their attention from one object and switch to the other object might be related to children's cognitive development, such as Executive Function (e.g., Minai, et al., 2012). The relationship between children's demonstrative comprehension and Executive Function will be discussed in more detail in section 3.3.

In sum, demonstrative comprehension is challenging to children, especially when the demonstratives are uttered by a speaker who has a different perspective from the child. Children robustly exhibit non-adult-like performances which can be categorized into two types of response patterns. One of the response patterns is analyzed as egocentrically biased (Webb & Abrahamson, 1976; Clark & Sengul, 1978), in which children tend to select the objects that are near them or that they want, failing to incorporate the speaker's perspective. The other response pattern is analyzed as salience biased (Tanz, 1980), in which children tend to select the objects closer to the speaker. As the child paid attention to the speaker while he was speaking, the object in front of the speaker was perceptually salient to the child.

These findings lead me to hypothesize that those non-adult-like comprehension patterns may be associated with the development of cognitive mechanisms, such as Theory of Mind and

Executive Function. This dissertation thus examines whether these two types of response patterns may be related to children's still-developing Theory of Mind and Executive Function. In the next section, I will first review the studies examining the relationship between language development and Theory of Mind as well as Executive Function, followed by a discussion on why/how Theory of Mind and Executive Function may be related to demonstrative comprehension.

3.2. Language development and cognitive development

3.2.1. Theory of Mind and language

Theory of Mind (ToM) is the ability to understand that others may have a different desire, emotion, or perspectives (Wimmer & Perner, 1983). Theory of Mind is often discussed primarily in terms of *false belief*, that is, the belief that what others hold is false in a given world (See reviews in Wellman, Cross, & Watson, 2001). On the other hand, Theory of Mind, by its definition, includes not only the understanding of different beliefs but also desires and emotions. As Wellman (2010) puts it, Theory of Mind is a “developmental progression”, which suggests that children develop their Theory of Mind through several stages, indicating that it is composed of several elements. Thus, Wellman and his colleagues proposed that Theory of Mind has five subcomponents which are developed in a particular order. The developmental trajectory of Theory of Mind is presented in (15).

- (15) Theory of Mind scales (Wellman, 2010; Wellman, Fang, & Peterson, 2011; Wellman & Liu, 2004)
- a. Diverse desires: the ability to understand that people may have different desires about the same thing
 - b. Diverse beliefs: the ability to understand that people may have different beliefs about the same situation
 - c. Knowledge access: the ability to understand that others may have different beliefs because they perceive the situation differently
 - d. False belief: the ability to understand that others may hold a belief that does not match with the true situation
 - e. Hidden emotion: the ability to understand that others may feel one way but reveal their emotion in a different way

Theory of Mind has been widely discussed in relation with children's language development (Astington & Baird, 2005; Astington & Jenkins, 1999; J. G. de Villiers, 2007; Harris, de Rosnay, & Pons, 2005; Miller, 2006; Millett, 2010; Milligan, Astington, & Dack, 2007; L.-J. Zhang & Wu, 2011). Astington and Jenkins (1999) and others (e.g., Astington, 2000; Astington & Baird, 2005; Cassidy, Fineberg, Brown, & Perkins, 2005; Deák, Ray, & Brenneman, 2003; Hughes et al., 2005; Rosnay, Pons, Harris, & Morrell, 2004) revealed that children's development of Theory of Mind is related to children's general verbal development, which is measured by language tests such as Test of Early Language Development (e.g., Astington, 2000), Peabody Picture Vocabulary Test (e.g., Deák, Ray, & Brenneman, 2003), and Clinical Evaluation of Language Fundamentals (e.g., Astington & Baird, 2005). Milligan et al. (2007)

meta-analyzed these studies, revealing that children's performances in the Theory of Mind tasks, which is the false belief task, is related to children's general language development, as well as children's development of different language aspects such as vocabulary, syntactic development, and comprehension of complement structures.

Theory of Mind, particularly false belief, has more recently been investigated in light of its association with a number of specific aspects of language development. For instance, Theory of Mind development has been discussed with children's acquisition of complement structures, such as the comprehension of sentences like "he thinks the candle is an apple." A sentence with complement structure is particularly interesting because the truth of the embedded sentence does not interact with the truth of the whole sentence. For example, 'the candle is an apple' is not true based on the world knowledge, but when this sentence is embedded in another sentence such as 'he thinks the candle is an apple', the truth of the whole sentence is now judged on how the person 'he' thinks rather than whether his thought is true or false. Studies have revealed significant correlation between children's success/failure of comprehension of the complement structures and their false belief understanding (e.g., J. G. de Villiers & Pyers, 2002; Low, 2010; Rakhlin et al., 2011; Schick, de Villiers, de Villiers, & Hoffmeister, 2007). However, since the complement structures usually contain mental verbs, such as *think*, *believe*, and *know*, others have argued children's mastery of this type of sentence is related to children's understanding of mental verbs rather than the syntactic structure of the sentence. Thus, children's acquisition of mental verbs has also been of particular interest in this field (e.g., Moore, Pure, & Furrow, 1990; Papafragou, Cassidy, & Gleitman, 2007).

Researchers argue that in order for children to correctly interpret the meaning of mental verbs, children need to be able to understand that there are different desires, perspectives, beliefs

and emotions out there. Indeed, studies have shown that children's comprehension of mental verbs is related to their Theory of Mind, particularly false belief. Recently, researchers have started to investigate children's development of pragmatics in relation to their development of false belief. For example, Zufferey (2010) investigated the relationship between children's acquisition of discourse connectives in French (e.g., *puisque* 'since' and *parce que* 'because') and Theory of Mind. The result suggests that children's development of Theory of Mind may play an important role in comprehending sentences that contain discourse connectives when discourse connectives are used to connect the premise and conclusion that is based on the speaker's belief⁵. De Cat (2013) and Modyanova and Wexler (2013) examined the relationship between children's acquisition of definite articles in English (e.g., *the*) and Theory of Mind, hypothesizing that to comprehend definite articles, children need to evaluate the interlocutors' knowledge status in order to decide whether the interlocutors have the same knowledge status as the children's in terms of the object mentioned in the speech context. For example, the definite article '*the*' must be used in the situation in which the hearer knows of the referred object and the referred object was already mentioned in the prior discourse. Given that children need to estimate the interlocutor's knowledge of the referred object, the development of Theory of Mind may thus play a role in the comprehension of definite articles. However, both De Cat (2013) and Modyanova and Wexler (2013) fail to provide evidence showing that comprehension of definite

⁵ Zufferey (2010) discussed several different uses of discourse connectives. However, she only focused on one that is used in epistemic domain. For example, in (1), the conclusion 'Max is ill' is based on the premise that 'he didn't come to work today'. More importantly, the inference from the premise to the conclusion is simply based on the belief of the speaker who uttered this sentence. Thus, this sentence can also be rephrased as *the speaker believes that Max is ill because Max did not come to work today*.

(1) Max is ill, *because* he didn't come to work today. (Zufferey, 2010, p.98)

articles is related to Theory of Mind development. Note that these studies focused on children's understanding of false beliefs and the comprehension of definite articles. Since false beliefs do not cover every subcomponent in Theory of Mind development, the relationship between children's comprehension of definite articles and Theory of Mind may emerge when other subcomponents of Theory of Mind are under examination.

De Mulder (2011) investigated children's production of referring expressions and Theory of Mind development as well as Executive Function. In her study, she asked children to describe pictures to another experimenter who was not able to see the pictures; therefore, children needed to carefully select expressions to identify the objects involved in the pictures. In this case, children need to use the indefinite article 'a' and avoid using terms such as the definite article 'the' or pronouns, for instance. The results provide supporting evidence showing that children's production of referring expressions in communication is related to their Theory of Mind development, but probably not Executive Function. This indicates that Theory of Mind plays a role in children's ability to evaluate the interlocutors' perspective in terms of the referred object. Resches and Perez Pereira (2007), who used a similar paradigm assessing children's ability to describe a story to a person who has no prior knowledge of it, also reported that children's perspective-taking in communications is related to their Theory of Mind development.

In sum, studies have suggested a relationship between children's development of Theory of Mind and their acquisition of a variety of specific linguistic expressions, including those that require pragmatic computations to correctly convey these expressions such as discourse connectives, referring expressions, and possibly definite articles. That is, Theory of Mind may play a role in children's ability to consider the information coming from the discourse context, such as the knowledge of the interlocutors' and the logical connection between sentences. Given

that there is evidence of ToM influencing children's pragmatic development, their demonstrative comprehension, which also requires pragmatic computation, is another domain serving as a testing ground to examine.

3.2.2. Executive Function and language

Executive Function (EF) is a set of cognitive functions that allows a person to regulate and monitor their own behaviors and thoughts (Aron, 2007; Miyake & Friedman, 2012; Miyake et al., 2000). Miyake and Friedman (2012) proposed that Executive Function has three subcomponents: inhibition, shifting, and updating, which were suggested to be independent abilities but interact with each other. Inhibition is the ability to override the prominent or dominant response in a given situation; shifting is the cognitive flexibility to shift between tasks and mental sets; updating is the ability to monitor and rapidly add or delete information within working memory. Among these three components, inhibition and shifting have been widely discussed with children's language development (see Mazuka et al., 2009 for a review).

Bialystok and her colleagues have conducted a series of studies investigating whether bilingual children have any cognitive advantages compared with monolingual children (Bialystok, 1999, 2010; Bialystok & Martin, 2004; Bialystok & Viswanathan, 2009). Overall findings from their studies and others (Carlson & Meltzoff, 2008; Poarch & van Hell, 2012) have suggested that bilingual preschoolers outperformed their monolingual peers in the shifting tasks (cf., Paap & Greenberg, 2013). This line of research has been expanded to toddlers (Poulin-Dubois, Blaye, Coutya, & Bialystok, 2011) and the other EF component, working memory (Morales, Calvo, & Bialystok, 2013).

In addition to the bilingual experiences, EF development has been argued to relate with the development of a number of specific linguistic domains. For example, scholars have suggested EF is related to children's online sentence processing (Choi & Trueswell, 2010; Woodard, Pozzan, & Trueswell, 2014). Children are known to show non-adult-like processing patterns in comprehending sentences such as 'put the frog on the napkins in the box.' This type of sentence creates temporal ambiguity in which the propositional phrase 'on the napkins' may temporarily serve as the goal and later turn out to be a modifying phrase; children thus need to revise their initial analysis of 'on the napkins', but they often fail to do so. Woodard et al. (2014) directly examined children's comprehension of the kindergarten path sentences and their EF, revealing that children who are not able to revise their initial analysis also performed worse in the inhibition control tasks. Children's comprehension of abstract linguistic expressions also has been discussed with respect to their EF development. For instance, Beck, Riggs, and Gorniak (2009) have reported a correlation between inhibition and children's comprehension of counterfactual expressions. In their study, children were told a story in which Piglet was drawing a picture at a table, and the wind blew the picture into a tree. Then, children were asked "what if the wind hadn't blow, where would the picture be?"(p.344). To comprehend the counterfactual expressions successfully, children needed to inhibit the idea that the premise was in fact true in the world and imagine what the alternative would be. Results suggest that children's inhibition ability is related to their ability to reason the counterfactuals. In addition to counterfactual comprehension, Minai, Jincho, Yamane, and Mazuka (2012) discussed the role of EF in relation with children's comprehension of sentences containing quantification, such as the universal quantifier *every*. The authors presented the sentences containing *every*, such as '*every turtle is holding an umbrella*', together with a picture depicting three turtles each holding an umbrella,

and an extra umbrella that nobody was holding. This extra umbrella is visually salient but is not playing any role in determining the truth of the sentence. From the results, Minai et al. (2012) have shown that children's ability to ignore the salient extra object in order to correctly interpret the *every*-sentence is related to their cognitive flexibility (*shifting* in Miyake and Friedman's model).

The studies discussed so far were focused on children's comprehension of syntactic structure and semantic meanings in relation to their EF development. Another line of research that is more relevant to the current study investigates children's pragmatic abilities and their EF development. Nilsen and Graham (2009, 2012) argued that children's communicative perspective-taking is related to EF. In Nilsen and Graham (2009), children were asked to complete a referential communication task and a series of EF tasks that measured children's inhibition, shifting, and updating. In the referential communication task, children were sitting in front of a display case and the experimenter was sitting on the other side of it. In the display case, there were two objects with different sizes (e.g., small duck and large duck) and two irrelevant objects (e.g., a whale and a bottle) as shown in Figure 6. The four objects were always shown to the children (see Figure 7a), but one of the similar objects (e.g., small duck) was blocked to the experimenter (see Figure 7b). Then, the experimenter asked the child to 'pick up the duck'.



Figure 7. Sample picture in referential communication task in Nilsen and Graham (2009).

The results revealed that children's selection of the alternative object (e.g., the small duck) was related to their poor performance in the inhibition tasks. Thus, the authors suggested that children's ability to incorporate the speaker's perspectives in communications is related to children's development of EF, particularly inhibition. Brown-Schmidt (2009) also argues that when communicating to locate a reference in a situation as described above, children may be required to suppress their own perspective in order to successfully incorporate the speaker's perspective, and that this ability is deeply related to their EF development. This may also suggest that when children comprehend demonstratives requiring them to consider the speaker's perspective, EF may also play a role in the ability for children to successfully comprehend demonstratives.

In sum, the current section discussed that children's development of language is interrelated with their development of ToM and of EF. In particular, both ToM and EF have been suggested to play an important role in children's pragmatic development, such as perspective-taking communication (Brown-Schmidt, 2009; Nilsen & Graham, 2009, 2012; Wardlow, 2013). This line of findings strengthens the speculation on the relationship between children's demonstrative comprehension and cognitive development. In the next section, a more detailed explanation of the hypothesis between the two domains will be presented.

3.3. The relationship between comprehension of demonstratives and cognitive development

Previous studies suggest that children's non-adult-like comprehension of demonstratives may be related to their still-developing cognitive abilities. In particular, based on children's non-adult-like interpretations, such as egocentric biased responses and salience biased responses,

their demonstratives may be related to their still-developing Theory of Mind and Executive Function. The association between children's language comprehension and their development of Theory of Mind as well as Executive Function has been established for decades. Therefore, exploring the role of children's Theory of Mind and Executive Function in their demonstrative comprehension will be one direction to seek for the reason behind children's non-adult-like comprehension of demonstratives. This section will discuss the relationship between demonstrative comprehension and cognitive development and provide the foundation of the current study.

3.3.1. Demonstrative comprehension and Theory of Mind

Previous studies revealed that children exhibit egocentric interpretation of demonstratives when the demonstratives are uttered by a speaker who has a different perspective. Children's egocentric non-adult-like comprehension of demonstratives is proposed to reflect their non-adult-like Theory of Mind (de Villiers, 2007; Diessel, 2012). When comprehending demonstratives uttered by a speaker who has a different perspective from the children, children need to be able to establish the reference point based on the speaker's perspective rather than their own. In such a situation, the speaker's use of *this* and *that* is not the same as the child's use of these words. For example, imagine a situation in which the speaker sat far apart from the child and a cup was placed in front of each of them; the speaker uttered '*this cup*' referring to the cup right in front of him/her, but from the child's perspective the particular cup being mentioned was apart from the child and thus that particular cup would be referred as '*that cup*' instead of '*this cup*'. The child, thus, needs to know that the speaker may have a different perspective, and he/she needs to incorporate the speaker's perspective in order to successfully comprehend demonstratives uttered

by the speaker. Understanding that others may have a different perspective and taking that different perspective requires an adult-like Theory of Mind. Therefore, I hypothesized that children's successful comprehension of demonstratives may be related to their already-developed Theory of Mind⁶. I particularly considered *Knowledge Access* as the subcomponent that may be related to children's demonstrative comprehension. Knowledge Access is one's ability to estimate others' knowledge status and understand that others may have a different perspective from one's own. I hypothesized that children particularly need this ability to successfully establish a reference point based on the speaker rather than themselves when comprehending demonstratives. Therefore, I propose that children's demonstrative comprehension is related to their Knowledge Access ability.

3.3.2. Demonstrative comprehension and Executive Function

Let me now turn to the discussion on the relationship between demonstrative comprehension and Executive Function. In the above section, I discussed the potential of Theory of Mind to play a role in children's demonstrative comprehension. However, as argued by

⁶ As I discussed in Chapter 1, the production of the Turkish demonstrative *şu* requires the speaker to incorporate the listener's perspective, while the comprehension of the distance contrast in English and Chinese demonstratives requires the listener to incorporate the speaker's perspective. Thus, incorporation of the interlocutor's perspective is essential to master demonstratives in different languages. Interestingly, Küntay & Özyürek (2006) suggested that children's correct production of *şu* may be related to their Theory of Mind development. The argument in Turkish is in line with the hypothesis in the current study, in that children's ability to incorporate the interlocutor's perspective may be related to their still-developing cognitive abilities. Thus, the hypothesis discussed in the current dissertation could also explain children's non-adult-like production in Turkish. That is to say, children who fail to infer the listener's perspective observed in Turkish may also be attributed to their Theory of Mind development.

Samson and Apperly (2010), Theory of Mind may not be the sole factor interacting with children's perspective-taking. Children's egocentrism when it comes to perspective-taking may be related to two other things. First, considering a different perspective requires children to inhibit their own perspective and switch to that different perspective; however, this process is argued to be cognitively demanding. Second, in a real daily communication, children need to pick up the correct object that is being mentioned in the discourse while there is tons of irrelevant information in the context; thus, once again, children need to inhibit the irrelevant information and reengaged in the correct information.

Given this, one can see the important role that the Executive Function may play here. Let me now discuss why Executive Function may also play a role in children's demonstrative comprehension. I considered *mental flexibility* (*shifting* in Miyake and Friedman's model), which is the ability to switch between perspectives, as the crucial component of EF of particular interest. Recall that previous studies on children's demonstrative comprehension reported two types of response patterns: egocentric biased and salience biased. Regarding the egocentric biased response pattern, I argued that children are egocentric because they tend to fail to understand that the speaker of the demonstratives may have a different perspective, and they fail to incorporate the speaker's perspective into the interpretation of the demonstrative words; thus, they interpret demonstratives based on their own perspective. According to Samson and Apperly (2010), although children may understand that the speaker may have a different perspective, the incorporation of such a perspective may be cognitively costly. The cognitive cost may be controlled by the switching of the perspectives. Children, being egocentric, establish their own perspective from which they interpret the world. However, when they need to interpret the demonstrative words uttered by another person with a different perspective, they are required to

inhibit and disengage from their own perspective, and then re-engage in a new perspective of the speaker. Here, they need to flexibly switch between their own perspective and the new perspective. Thus, successful demonstrative comprehension may also recruit cognitive processes that are under control of Executive Function, particularly the successful perspective switch, and children's egocentric demonstrative comprehension may also reflect their failure to successfully switch to the new perspectives. The mental flexibility in Executive Function, thus, may be required for children to successfully switch between their own perspective and the speaker's perspective when comprehending demonstratives.

With respect to the salience biased response pattern, recall that Tanz (1980) revealed that children's non-adult-like demonstrative comprehension may be influenced by the perceptual saliency of the objects; for example, the objects that appear near the speaker may receive more attention from the children. If the visually more salient object in the context is not the object the speaker intended, children may need to inhibit their attention to the visually salient object and shift to the speaker-intended object, in addition to inhibiting their own perspective that leads them interpret demonstratives egocentrically. The visual saliency issues may also occur in the demonstrative comprehension in daily life communication. In a daily life context, children are typically exposed to more than one type of object in a given discourse context. For example, when the speaker asks for *this cup*, there may be bowls, spoons, and plates in the context as well. These objects are irrelevant information to interpret the demonstrative phrase '*this cup*'. If any of the objects are more attractive to children, they will need to redirect their own attention to the relevant information from the irrelevant information in the context. Inhibiting the salient but irrelevant information from the context may be related to children's still-developing Executive Function as well, particularly mental flexibility, as suggested by Minai et al. (2012). Minai et al.

(2012) investigated children's interpretation of quantification sentences in relation to mental flexibility. The quantification sentences were presented together with a visual context in which an irrelevant object were presented, and this irrelevant object caught children's attention, resulting in the non-adult-like interpretation of the quantification sentences. The results point to a positive correlation between children's ability to ignore the irrelevant object and their mental flexibility. Given the above discussion, children's salience biased interpretation of demonstratives may reflect children's Executive Function as well.

Additionally, and interestingly to the current discussion, the development of the EF and ToM is suggested to be interrelated (Devine & Hughes, 2013, 2014; Hughes, 1998; Hughes & Ensor, 2007; Müller, Zelazo, & Imrisek, 2005). In a recent meta-analysis, Devine and Hughes (2013, 2014) revealed that children's development of Executive Function and Theory of Mind are interrelated, regardless of age and the languages children are acquiring. Children's development of Executive Function and Theory of Mind are also argued to interact with their language development (Low, 2010). Therefore, exploring the roles of Theory of Mind together with Executive Function in demonstrative comprehension will provide a better understanding of how cognitive abilities may be interacting with the acquisition of linguistic expressions.

Taken together, children's non-adult-like comprehension of demonstratives might be related to their still-developing cognitive abilities, particularly Theory of Mind and Executive Function. However, such a speculation has not been directly tested yet; thus, the present study aims to investigate the relationship between children's comprehension of demonstratives, specifically in the context that the speaker has a different perspective to the child, and their cognitive development, particularly the development of Theory of Mind and Executive Function.

3.3.3. A cross-linguistic perspective on Theory of Mind and Executive Function

Although Theory of Mind and Executive Function are suggested to be interrelated in some studies, other studies suggest that children acquiring different languages do not seem to follow the same developmental path in terms of Theory of Mind and Executive Function (cf., Devine & Hughes, 2013; Wellman, Fang, Liu, Zhu, & Liu, 2006). Interestingly, however, research to date has reported mixed results in terms of *how* children in different language groups may differ from each other with respect to their development of Theory of Mind and Executive Function. Tsou (2005) investigated Chinese-speaking children's Theory of Mind development and discussed the results with those of studies conducted with English-speaking children. Based on the comparison, she proposed that Chinese-speaking children may have performed poorer on comprehending demonstratives than their English-speaking peers. D. Liu, Wellman, Tardif, and Sabbagh (2008) meta-analyzed Theory of Mind studies conducted with Chinese-speaking children and directly compared the data with another set of studies conducted with English-speaking data. The results revealed that the developmental trajectory of Theory of Mind was the same between the two groups of children; however, in terms of the age, Chinese-speaking children took longer to develop their Theory of Mind. On the other hand, Sabbagh, Xu, Carlson, Moses, and Lee (2006) did not report the same results. They measured Chinese-speaking children and English-speaking children's Theory of Mind as well as Executive Function. When they compared the data from these two language groups, no significant differences were found between Chinese-speaking children and English-speaking children in terms of their Theory of Mind; nevertheless, their Executive Function differed. In particular, Chinese-speaking children outperformed their English-speaking peers.

Thus, there is a complex picture regarding whether different language groups may show different developmental pattern in their cognitive abilities. The discrepancies among these findings is the motivation to investigate both English-speaking and Chinese-speaking children. Regardless of whether children's cognitive development may differ depending on their language background, of current interest is whether I can elicit the same type of relationship between demonstrative comprehension and children's cognitive development from the two groups of children.

Given the discussions above, the current study investigated children's demonstrative comprehension in relation to their cognitive development from a cross-linguistic view. In Experiment 1, I studied the relationship between the two domains by focusing on English-speaking children; in Experiment 2, I focused on Chinese-speaking children as a cross-linguistic expansion.

3.4. Experiment 1: Child English

Experiment 1 explored whether English-speaking children's demonstrative comprehension is related to their still-developing Theory of Mind and Executive Function.

3.4.1. Participants

Fifty-two English-acquiring children aged 3, 4, 5, and 6 years old participated (3;0-6;2, mean = 4;4, with 26 males and 26 females), including 16 three-year-olds (3;0-3;10, mean = 3;5), 23 four-year-olds (4;0-4;11, mean = 4;5), 10 five-year-olds (5;0-5;7, mean = 5;2), and 3 six-year-olds (6;1-6;2, mean = 6;1). An additional 9 children were tested but were excluded from the analysis for the following reasons: incompleteness of all the necessary tasks (6 children); failure to

learn the general rule of the Theory of Mind task (1 child); failure to learn the task rule of the Executive Function task (1 child); and coding error that occurred during the experimental session (1 child). These child participants were recruited at preschools in Lawrence, Kansas. In addition, 20 adult native speakers of English also participated, who were recruited at the University of Kansas (19;3-23;2, mean = 20;3).

3.4.2. Tasks

In order to examine the relationship between children's demonstrative acquisition and cognitive development, a multi-task design was adopted. Two demonstrative linguistic comprehension tasks, an Act-out Task and a Judgment Task, were utilized together with two cognitive tasks, the Hiding Game (P. A. de Villiers & Pyers, 2001; Gale et al., 1996; Povinelli & DeBlois, 1992; Schick et al., 2007) to measure children's Theory of Mind, and the Dimension Change Card Sort (DCCS, Zelazo, 2006) to measure children's Executive Function.

3.4.2.1. Act-out Task

The Act-out Task was used to ensure children's understanding of the distance contrast between *this* and *that* based on their own perspectives. This task was widely used in the previous studies investigating children's comprehension of demonstratives. In the task, children were asked to perform the action following the instruction that has demonstratives given by the experimenter. Children's act-out outcome reflects how they interpret demonstratives. In terms of the experimental workspace, the child sat at a table that had an approximately 55 cm long cloth. Two identical boxes and toy figurines of characters were placed on the cloth at the workspace. One of the boxes was located right in front of the child and the other one located far from

him/her, but still within arm-reach distance to the child. Note that the two boxes were not placed in a straight line; instead the farther box was placed on either the right edge of the near box or the left edge, so that both boxes were visible to the child. The experimenter, serving as the speaker, sat right next to the child and thus the child shared the same perspective with the experimenter. The task setting is shown in Figure 8.

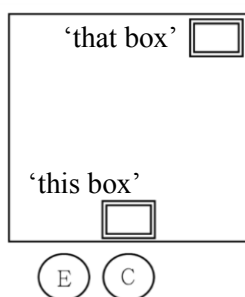


Figure 8. Experimental setting in Act-out Task (E = experimenter; C = Child).

At the beginning of the task, the experimenter directed the child's attention to both boxes by pointing to the two boxes and saying the following sentences: "Look, we have two boxes and animals. In the game, I am going to tell you to put each of the animals (the toy figurines) in one of the boxes." In the task, the child was asked to put toy characters in one of the boxes, either in 'this box', i.e., the box closer to the child, or in 'that box', i.e., the box far from the child, by receiving the act-out instruction as in (16).

(16) Put X in *this/that* box.

If the child heard 'Put Pooh in *this* box', for example, he/she was expected to put Pooh in the box closer to him/her. If the child heard 'Put Piglet in *that* box', he/she was expected to put

Piglet in the box far from himself/herself. In order to minimize the potential impact from extra-linguistic cue, when giving the act-out instruction, the experimenter did not provide any extra-linguistic cue, such as eye-gaze and pointing (Clark & Sengul, 1978; Webb & Abrahamson, 1976). There were six trials in total, with three trials on *this* and three trials on *that*. Whether children can correctly put toy figurines in the appropriate box based on the act-out instruction was recorded.

3.4.2.2. Judgment Task

The Judgment Task was used to examine children's comprehension of demonstratives when the speaker has a different perspective from their own. The task was administered as a series of picture stories with two characters, a King and a Servant. The story was introduced as a 'good worker test', in which the King uttered a demand as in (17) to the Servant and the Servant was expected to fulfill the demand.

(17) Paint *this/that* X blue.

In the story setting, two identical objects (e.g., plates) were used with one placed near both the King and the Servant and the other one placed far from both of them (see Figure 9a) .

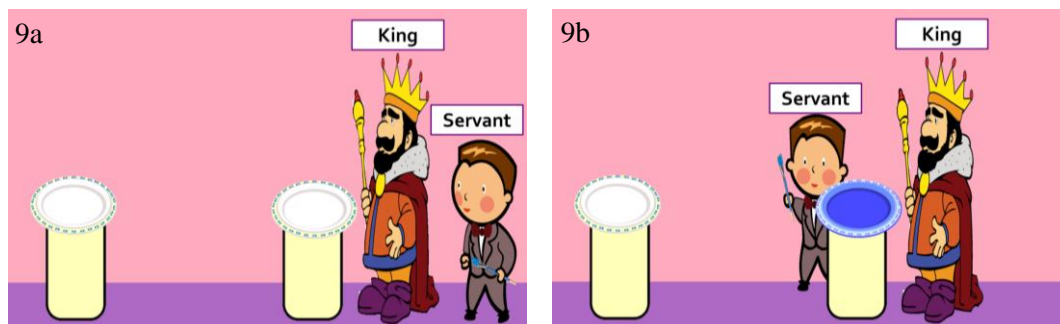


Figure 9. Sample pictures in Judgment Task

In each story, the King demanded the Servant to paint a particular object blue by saying sentence (17) and the Servant tried to fulfill the demand by painting one of the objects. After the Servant finished his painting, he asked the child to judge whether he painted the correct object or not. The child then was asked to decide whether the Servant's painting outcome was correct according to the King's demand. The story plot of one trial is presented in (18).

(18) (Figure 9a) King: Here are two plates. Let me think about which plate I want you to paint.

King: Paint this plate blue.

(Figure 9b) Servant: Here is what I did. Am I right or wrong?

There were four conditions with two types of demonstratives (*this* vs. *that*) and two types of Servant's fulfillments (Match or Mismatch). There were eight trials in total. In the Match conditions, the Servant's painting outcome matched the demand. As presented in Figure 10, in some trials, the King demanded the Servant to paint *this* plate and the Servant painted the plate near the King, and thus the painting outcome matched the demand that had *this* (see Figure 10a). In other trials, the King demanded the Servant to paint *that* plate and the Servant painted the

plate apart from the King, and thus the painting outcome matched the demand that had *that* (see Figure 10b). For items in the Match conditions, the child was expected to accept the painting outcome.

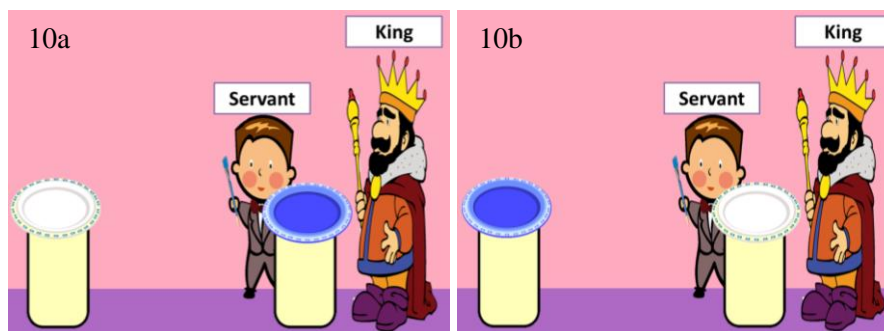


Figure 10. Match conditions in the Judgment Task

In the Mismatch conditions, the Servant's painting outcome did not match the demand. As presented in Figure 11, in some trials, the King demanded the Servant to paint *this* plate but the Servant painted the plate apart from the King, and thus the painting outcome did not match the demand that had *this* (see Figure 11a). In other trials, the King demanded the Servant to paint *that* plate but the Servant painted the plate near the King, and thus the painting outcome did not match the demand that had *that* (see Figure 11b). For items in the Mismatch conditions, the child was expected to reject the painting outcome.

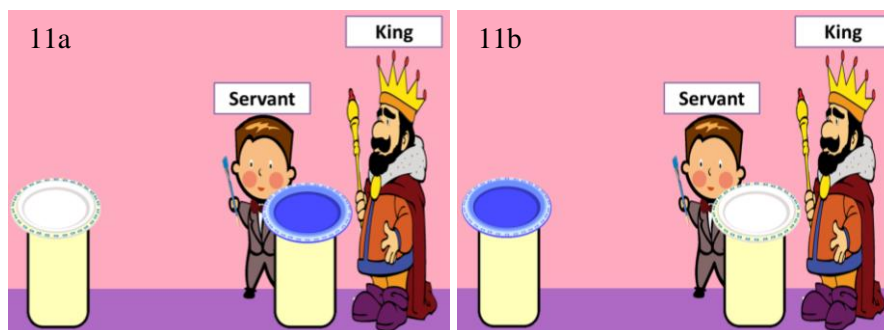


Figure 11. Mismatch conditions in the Judgment Task

The objects that were used in the task included a plate, a bowl, a pillow, a pot, a cup, a bag, a clock, and a box. The trials were presented with a fixed order to each child (see Appendix I). Whether children could correctly accept the Match conditions and correctly reject the Mismatch conditions was recorded.

3.4.2.3. Theory of Mind task: the Hiding Game

The Hiding Game (P. A. de Villiers & Pyers, 2001; Gale, de Villiers, de Villiers, & Pyers, 1996; Schick et al., 2007) was selected to measure children's development of Theory of Mind, particularly the *Knowledge Access* (Wellman et al., 2011; Wellman & Liu, 2004). In the Hiding Game, three characters, the Hider, the Knower, and the Guesser, each played a role in a series of hiding events. The Hider first introduced the objects that she was going to hide (e.g., donuts) (see Figure 12a) and two helpers, the Knower and the Guesser, helped the child to find the hidden objects after each hiding event. In each hiding event, the Knower was asked to observe the hiding procedure and knew the hiding outcome while the Guesser was blindfolded and did not witness the hiding event; thus, the Guesser did not know where the hidden object was (see Figure 12b). While the hiding was ongoing, a curtain blocked the scene so the child did not observe the hiding event (see Figure 12c). After the hiding was completed, the curtain was removed and the Knower and the Guesser each pointed to the box they thought had the hidden object (see Figure 12d) (The full plot of the hiding game is presented in Appendix II). The child's task was to find the hidden object following the suggestion given by the Knower and the Guesser.



Figure 12. Sample pictures in the Hiding Game

Before the hiding game began, the child was given one practice trial in which the Hider was the only character who hid the object, and pointed to the correct box at the end of the hiding. If the child did not point to the Hider's box in the practice trial, the experimenter would explicitly tell the child that the Hider was there to help, and thus the box the Hider pointed to had the hidden object. The practice trial was used to demonstrate that the child needed to listen to someone's advice before finding the hidden object.

I measured whether the child could correctly point to the Knower's box in order to find the hidden object. There was one practice trial and five main trials. The two bears, brown bear and white bear, took turns to be the Knower and the Guesser. Therefore, children could not rely on pointing to one of the bears consistently (e.g., point to the brown bear throughout the task) to find the hidden object.

3.4.2.4. Executive Function task: Dimensional Change Card Sort (DCCS)

The standard version of Dimensional Change Card Sort (DCCS; Zelazo, 2006) was used to measure children's development of EF, particularly *shifting*, one of the subcomponents of EF. Shifting is the ability to flexibly switch between perspectives (Miyake & Friedman, 2012). In the task, children were shown cards that could be sorted based on two dimensions, color and shape. There were two phases in this task. In the first phase, children were asked to sort cards based on one dimension, e.g., color (see Figure 13a and 13b). This is called the Pre-switch Phase. In the second phase, children were asked to sort the same set of cards based on the other dimension, e.g., shape (see Figure 13c and 13d). This is called Post-switch Phase. Each session had six trials, totaling 12 trials in the task. Whether children could correctly sort cards particularly in the Post-switch Phase was recorded.

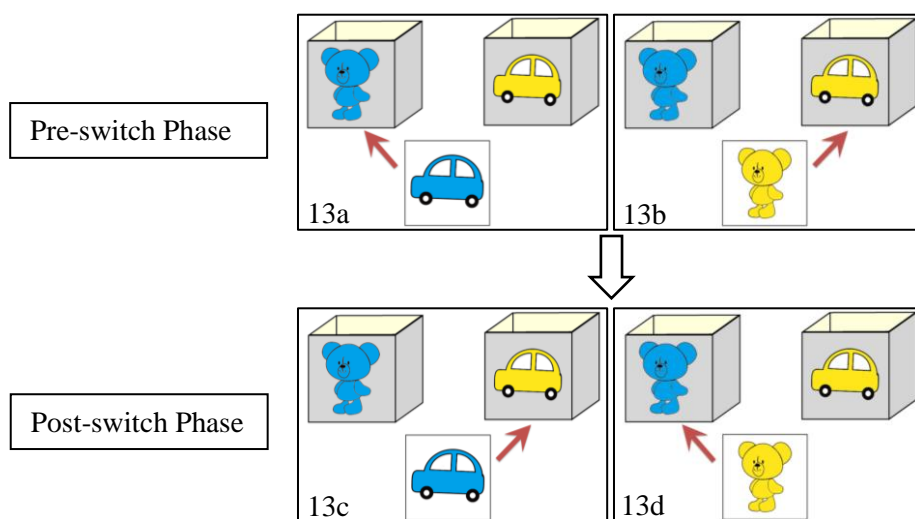


Figure 13. Sample trails in DCCS (switch from color to shape)

In order to counterbalance the presentation order of the sorting dimensions across participants, two sets of different materials with different orders of sorting rules were prepared and each child only saw one of the two sets of materials. Half of the children were asked to sort cards based on color first and then by shape (Figure 13), while the other half of the children were asked to sort shape first and then by color (Figure 14).

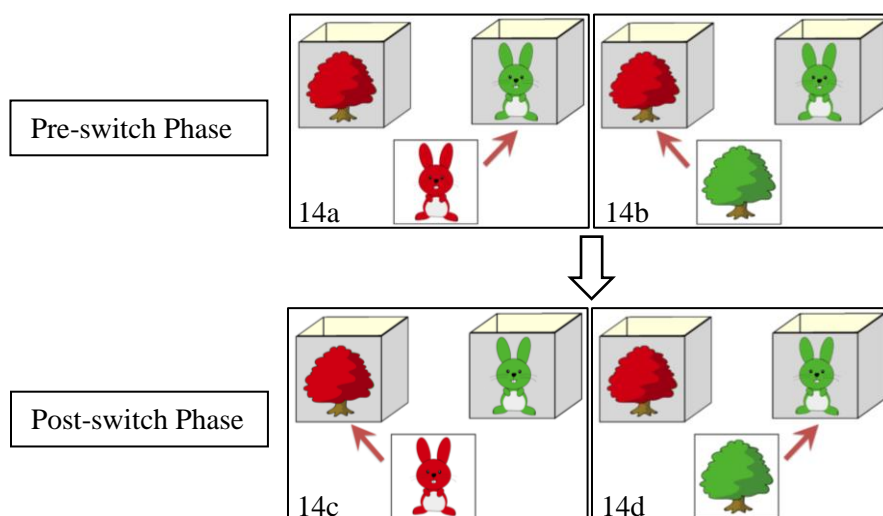


Figure 14. Sample trials in DCCS (switch from shape to color)

All the materials were electronically generated, and the task was administered using the experiment software Paradigm (Perception Research Systems, Inc., Tagliaferri, 2005) with a laptop PC.

3.4.3. Procedure

Child participants were invited individually to a quiet room in their preschools to participate in the study. The four tasks were administered in the following order: the Act-out Task first, the Judgment Task second, Hiding Game third, and finally the DCCS. Adult controls

only participated in the Judgment Task; this is because I would like to see if the Judgment Task created for the study measures the distance contrast between *this* and *that* based on a different perspective in the given story context. Regarding the Act-out Task, since previous studies on demonstrative comprehension have shown that the performances of the English-speaking adults in the Act-out Task was at ceiling (Clark & Sengul, 1978), I assumed that English-speaking adults in general would not have problems with the same type of Act-out Task in the current study. They were tested collectively in the classroom and were asked to write down their answers on the response sheet.

3.4.4. Results and discussions

In this section, I will first present the results on the Act-out Task, which was used to ensure children's ability to establish the distance contrast between *this* and *that* based on their own perspective. Only the data from those children who were able to do so will be analyzed in the Judgment Task, the Hiding Game and DCCS.

3.4.4.1. Results of the Act-out Task

In the Act-out Task, children's selection of the box where they put toy figurines was measured. When the child was told to 'Put X in *this* box', if he/she put the toy figurine in 'this box' which was located in front of him/her, this act-out response was coded as a correct response for *this*. When he/she was told to 'put X in *that* box', if he/she put the toy figurine in 'that box' which is located apart from him/her, this response was also coded as a correct response for *that*. As shown in Table 5, the mean percentage of the correct responses was 86.67% ($SD = 16.36$) for the act-out instruction with *this* and 58.98% ($SD = 35.92$) for the act-out instruction with *that*.

Table 5. The percentages of correct responses on *this* and *that* with English-speaking children (%(*SD*))

	Trials with <i>this</i>	Trials with <i>that</i>
Children	86.67 (16.36)	58.98 (35.92)

I further categorized children into two groups, ‘Act-out passers’ and ‘Act-out failers’, depending on whether they could return correct responses for two out of three trials with *this*, and two out of three trials with *that*. Among the 52 children, 15 of them were categorized as ‘Act-out failers’ (3;4-5;3, $M = 4;3$) and 37 of them were categorized as ‘Act-out passers’ (3;0-6;2, $M = 4;5$). Those ‘Act-out failers’ fell into two types of error response patterns. One group of children were consistently selecting ‘this box’ ($N = 11$), resulting in the low accuracy in trials with *that*. The other group of Act-out failers were randomly selecting one of the boxes ($N = 4$) regardless of whether the instruction contained *this* or *that*. From the two types of response patterns, it can be interpreted that the child did not understand the distance contrast between *this* and *that* based on his/her own perspective.

On the other hand, for those who were grouped into the ‘passers’ category ($N=37$, 3;0-6;2, $M = 4;5$), it was interpreted that they were able to comprehend *this* and *that* correctly based on their own perspective, and thus were able to establish distance contrast between *this* and *that* based on their own perspectives. Recall that the purpose of the study is to examine children’s interpretation of demonstratives based on a different perspective in relation to their ToM and EF. The 37 Act-out passers will be the focus for the following analysis, in that I further examined whether these children could successfully comprehend demonstratives based on a different

perspective and, if so, whether their successful comprehension of demonstratives was related to their performances in the ToM task and EF task.

3.4.4.2. Results of the Judgment Task

The Judgment Task was used to assess children's ability to comprehend demonstratives based on a perspective different from the children's own. In the Judgment Task, participants were asked to judge whether the Servant's painting outcome matched or mismatched the King's demands that had the demonstrative word. In the match condition in which the painting outcome correctly matched the demands, children's acceptance was coded as a correct response. In the mismatch condition in which the painting outcome was wrong and mismatched the demands, children's rejection was coded as a correct response. The mean percentages of the correct responses in each condition for both children and adults were calculated and summarized in Table 6.

Table 6. The percentages of the correct responses in the Judgment Task by English-speaking children and adults (% (*SD*))

	Children (<i>N</i> = 37)	Adult (<i>N</i> = 20)
Match on <i>this</i>	93.24 (20.96)	100.00 (0.00)
Mismatch on <i>this</i>	24.32 (34.60)	97.50 (11.18)
Match on <i>that</i>	89.19 (26.71)	100.00 (0.00)
Mismatch on <i>that</i>	28.38 (40.04)	100.00 (0.00)

Adults' comprehension was almost 100% correct throughout the conditions, which established the grounds such that adults were able to contrastively comprehend *this* and *that* in the given story context used in the Judgment Task. That is, *this* picks out the object near the King while *that* picks out the object apart from the King in the given story context in the task. Children, on the other hand, were able to correctly accept items in the Match conditions with 93.24% for *this* and 89.19% for *that* respectively, but their rejections on the Mismatch conditions were low. Notice that children's rejection for *this* is of particular interests, and the rate was 24.32%.

Let me now turn to children's individual responses. Although children seemed to accept all the Match conditions and Mismatch conditions from the average percentage discussed above, children's correct response percentage ranged from 0% to 100%. The variability among children's correct responses motivated a further qualitative analysis on children's performance. I examined children's responses and identified several types of response patterns. Among the 37 children, eight children were almost adult-like, correctly accepting the Match items and rejecting Mismatch items most of the time. Eighteen children accepted all the items regardless of the Match/Mismatch conditions, which indicates that they wrongly accepted the Mismatch conditions. Two potential reasons may underlie such a response pattern. One explanation might be that children are not able to estimate the speaker's perspective from the speaker's orientation. Given the visual setting that provided in the task, the two objects in the picture are assumed to have been equal-distant to the child. Both objects could be potentially either *this* or *that* if the child could not determine the distance. The objects were presented on the screen in front of the child and they were within arm-reach distance to the child; thus children could easily point to the object or "touch" the object on the screen. Therefore, for children, the objects could be indicated

by using *this* because both of them were ‘near’ the child. The interpretation of *that*, on the other hand, is suggested to be vague, that is, *that* can also be used when the object is near the speaker (Levinson, 2004). The interpretation of *that* will be discussed in more detail in section 3.6.4. The other explanation is that children may simply have been reluctant to reject the painting outcome. Children in the task were asked to judge whether the Servant was correct or not while considering the Servant was taking a test; children may have hesitated to judge the outcome as wrong. In fact, among the 18 ‘*all-correct*’ children, three were able to point to the correct item before the painting happened. This suggests that some children could evaluate the King’s perspective regarding the distance of the objects; however, when they were asked about the painting outcome, they may have been showing sympathy to the Servant and judged the outcome as correct. One child consistently selected the object far from the King, ignoring the demonstrative words in the demand. The rest of the ten children judged the painting outcomes randomly with no observable explicit strategies. The overall error patterns found in the present study seem to be consistent with egocentric bias, in that children were not able to establish the reference points based on a perspective that was not their own.

Let me now discuss children’s performance by age group, which is presented in Table 7. Overall, the developmental pattern was not so clear for the comprehension of *that*.

Table 7. English-speaking children's percentages of correct responses in each condition in the Judgment Task by age groups (% (*SD*))

	3 yr (N=10)	4 yr (N=16)	5 yr (N=8)	6 yr (N=3)
Match on <i>this</i>	85.00 (33.75)	93.75 (17.08)	100.00 (0.00)	100.00 (0.00)
Mismatch on <i>this</i>	15.00 (24.15)	12.50 (22.36)	37.50 (44.32)	83.33 (28.87)
Match on <i>that</i>	100.00 (0.00)	78.13 (36.37)	100.00 (0.00)	83.33 (28.87)
Mismatch on <i>that</i>	25.00 (35.36)	9.38 (20.16)	43.75 (49.55)	100.00 (0.00)

For items on *that* in the Match conditions, children's performance was above chance level, but the accuracy rate was not always above 90% from age three to age six. For items on *this* in the Mismatch conditions, a gradual increase in the accuracy can be observed as age increases; however, three-year-olds outperformed four-year-olds in this condition. It is also worth noting that even 6-year-olds did not show over 90% accuracy on average for items on *this* in the Mismatch conditions. This finding is consistent with Webb and Abrahamson (1976), in which they have shown that even some seven-year-olds (with age ranged from 6;6-7;6) did not achieve fully adult-like performance when comprehending demonstratives based on a different perspective. Regarding the developmental trajectory, one possible explanation for the interpretation of *that* can be attributed Levinson's analysis. Levinson (2004) suggested that the interpretation of *that* is less straightforward since the exophoric use of *that* is applied to a wider range of contexts. For example, *that* can also pick out the object near the speaker. Indeed, in the pilot study with adults, several participants commented that the Mismatch conditions for the items on *that* could potentially be accepted as correct. Therefore, whether children were

responding to the items of *that* thinking that *that* could also point to the object close to the speaker was not so clear.

With respect to the interpretation of *this*, a gradual increase of accuracy as age increased was observed for both Match and Mismatch conditions. This finding is consistent with previous studies (Clark & Sengul, 1978; Webb & Abrahamson, 1976), which have suggested an age effect on children's demonstrative comprehension. One potential explanation for this age effect may come from children's cognitive development, such as Theory of Mind. As discussed in previous section, children develop their language abilities while the development of their cognitive abilities is still under way; thus, as children are developing their Theory of Mind gradually, their demonstrative comprehension may also develop toward adult-like.

3.4.4.3. Results of the Theory of Mind task: the Hiding Game

In the Hiding Game, participants were asked to find the hidden donut and crucially, participants needed to point to the Knower's box in order to find the hidden donut. Children's performances were categorized as either 'passers' or 'failers' following the criteria used in Schick et al. (2007). Children were categorized as 'passers' if (i) they pointed to the Knower's box in four out of five trials, and (ii) they were able to do so for at least three trials in a row. Fifteen out of 37 children were categorized as 'passers' in this task. The ratio of the passers and failers in the ToM task within each age group is presented in Table 8.

Table 8. The ratio of English-speaking passers and failers in Theory of Mind task (numbers of children/total number of children)

	ToM Passers	ToM Failers
3 yr (N =10)	10% (1/10)	90% (9/10)
4 yr (N=16)	37.5% (6/16)	62.5% (10/16)
5 yr (N=8)	62.5% (5/8)	37.5% (3/8)
6 yr (N=3)	100% (3/3)	0% (0/3)
Total	40.54% (15/37)	59.46% (22/37)

As shown in Table 8, most of the younger children failed in the task while older children were able to pass the task, which is consistent with previous findings on the similar task (Gale et al., 1996; Schick et al., 2007); in particular, about half of 4-year-old children were able to pass the task, and most of the 5-year-olds were able to pass the task with the same standard.

3.4.4.4. Results of the Executive Function task: the DCCS

Two different order lists in DCCS were administered, in order to counterbalance the order of the sorting dimensions presented throughout the test. In List 1, children were told to sort cards according to the color in the Pre-switch Phase, and according to the shape in the Post-switch Phase; in List 2, the order of the sorting dimension was presented in the reversed order. Half of the children (N=21) were presented the List 1 order, and the other half of the children (N=16) were presented the List 2 order. The mean percentages of the correct card sorting between the two order lists was compared by conducting a *t*-test, having ‘list (List 1 vs. List 2)’ as a between-subjects factor. The results revealed no significant differences in terms of the

correct sorting in the Post-switch Phase between lists ($t(35) = -1.159, p = .254$), which suggests that the order of the sorting dimensions does not affect children's sorting performance. I thus collapsed the List-based grouping of the children and analyzed the data from all the children following Zelazo's (2006) criteria. According to Zelazo, children pass the Pre-switch Phase if they can give correct responses in at least five out of six trials, and those who cannot do so will be considered as unable to understand the sorting rule. One child aged 3;10 was excluded from the following analysis based on this criterion. Children who passed the Pre-switch Phase were further categorized into 'passers' and the 'failers' on the basis of their performance in the Post-switch Phase; for children who could give correct responses in at least five out of six trials in the Post-switch were categorized as 'passers'.

Table 9. The ratio of English-speaking passers and failers in Executive Function task (numbers of children/total number of children)

	EF Passers	EF Failers
3 yr (N=10)	60% (6/10)	40% (4/10)
4 yr (N=16)	56.25% (9/16)	43.75% (7/16)
5 yr (N=8)	87.5% (7/8)	12.5% (1/8)
6 yr (N=3)	100% (3/3)	0% (0/3)
Total	67.57% (25/37)	32.43% (12/37)

The results of the categorical analysis were illustrated in Table 9. Among the 37 children, 25 fell onto the 'passers' category while 12 fell in the 'failers' category.

3.4.4.5. Across-task correlation between the Judgment Task and cognitive tasks

The main goal of the current experiment was to explore the relationship between English-speaking children's demonstrative comprehension based on a different perspective and their development of ToM and EF. In order to directly examine the relationship between children's demonstrative comprehension and their cognitive development, Spearman's Rho correlation coefficients were calculated among the following variables: (i) the mean accuracy of children's demonstrative comprehension measured in the Judgment Task for each condition: mean percentage of correct responses (acceptance) on *this*-Match items; mean percentage of correct responses (rejection) on *this*-Mismatch items; mean percentage of correct responses (acceptance) on *that*-Match items; mean percentage of correct responses (rejection) on *that*-Mismatch items; (ii) pass/fail category in the Hiding Game; (iii) pass/fail category in the DCCS. The results are illustrated in Table 10.

Table 10. Spearman's Rho correlation coefficients with English-speaking children (r_s (p))

	Pass/fail category in ToM task	Pass/fail category in EF task
Match on <i>this</i>	.115(.249)	.141(.203)
Mismatch on <i>this</i>	.288*(.042)	.113(.252)
Match on <i>that</i>	.225(.090)	.017(.461)
Mismatch on <i>that</i>	.167(.162)	.200(.117)

Note. All significance tests are one-tailed. * indicates $p < .05$

As presented in Table 10, English-speaking children's correct rejection on *this* is significantly correlated with their performance in the Hiding Game. No other correlation coefficient is significant. These results indicate that English-speaking children's development of Theory of

Mind is related with their comprehension of *this* whereas their development of Executive Function may not be related to their demonstrative comprehension. Discussions on why Executive Function did not significantly correlate with demonstrative comprehension and why the comprehension of *that* did not show significant correlation with Theory of Mind will be presented in the section 4.6.

Recall that the analyses conducted above are restricted to children who passed the Act-out Task. An additional analysis on children who failed the Act-out Task ($N = 15$) was carried out to show that the correlation between Theory of Mind and children's correct comprehension on *this* may be due to the perspective-taking ability that lies in the demonstratives. The results showed that the comprehension of *this*-Mismatch items by children who failed the Act-out Task did not revealed a significant correlation with either Theory of Mind ($r_s = -.108, p = .351$) or Executive Function ($r_s = .224, p = .212$).

3.4.5. Summary of Experiment 1

To summarize, Experiment 1 has shown that although many of the English-speaking children have no problem in comprehending demonstratives that are uttered by a speaker who shares the same perspective with them in the Act-out Task, they still had difficulties comprehending demonstratives when they were required to consider a different perspective in the Judgment Task. These children's performance in the Judgment Task revealed a significant correlation to their performance in the Hiding Game, but not DCCS. In particular, children who passed Hiding Game returned better comprehension of *this* uttered by the speaker whose perspective was different from their own, whereas children who passed DCCS did not show such a tendency. This result suggests that English-speaking children's demonstrative comprehension,

particular comprehension of proximal demonstrative *this*, may be related to children's Theory of Mind development, but probably not Executive Function. In the next section, Experiment 2 focusing on Chinese-speaking children's comprehension of demonstratives and cognitive development will be presented.

3.5. Experiment 2: Child Chinese

Experiment 2 cross-linguistically expanded Experiment 1 by investigating Chinese-speaking children's demonstrative comprehension in relation to their cognitive development. Recall that previous studies on children's cognitive development have suggested that children who acquire different languages may have different developmental patterns on Theory of Mind and Executive Function. In particular, Chinese-speaking children have been found to perform differently in those two kinds of cognitive tasks than their English-speaking peers (D. Liu et al., 2008; Sabbagh et al., 2006; Tsou, 2005; Wellman et al., 2011). This raises a question of whether Chinese-speaking children will also show a similar correlation pattern between their demonstrative comprehension and cognitive development. Experiment 2 thus investigates Chinese-speaking children's demonstrative comprehension and its relationship with their Theory of Mind and Executive Function.

3.5.1. Participants

Sixty Chinese-speaking 4-, 5-, and 6-year-olds (4;4-6;3, mean=5;2) participated in Experiment 2, 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 for (1) not completing the task, and (2) did not understanding the rule of

the task from the analysis due to not completing all the tasks or failing to learn how to complete the tasks. In addition, 16 adult native Chinese speakers also participated (19;9-38;11, mean=33;8), serving as the adult control group. The child participants were recruited in two preschools in Chiayi, Taiwan. In addition, an adult control group of 16 adult native Chinese speakers also participated (19;9-38;11, mean=33;8). The adult participants were recruited in Taipei, Taiwan.

3.5.2. Tasks

The tasks in Experiment 2 were Chinese translated versions of the ones used in Experiment 1 with English-speaking children. In Experiment 2, I also administered two demonstrative linguistic comprehension tasks, including the Act-out Task and the Judgment Task, as well as two cognitive tasks, including the Hiding Game and the DCCS. The only difference between the tasks used in Experiment 1 and Experiment 2 is the language that was being used. Thus, the linguistic stimuli used in the linguistic comprehension tasks will be introduced in this section.

The first task was the Act-out Task, which was used to assess children's comprehension of demonstratives based on their own perspectives. In the task, children were given act-out instructions in Chinese such as in (19).

- (19) *ba*⁷ X *fun* *zai* ***zhe-na-*** *ge* *hezi* *li*
 BA X put in this/that CL_{generic} box inside
 ‘Put X in *this/that* box’

The second task was the Judgment Task, which was used to measure whether children can comprehend demonstratives based on a perspective which is different from their own. In the task, children listened to the King’s demand as in (20) and judged whether the Servant’s fulfillment matched or mismatched the demand. Example (20) is the sample of the demand stimuli.

- (20) *ba* ***zhe/na*** *ge* X *tu* *cheng* *lanse*
 BA **this/that** CL_{generic} X paint as blue
 ‘Paint this/that X blue’

3.5.3. Procedure

Fifty-eight child participants participated in the study in a quiet room in their preschools and two other child participants participated in a quiet room in their houses. All children received all four tasks in the following order: the Act-out Task, the Judgment Task, the Hiding Game, and DCCS. All adult participants participated in a quiet room and were involved in only the linguistic comprehension tasks, including the Act-out Task and the Judgment Task. Recall that English-

⁷ Note that previous studies have already shown that children acquire the BA construction around three and four. In terms of production, children as young as age three can produce BA constructions appropriately in various types of contexts that required BA construction (Ping Li, 1993); while with respect to comprehension, four-years-old exhibit adult-like interpretation of the sentences with BA construction (Cheung, 1992).

speaking adults only participated in the Act-out Task and not the Judgment Task. All participants were invited individually to the study.

3.5.4. Results and discussions

3.5.4.1. Results of the Act-out Task

The Act-out Task was used to ensure children's ability to establish the distance contrast between the two demonstrative words based on their own perspective. I examined participants' act-out responses to the instruction that has demonstrative words. The overall results are presented in Table 11.

Table 11. Percentages of correct responses in Act-out Task by Chinese-speaking children and adults (%(*SD*))

	Trials with <i>zhe-ge</i> ('this')	Trials with <i>na-ge</i> ('that')
Children (N = 60)	88.89 (15.74)	70.00 (32.30)
Adults (N=16)	95.83 (17.00)	100.00 (0.00)

The adults' performance was near ceiling, and children overall exhibited above chance correct interpretations. Recall that the main goal of the current study was 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 as the baseline, ensuring children's ability to comprehend *zhe-ge* ('this') and *na-ge* ('that') contrastively based on their own perspective. Therefore, based on children's responses, children were categorized into either 'Act-out passers' or 'Act-out failers'.

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 'Act-out passers' (N = 47); otherwise, they fell into 'Act-out failers' category (N = 13).

Within the group of 'Act-out failers', children could be further categorized into two groups based on their error response patterns: *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 was the box right in front of the child and the experimenter. This response pattern has been reported in previous literature (e.g., Tanz, 1980; Webb & Abrahamson, 1978). Children who exhibited this type of response pattern were proposed to have no contrast for demonstratives. In the Random group, excluding children who simply select the boxes with no specific pattern, there were three children who consistently selected *zhe-ge* ('this') box 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 *zhe-ge* ('this') box was not enough for more toy figurines. To sum up, the 'Act-out failers' did not seem to understand that demonstrative words are used contrastively based on distance, and the asymmetric accuracy between *zhe-ge* ('this') and *na-ge* ('that') does not entail that children understood the meaning of *zhe-ge* ('this') but not *na-ge* ('that'); in fact, they did not understand the distance contrast between the two demonstrative words. Therefore, for the remaining result section, I only analyzed data from the 'Act-out passers' in the other three tasks to see (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 Executive Function task.

3.5.4.2. Results of the Judgment Task

In order to examine whether children who could comprehend demonstratives based on their own perspective could also correctly comprehend demonstratives based on others' perspective, I focused on the Act-out 'pass' children's responses in the Judgment Task. I calculated the percentage of correct responses in each condition for both children and adult controls. As shown in Table 12, adults were at ceiling for each condition, whereas children showed 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. This is also the response pattern that was found with English-speaking children.

Table 12. Percentages of correct responses in Judgment Task by Chinese-speaking children and adults (%(*SD*))

	Children(N = 47)	Adults (N =16)
Match with <i>zhe-ge</i>	95.74 (14.10)	100.00 (0.00)
Mismatch with <i>zhe-ge</i>	38.30 (43.26)	100.00 (0.00)
Match with <i>na-ge</i>	91.49 (24.05)	100.00 (0.00)
Mismatch with <i>na-ge</i>	40.43 (47.36)	100.00 (0.00)

Children's individual responses in the task were further analyzed. Ten out of 47 children correctly responded to all the trials, that is, they correctly accepted all the Match trials and

rejected all the Mismatch trials. These children's responses were considered as adult-like. Only one child correctly responded to the Match trials and Mismatch trials on *zhe-ge* ('this'), and failed to judge the trials on *na-ge* ('that'), which suggests that this child did not distinguish *na-ge* ('that') from *zhe-ge* ('this') based on the King's perspective. Twenty out of 47 children failed to reject Mismatch trials consistently, by accepting all the trials throughout. The reasons for this are already discussed in the Experiment 1. The responses from the rest of 16 children did not form a consistent response pattern. From the discussion above, error patterns seem to vary across children; nonetheless, these children's data provide evidence showing that children were egocentric when comprehending demonstratives in that they were not able to establish the distance contrast between *zhe-ge* ('this') and *na-ge* ('that') based on a different perspective.

Let me now discuss the results based on the age groups. Results in Table 13 shows an age effect numerically on the interpretation of demonstratives, particularly in the Mismatch conditions.

Table 13. Percentages of correct responses in each condition from Chinese-speaking children with different age group (% (*SD*))

	4 yr (N=19)	5 yr (N=20)	6 yr (N=8)
Match with <i>zhe-ge</i>	100.00 (0.00)	92.50 (18.32)	93.75 (17.68)
Mismatch with <i>zhe-ge</i>	26.32 (38.62)	35.00 (40.07)	75.00 (46.29)
Match with <i>na-ge</i>	97.37 (11.47)	87.50 (27.51)	87.50 (35.36)
Mismatch with <i>na-ge</i>	31.58 (44.75)	45.00 (48.40)	50.00 (53.45)

As shown in Table 13, children's accuracy on mismatch conditions gradually increased as age increased. In particular, in *zhe-ge*-Mismatch, five-year-olds were still below chance level whereas six-year-olds' average correct responses were as high as 75%. Interestingly, in *na-ge*-Mismatch, six-year-olds' performances were still at chance level. This result is particularly different from what has been found with English-speaking children. Six-year-old English-speaking children were 100% accurate on *that*-Mismatch items. One possible explanation for the different results between the two groups of language-acquiring children might be attributed to the linguistic differences on the distal demonstrative word *na-ge* ('that') or *that* in English. S. Huang (1999) has identified eight discourse-pragmatics functions of the distal demonstrative *na-ge* ('that') in Mandarin Chinese. Among the eight functions, there are two that did not exist in English, which are connective use (i.e., used to loosely connect utterances) and pause-filler function (i.e., used during planning or retrieval of information). The analysis shows that Chinese distal demonstrative *na-ge* ('that') may have more functions compared to the English distal demonstrative *that*, which may suggest that the Chinese distal demonstrative *na-ge* ('that') may be more complicated than English *that*. The poor performance on *na-ge*-Mismatch items with the six-year-old Chinese-speaking children may reflect what has been suggested in the linguistic analysis. Since the distal demonstrative in Chinese has more functions than the English distal demonstrative, the Chinese distal demonstrative may be harder to fully master. In general, the six-year-old children's overall performances on the Mismatch conditions were still poorer than adults. This finding is consistent with what has been suggested in previous literature. E. V. Clark and Amaral (2010) suggested that the full mastery of demonstrative interpretations would be at age six or even older. The results suggest that six-year-olds performed much better than four-

and five-year-olds; however, they were still not adult-like. Thus, the results also suggest that even six-year-olds did not fully master the demonstrative interpretations.

3.5.4.3. Results of the Theory of Mind Task: The Hiding Game

In the Hiding Game, children's performances were analyzed based on whether they could find out the hidden objects in the Knower's box. Based on Schick et al. (2007), children were categorized into passers if they found the hidden object four out of five times with three times in a row. Among the 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 five out of 18 failers were categorized as failers because they did not find the hidden object three times in a row, but found the hidden object four out of five times. More specifically, these children were wrong only in the third trial among the five trials. According to Gale et al. (1996) and Schick et al. (2007), this response pattern is interpreted as children simply guessing rather than relying on the Theory of Mind reasoning. It is interesting to note that this particular response pattern did not appear in Gale et al.'s (1996) study, although they set such a criterion.

Table 14. Percentages of Chinese-speaking passers and failers in Hiding Game (numbers of children/total number of children)

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

With respect to the age group differences, as demonstrated in Table 14, nearly half of the four-year-olds and the five-year-olds passed the task and only two six-year-olds failed the task. This age group difference was predicted based on previous studies (Gale et al., 1996; Schick et al., 2007), although the number of passers was expected to be more than 50% for the four-year-old children. Gale et al. (1996) reported more than 60% of the four-year-olds passed this task.

Recall that within the English-speaking children in Experiment 1, 37% of the four-year-olds, 62% of the five-year-olds, and 100% of the six-year-olds were categorized as the EF passers. When compared with Chinese-speaking children shown in Table 14, the four-year-old Chinese-speaking children seemed to outperform English-speaking peers; however, the developmental pattern was the opposite when looking at six-year-olds' data. This numerical comparison is particularly interesting because previous studies have reported either no differences between the two language-acquiring groups of children in terms of their ToM development (Sabbagh et al., 2006), or English-speaking children exceeding Chinese-speaking peers' ToM performance. The results from both English-speaking children and Chinese-speaking children seem to suggest two possible directions, although the number of six-year-olds was low for English-speaking children.

3.5.4.4. Results on the Executive Function Task: the DCCS

Recall that I administered two different order lists in DCCS, in order to counterbalance the order of the sorting dimensions presented throughout the test. In List 1, children were told to sort cards according to the color in the Pre-switch Phase, and according to the shape in the Post-switch Phase; in List 2, the order of the sorting dimension was presented in the reversed order.

Half of the children (N=22) were tested with the List 1 order, and the other half of the children (N=25) were tested with the List 2 order. The mean percentages of the correct card sorting in the Post-switch Phase between the two groups of children were compared, conducting an independent *t*-test. The result revealed no significant differences between lists ($t(45) = .209, p = .836$), which suggests that the order of the sorting dimensions does not affect children's sorting performance.

I thus collapsed children's data and analyzed the data from all the children following Zelazo's (2006) criteria. Based on Zelazo's (2006) analysis criteria, I categorized children as EF 'passers', if they first sorted cards correctly for five out of six trials in the Pre-switch Phase, and then sorted cards correctly for five out of six trials in the Post-switch Phase; otherwise, I categorized them as EF 'failers'. In the Pre-switch Phase, all 47 children correctly sorted cards for six out of six trials, which means 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 five out of six trials; these children were categorized as EF passers. The remaining seventeen children who failed to match the criteria were thus categorized as EF failers.

Table 15. The percentages of Chinese-speaking passers and failers in DCCS (numbers of children/total number of children)

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

Let's now turn to children's 'pass' and 'fail' rate in different age groups. As presented in Table 15, the number of passers increased while the age increased. However, in the four-year-old group, only half of the children passed the task, which was unexpected based on Zelazo, Frye, and Rapus's (1996) findings with English-speaking children. Zelazo et al. (1996) reported that most of the three-year-olds had difficulty in switching to new rules in the Post-switch Phase; yet, the 90% of the four- and five-year-olds should already have been successful at switching to the new rule in the Post-switch Phase. Intriguingly, in the current study, Chinese-speaking children seem to have more difficulties as compared with English-speaking children reported by Zelazo et al. (1996). In particular, the result shows that half of the four-year-olds still struggled to switch to the new rule. Additionally, when compared with English-speaking children reported in Experiment 1, the same cross-linguistic pattern still emerges. I will briefly discuss the cross-linguistic pattern here, but a detailed discussion on the direct comparison will be provided in section 3.6.1. Recall that regarding English-speaking children's pass ratio, 56% of four-year-olds, 88% of five-year-olds, and 100% of six-year-olds passed the task. Compared with the data shown in Table 16, English-speaking children seem to perform slightly better than Chinese-speaking peers when looking at the numerical tendency, although English-speaking children's pass rate is not as high as Zelazo et al. (1996) has reported. This cross-linguistic pattern is not predicted from the findings of previous studies. In Sabbagh et al. (2006), when comparing the same age group, Chinese-speaking children outperformed their peers of English-speaking children in all of the EF tasks, including the task that is compatible with DCCS. This difference between English-speaking children and Chinese-speaking children, although not significant, may

potentially generate different results on the relationship between EF and demonstrative comprehension.

3.5.4.5. Across-task correlation between the Judgment Task and cognitive tasks

In order to examine the relationship between children's demonstrative comprehension and their cognitive abilities, one-tailed Spearman's Rho correlation coefficients were conducted. The variables that were included in the analysis are shown as following: (i) the percentages of children's correct demonstrative comprehension in the Judgment Task, which are the percentages of children's acceptance of *zhe-ge*-Match items, the percentages of children's rejection of *zhe-ge*-Mismatch items, the percentages of children's acceptance of *na-ge*-Match items, as well as the percentages of children's correct rejection of *na-ge*-Mismatch items, (ii) the pass/fail category in the Hiding Game (ToM task), and (iii) the pass/fail category in the DCCS (EF task).

Table 16. Spearman's Rho correlation coefficients with Chinese-speaking children (r_s (p))

	Pass/fail category in ToM task	Pass/fail category in EF task
Match with <i>zhe-ge</i>	.230(.060)	-.071(.318)
Mismatch with <i>zhe-ge</i>	.249*(.046)	.150(.157)
Match with <i>na-ge</i>	-.175(.119)	-.034(.411)
Mismatch with <i>na-ge</i>	.208(.080)	-.017(.456)

Note. All significance tests are one-tailed. * indicates $p < .05$

The correlation results were exactly the same as the one from in Experiment 1 with English-speaking children; as presented in Table 16, only the correct rejection rate in the *zhe-ge*-

Mismatch conditions is significantly correlated with children's performance in the Hiding Game, which was also the only significant correlation found for English-speaking children in Experiment 1. Children's correct responses in *na-ge* ('that') conditions did not significantly correlate with their performance in the Hiding Game. Additionally, regarding the development of Executive Function, there is no 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 demonstratives, particularly *zhe-ge* ('this') is related with children's development of Theory of Mind, whereas the development of Executive Function is not related to children's comprehension of demonstratives. The results of the cross-task analysis support the prediction of the current study, showing the exact same correlation pattern as in Experiment 1 with English-speaking children.

The above analyses focused on children who passed the Act-out Task. I further analyzed children who failed the Act-out Task ($N = 13$) and aimed to examine whether their performances in the Judgment Task was related to their cognitive abilities. Results showed that the Act-out Failers' comprehension of *zhe-ge* did not significantly correlate with their Theory of Mind ($r_s = -.141, p = .323$) nor Executive Function ($r_s = .058, p = .426$). This result provides a further support to the hypothesis that children's difficulty in comprehending demonstrative based on a different perspective is related to their Theory of Mind, suggesting that it would be children's ability to incorporate the speaker's perspective in demonstrative comprehension that is related to the cognitive development, not other component of demonstrative meaning such as distance distinction.

3.5.5. Summary of Experiment 2

In sum, Experiment 2 with Chinese-speaking children has shown the exact same response patterns that have been found in Experiment 1 with English-speaking children. Although Chinese-speaking children have no problems in comprehending demonstratives based on their own perspective in the Act-out Task, many of them still exhibit non-adult-like comprehension when the demonstratives are uttered by a speaker who has a different perspective in the Judgment Task. Children's demonstrative comprehension in the Judgment Task, particularly the comprehension of the proximal demonstrative *zhe-ge* ('this'), correlated with their performances in the Hiding Game, but not DCCS. Results from Chinese-speaking children indicate that children's comprehension of demonstratives may be indeed related to their Theory of Mind. But the role that Executive Function may play in children's demonstrative comprehension remains unclear.

3.6. General discussions on demonstrative comprehension and cognitive development

The current studies aim to examine the relationship between children's comprehension of demonstratives and their cognitive development, particularly, their development of Theory of Mind and Executive Function. Results from both Experiment 1 with English-speaking children and Experiment 2 with Chinese-speaking children revealed that children's comprehension of demonstratives is related to their development of Theory of Mind, but probably not Executive Function. More specifically, the results suggest that Theory of Mind plays an important role in children's comprehension of the proximal demonstrative, *this* in English and *zhe-ge* ('this') in Mandarin Chinese. However, the role of Executive Function in demonstrative comprehension is

still unclear. The results support the hypothesis of the current study, showing that demonstrative comprehension and Theory of Mind are interrelated.

In the following sections, an additional cross-linguistic analysis on the interaction between language background, Theory of Mind, and Executive Function on children's demonstrative comprehension will be presented, following the discussions of (i) the role of language background in the comprehension of demonstratives, (ii) the relationship between demonstrative comprehension and Theory of Mind, (iii) the relationship between demonstrative comprehension and Executive Function, and (iv) the comprehension of distal demonstrative, *that* in English and *na-ge* ('that') in Mandarin Chinese.

3.6.1. The role of language background in the comprehension of demonstratives: a cross-linguistic examination

The cross-task analyses on both English-speaking and Chinese-speaking children have revealed that children's correct rejection on Mismatch items of the proximal demonstrative, such as *this*, correlates with Theory of Mind performances, indicating that Theory of Mind may play a role in children's demonstrative comprehension, particularly on proximal demonstrative. However, the results from the cognitive tasks seem to differ between the two groups of children. The summary of the results of Hiding Game and DCCS across the two groups of children are repeated in Table 17 and Table 18 respectively.

Table 17. The ratio of passers and failers in Theory of Mind task (numbers of children/total number of children)

	English-speaking children		Chinese-speaking children	
	ToM Passers	ToM Failers	ToM Passers	ToM Failers
4 yr	37.5% (6/16)	62.5% (10/16)	52.63% (10/19)	47.37% (9/19)
5 yr	62.5% (5/8)	37.5% (3/8)	65% (13/20)	35% (7/20)
6 yr	100% (3/3)	0% (0/3)	75% (6/8)	25% (2/8)
Total	66.67% (15/27)	33.33% (22/27)	61.70% (29/47)	38.30% (18/47)

Table 18. The ratio of passers and failers in Executive Function task (numbers of children/total number of children)

	English-speaking children		Chinese-speaking children	
	EF Passers	EF Failers	EF Passers	EF Failers
4 yr	56.25% (9/16)	43.75% (7/16)	47.37% (9/19)	52.63% (10/19)
5 yr	87.5% (7/8)	12.5% (1/8)	70% (14/20)	30% (6/20)
6 yr	100% (3/3)	0% (0/3)	87.5% (7/8)	12.5% (1/8)
Total	81.25% (25/27)	18.75% (12/27)	63.83% (30/47)	36.17% (17/47)

As demonstrated in Table 17, Chinese-speaking children's performances in the Hiding Game, the Theory of Mind task, seem to be better than those of English-speaking children. In particular, considering the pass rate in the four-year-olds, Chinese-speaking children were more likely to pass the task than English-speaking peers. Although the six-year-olds showed the reverse tendency, the number of English-speaking children was much lower and may not be

representative enough for a direct comparison. While Chinese-speaking children seemed to exceed their English-speaking peers' performance in Theory of Mind task, English-speaking children seemed to outperform Chinese-speaking children in the DCCS, the Executive Function task. As presented in Table 18, the overall pass rate for English-speaking children was numerically higher than that of Chinese-speaking children. Given the numerical differences of children's performances across the two groups of children observed in Table 17 and 18, it would be worthwhile to conduct a cross-linguistic analysis that takes into consideration children's performances in Theory of Mind task and Executive Function task. Recall that children's interpretation of proximal demonstrative was of particular interest; crucially, in the Judgment Task, I was particularly interested in how children respond to the Mismatch items of proximal demonstrative. Thus, to examine the role of children's language background while considering the effect from Theory of Mind, and Executive Function on their demonstrative comprehension, I conducted a two (Language: English vs. Chinese) by two (the pass/fail category of ToM) by two (the pass/fail category of EF) ANOVA, including the mean percentages of children's rejection on Mismatch items of proximal demonstrative as the dependent variable. The summary of the ANOVA results is demonstrated in Table 19.

Table 19. 2 x 2 x 2 ANOVA

	<i>df</i>	<i>F</i>	<i>p</i>
(A) Pass/fail category of ToM	1	3.747	.057
(B) Pass/fail category of EF	1	1.919	.170
(C) Language	1	1.260	.265
A x B (interaction)	1	1.578	.213
A x C (interaction)	1	.008	.928
B x C (interaction)	1	.010	.922
A x B x C (interaction)	1	.001	.976

As shown in Table 19, no significant main effect of language was found in children's judgment in the mismatch trials on proximal demonstrative ($F(1, 76) = 1.260, p = .265$), suggesting that no matter which language children acquire, children of different language-speaking communities may not differ from each other. Regarding children's cognitive abilities, there was a marginal main effect of the pass/fail category of ToM on children's rejection of mismatch trials on proximal demonstrative, such as *this* and *zhege* ($F(1, 76) = 3.747, p = .057$). In particular, ToM passers ($M = 43.18, SD = 42.58$) tend to reject more mismatch trials on proximal demonstratives in the Judgment Task than ToM failers ($M = 20.00, SD = 33.59$). However, there was no significant main effect of the pass/fail category of EF ($F(1, 76) = 1.191, p = .170$). There were also no significant interactions among these variables.

These results indicate that the language children are acquiring may not have played an important role in children's demonstrative comprehension in the current studies. Children's difficulty with demonstrative comprehension may thus be a universal issue since it was found in

both English and Chinese, although further cross-linguistic evidence is required. This result is also supported by previous studies. Zhao (2007), who investigated Chinese-speaking children's demonstrative comprehension, also reported that children fail to consider the speaker's perspective and thus exhibit egocentric demonstrative comprehension. Zhao's finding suggests that children in general may face difficulty in perspective-taking when comprehending demonstratives.

However, the semantic features of demonstratives vary across languages (Diessel, 1999). Languages that employ speaker-object distance scale in demonstratives usually have a two-way system as English and Chinese do. The two-way system has a proximal demonstrative that picks out an object near the speaker and a distal demonstrative that picks out an object that is some distance away from the speaker. Some languages, such as Spanish and Japanese, have a three-way system. Anderson and Keenan (1985) suggest that the three-way system could be divided into "distance-oriented" system and "person-oriented" system (cf. Diessel, 1999, p.39). Taking an example from Diessel (1999), Spanish is a distance-oriented system in which *este* points to a proximate object, *ese* points to an object in the medial, and *aquel* points to a far object, whereas Japanese is a person-oriented system in which *kore* points to an object near the speaker, *sore* points to an object near the hearer, and *are* points to an object away from both speaker and hearer. Interestingly, the person-oriented system may allow a four-way distinction. For example, according to Diessel's (1999) typological survey, in Quileute, *xo''a* points to an object near the speaker, *so''o* points to an object near the hearer, *sa''a* points to an object near both the speaker and the hearer, and *á:tca'a* points to an object away from both the speaker and the hearer. Regardless of the two-way or three-way system, the object-speaker distance scale encoded in demonstratives appears to be the most frequently used contrast in world languages.

In addition to the distance contrast, demonstratives in other languages have different deictic distinctions such as visibility of the referent (e.g., Ute), up/down elevation (e.g., Khasi), geographical features (e.g., Dyirbal), and the movement of the referent (e.g., Nunggubuyu) (see discussions in Diessel, 1999). Since the discussion in this chapter only aims to show the linguistic-internal differences across languages, only two most frequent features encoded in world languages, invisibility and elevation, will be briefly reviewed. Regarding the invisibility feature, typically, there would be a proximal demonstrative, distal demonstrative and a third demonstrative that picks out the invisible object. For example, Ute has a proximal demonstrative *íca*, a distal demonstrative *máryu*, and a demonstrative for invisible object *úryu* (Diessel, 1999, p.42). With respect to elevation, typically, languages that have elevation features would have a demonstrative that picks out an object from a higher position relative to the reference point and a demonstrative that picks out an object from a lower position. For example, in Khasi, *u-tey* indicates the object higher than the reference point and *u-thie* indicates the object lower than the reference point. As shown in the above examples, demonstratives have features other than distance; however, children's acquisition of these features is understudied.

Therefore, to better understand children's demonstrative comprehension, further cross-linguistic investigation is called for, particularly taking into account these aforementioned cross-linguistic variations in demonstrative representations. The study in the following chapter attempts to investigate a language-specific characteristic in demonstratives in Chinese, with respect to how it may influence children's demonstrative comprehension.

With respect to children's cognitive development, children's ToM development may have impact on children's rejection of Mismatch items on proximal demonstrative; however, children's EF development does not seem to play an important role in terms of children's correct

comprehension of proximal demonstrative. Results from the cross-linguistic analysis in the current study further strengthen the claim that Theory of Mind is related to children's comprehension of demonstratives. Furthermore, although numerical differences between the two language-acquiring groups of children were observed, the ANOVA result presented above did not reveal significant interaction between children's language background and their Theory of Mind development or their Executive Function development. In other words, the tendency of the different cognitive developmental pattern observed between the two groups of children does not appear to impact children's demonstrative comprehension. Previous studies have reported different developmental patterns on Theory of Mind and Executive Function between English-speaking and Chinese-speaking children, although it is still under debate whether the differences exist. For example, Tsou (2005) and D. Liu et al. (2008) suggested that Chinese-speaking children performed poorer than their English-speaking peers on the Theory of Mind tasks; on the contrary, Sabbagh et al. (2006) revealed that Chinese-speaking children and English-speaking peers did not differ from each other in terms of their performances on the Theory of Mind tasks, but Chinese-speaking children performed significantly better on Executive Function tasks than their English-speaking peers. Regardless of the disagreement among the findings discussed above, Devin and Hugh (2013, 2014) conducted a large-scale meta-analysis across all the studies seeking the correlation between Theory of Mind and Executive Function, and suggested that the development of Theory of Mind and Executive Function are significantly correlated even if the language backgrounds are considered. Thus, the development of Theory of Mind and Executive Function are similar across different language-acquiring groups. The results of the current study may be more in line with this argument suggesting that the language children are acquiring may

not affect children's development of Theory of Mind and Executive Function under the situation where the comprehension of demonstratives is considered.

3.6.2. Comprehension of demonstratives and Theory of Mind

When comprehending demonstratives, children need to understand that the speaker may have a different perspective and incorporate the speaker's perspective to resolve the reference of demonstrative. This ability is considered to be related to children's Theory of Mind (de Villiers, 2007; Diessel, 2012). The results from English-speaking children and Chinese-speaking children suggested that children's ability to take the speaker's perspective into account in identifying the referents for demonstratives is related to their development of Theory of Mind. In particular, children who are more likely to interpret proximal demonstratives appropriately are also more likely to be successful in the Theory of Mind task, which measures children's Knowledge Access. Recall that Knowledge Access is the ability to estimate others' knowledge status and understand that others may have a different perspective. It is thus implied that children who are not able to understand that others may have different perspectives from their own would not be able to interpret proximal demonstrative in adult-like way. In other words, children's ability to consider the speaker's perspectives when interpreting proximal demonstrative may indeed be related to their development of Theory of Mind.

Furthermore, additional analyses were conducted on children who did not pass the Act-out Task and thus were excluded from the results shown above. Results on these Act-out Failers in both Experiment 1 and Experiment 2 did not reveal a significant correlation between their performances in the Judgment Task and Theory of Mind Task. This suggests that if children could not establish the distance contrast of the demonstratives based on their own perspective,

their non-adult-like comprehension of demonstratives based on a different perspective would not relate to their development of Theory of Mind. That is to say, children's Theory of Mind development only related to children's ability in perspective-taking in demonstrative comprehension. This result strengthened the claim that children's ability to incorporate the speaker's perspective is the main component in demonstrative comprehension that relates to children's Theory of Mind.

The result of the current study is in line with De Mulder's (2011) and others' argument (e.g., Resches & Perez Pereira, 2007), which states that Theory of Mind plays a role in children's ability to take the interlocutor's perspectives. This is consistent with the common understanding of the nature of Theory of Mind. Theory of Mind is considered to be part of socio-cognitive development (Arslan, 2012; de Rosnay & Hughes, 2006; Wellman, 2010). In other words, it is the ability that is needed for an efficient communication and should be deeply related with children's pragmatic development. For instance, Theory of Mind is often discussed with autism. Previous research has suggested that the poor communicative skills of autistic children may be related to their under-developed Theory of Mind (e.g., J. de Villiers, Stainton, & Szatmari, 2007; Happé, 1993). Although the direction in which Theory of Mind and language may interact is still under debate, results from the current study and others may suggest that Theory of Mind indeed plays a role in children's ability to consider others' perspectives.

3.6.3. Comprehension of demonstratives and Executive Function

The results in the current study show that children's comprehension of demonstratives did not significantly correlate with their Executive Function, suggesting that Executive Function may not play a role in children's demonstrative comprehension. This result is in line with De

Mulder's (2011) findings. Contrary to the findings in previous studies showing that children's perspective-taking communication is related to their EF (e.g., Nilsen & Graham, 2009, 2012), De Mulder reported that only Theory of Mind is the good predictor of children's successful perspective-taking in communication. She further suggests that understanding others' mental states is the most crucial cognitive ability for children to correctly use referring expressions in communications.

However, although the results on Executive Function are consistent with De Mulder's findings, the relationship between children's comprehension of demonstratives and Executive Function is still unclear as tested in the current study. Recall that studies have suggested that children's ability to track the interlocutors' perspectives in conversation is related to their Executive Function (Brown-Schmidt, 2009; Nilsen & Graham, 2009, 2012). In addition to perspective taking, the salience biased response pattern revealed by Tanz (1980) was also argued to be associated with children's cognitive flexibility in EF. Based on these two arguments, I hypothesized that in order for children to correctly comprehend demonstratives based on a different perspective, they need to disengage from their own perspective and reengage with the speaker's perspective which is different from their own; also, in order for children to inhibit the attention to the object that is visually salient but not under discussion and shift their attention to the correct object the speaker intended, children may also require better cognitive flexibility. These reasons are why cognitive flexibility (*shifting*) may play a role in children's demonstrative comprehension.

The current study selected DCCS as the measurement of EF, which was suggested as a measure to examine children's cognitive flexibility in some studies (e.g., Zelazo, 2006) while it was also argued to be examining their inhibition control in other studies (Kloo, Perner, Aichhorn,

& Schmidhuber, 2010). Kloo et al. (2010) claim that children fail to switch the rule in the Post-switch Phase because they cannot inhibit the first rule they followed. Nilsen and Graham (2009), who studied children's perspective-taking communication in relation to their EF development, have revealed that inhibition control is the most crucial EF component that is associated with children's ability to take a different perspective in communication. Note that Nilsen and Graham (2009) did not use DCCS to measure children's inhibition control rather they used tasks that are similar to Stroop task. Given that what DCCS measures is still unclear and children's perspective-taking ability may be related to their inhibition control, it is possible that other tasks measuring children's Executive Function, particularly those that measure inhibition control, may associate with their demonstrative comprehension. Thus, one future direction to understand more about the role of EF in demonstrative comprehension is to include other types of EF measurements, such as Stroop task and Flanker's task that measures inhibition controls. If inhibition control is indeed related with perspective-taking, a correlation between children's demonstrative comprehension and their inhibition control abilities may emerge.

Let me now discuss the salience biased response pattern proposed by Tanz (1980) in light of Executive Function. In Tanz's experiment, she administered Act-out Task to test children's demonstrative comprehension based on a different perspective. Her results revealed that children tended to pick up objects near the puppet speaker because the puppet speaker was moving and thus attracted the child's attention so much that the child could not shift his/her attention to the demonstrative word used in the act-out instruction. That is, the perceptual saliency from the object may have potentially posed problems for children to correctly comprehend demonstratives. Based on Tanz's argument, I hypothesized that children's inability to disengage their attention from the moving puppet is related to their Executive Function. However, the current study was

not designed to directly assess whether the perceptual saliency in demonstrative comprehension is related to children's Executive Function. When examining children's demonstrative comprehension based on a different perspective, I used picture story judgment task instead of an act-out task. In addition, in the Judgment Task, I tried to minimize the saliency issue in the critical pictures. I made the two objects exactly the same in size and color. The only difference about the two objects was the distance to the King, who was the speaker. Most importantly, from the child's orientation point, the two objects were equal-distant to the child. Given these, I may not be able to directly assess the claim by Tanz (1980). Therefore, another future direction to explore the role of Executive Function in demonstrative comprehension is to use the act-out task to test children's comprehension of demonstratives based on a different perspective.

3.6.4. Comprehension of distal demonstrative

Let me now discuss why the comprehension of distal demonstratives, such as *that* in English and *na-ge* ('that') in Mandarin Chinese, did not provide results parallel to the proximal demonstrative, such as *this* and *zhe-ge* ('this'). As discussed in the previous section, Levinson (2004) suggested that the distal demonstrative *that* can be used in a wider range of contexts than proximal demonstrative *this*; in other words, the uses of *this* are more restricted. For example, if an object is located near the speaker, the speaker could felicitously use either *this* or *that* to indicate the object, but if the object is located far from the speaker, he/she could only use *that* to refer to the object felicitously. If considering such a claim, it may be predicted that the interpretation of *that* could be more challenging than *this* for young children. Such a difficulty may be supported by the following observation in the pilot study with adult native speakers of English. Some adult participants in the pilot study commented that in the Judgment Task, the

distal demonstrative *that* could be appropriately used with the objects that are either near the speaker or apart from the speaker. Therefore, the lack of association between children's comprehension of the distal demonstrative, as well as their poorer performance with the distal demonstrative than with the proximal demonstrative, may reflect this vagueness about the most felicitous circumstances to use *that*.

**Chapter 4. EFFECT OF LANGUAGE-SPECIFIC PROPERTY ON DEMONSTRATIVE
COMPREHENSION: CHILD MANDARIN AS A TESTING CASE**

The previous chapter examined a potential role of an extra-linguistic factor (i.e., children's development of cognitive abilities) on their demonstrative comprehension, seeking to explore why children exhibit non-adult-like interpretations of demonstratives when the speaker has a perspective different from their own. In this chapter, I will present a study to investigate the role of language-internal factors, i.e., language-specific morphological characteristics in the representation of demonstratives, which may play a role in children's demonstrative comprehension, seeking to understand whether there may be any linguistic-specific properties that may help children to avoid comprehension errors.

The representation of demonstratives varies across languages (Diessel, 1999). Demonstratives in some languages, such as English, are monomorphemic, while in other languages, such as Mandarin Chinese, demonstratives may contain more than one morpheme. In Mandarin Chinese, a demonstrative co-occurs with a *classifier*, which is a morpheme that specifies the semantic category of its associated noun. In this chapter, I will show that Chinese-speaking children are able to use the semantic information from the classifier to facilitate their demonstrative comprehension. In what follows, I will first review the internal structure of demonstrative phrases and classifier systems in Mandarin Chinese and discuss relevant psycholinguistic studies and acquisition studies. I will then present the study conducted with Chinese-speaking children exploring the role of classifiers in their demonstrative comprehension.

4.1. Demonstratives in Mandarin Chinese

A demonstrative phrase in Mandarin Chinese is composed of a demonstrative word and a *classifier*; optionally, numbers will occur between the demonstrative and the classifier and nouns may or may not occur in the phrase (C. T. J. Huang et al., 2009). The basic structure of demonstrative phrases is demonstrated in (21a) with some examples of the demonstrative phrases as shown in (21b), in which the noun is pronounced, and (21c), in which the noun is not overtly pronounced. The sequence of demonstrative phrases is suggested to be fixed (Tang, 1990).

(21) a. Demonstrative + (number) + *(classifier) + noun

b. *zhe* (yi) *zhi* *mao*

this (one) CL_{animal} cat

‘This cat.’

c. *zhe* (yi) *zhi*

this (one) CL_{animal}

‘This (one).’

As can be seen in (21a), the occurrence of the classifiers is obligatory in most of the context (Tang, 2007), which suggests a close relationship between demonstratives and classifiers from a syntactic perspective. In addition, the relationship between classifier and the noun are also suggested to be close since the classifiers categorize their associated noun based on the semantic categories of the nouns. As the classifiers interact with demonstratives and numbers on the one hand and establish the semantic dependency with the noun on the other, the classifier’s syntactic position in the tree structure has been debated (Hsieh, 2008c; Tang, 1990, 2007; N. N. Zhang,

2011, 2012). In the following sections, the previous analysis of the classifier's syntactic position will first be presented and then a discussion of how the classifiers' semantic dependency on the noun facilitates online sentence processing will be presented.

4.1.1. The role of the classifiers in demonstrative phrase

Demonstratives or numerals⁸ obligatorily precede classifiers in most contexts; meanwhile classifiers establish semantic relationships with their associated nouns. Given that the elements preceding and following the classifiers seem to have certain relationships with the classifiers, the classifiers' syntactic role in the demonstrative phrase has been of particular interest to researchers. Before discussing the syntactic position of classifiers in the demonstrative phrase, let me first examine the context in which the classifiers are obligatory. Tang (2007) suggested that the syntactic position of the entire demonstrative phrase in a sentence determined whether the classifiers were required. The classifiers are obligatory when the demonstrative phrases are located in the object position as in (22) while they are optional when the demonstrative phrases are in the subject position as in (23).

(22) *wo xihuan zhe *(zhi) mao*

I like this CL_{animal} cat

'I like this cat.'

⁸ Chinese classifiers are numeral classifiers, which will be discussed in more detail in the next section. As they are numeral classifiers, these classifiers are argued to have close relationship with the numerals which belong to the elements precede the classifier.

- (23) *zhe/na (zhi) shi mao*
 this/that CL_{animal} be cat
 ‘This is a cat.’

Sentence (22) shows that the classifier *-zhi* is obligatory to co-occur with the noun *cat*. It should be noted that the occurrence of the classifier is still obligatory even when a demonstrative phrase is used pronominally in the object position. For example, in (24), the sentence would be ungrammatical if the classifier were omitted.

- (24) *wo xihuan zhe *(zhi) (mao)*
 I like this CL_{animal} (cat)
 ‘I like this (cat).’

Although the noun is not overtly pronounced in the pronominal demonstrative phrase such as the one in (24), the classifier still implements the semantic dependency with the referent it is associated with. Thus, the classifier in the pronominal demonstrative phrase provides the semantic information of the referent. For instance, in (24), the classifier *-zhi* can only categorize nouns that denote ‘animals’; thus, the referent of the pronominal demonstrative phrase must be a type of animal in order to be semantically compatible with the classifier *-zhi*.

The semantic dependency between a classifier and its associated noun is suggested to be maintained at a syntactic level. Theorists have proposed different accounts on the position of a classifier in the demonstrative phrase in order to explain the classifier’s role within the demonstrative phrase. The debate regards whether the classifier is syntactically closer to the

noun or closer to the numbers (Hsieh, 2008a; C. T. J. Huang et al., 2009; Y.-h. A. Li, 1998; Tang, 1990; N. N. Zhang, 2012) and thus proposed right-branch structure and left-branch structure. Figure 14 demonstrates the right-branch structure. As shown in Figure 15, the number phrase (NumP) contains number (Num) and the classifier phrase (CIP); within the CIP, the classifier (CL) is in the specifier position and its sister node is the noun phrase (NP). Since the CL is the sister of the NP in the right-branch structure, researchers supporting this analysis suggest that the classifiers are syntactically closer to the noun. The main argument in this analysis is based on the semantic dependency between the classifier and the noun or the associated object. Zhang (2012) suggested that in this type of structure the semantic dependency between the noun and the classifiers is maintained through a head-to-head manner under this structure.

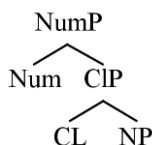


Figure 15. Right-branch structure (Li, 1998; Huang, Li, & Li, 2007; N. Zhang, 2012)

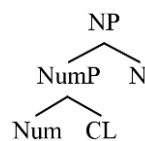


Figure 16. Left-branch structure (Hsieh, 2008c; Tang, 1990)

Figure 16 demonstrates the left-branch structure. As shown in Figure 16, the NumP is in the specifier position of the NP and is the sister of the CL node. Researchers supporting this left-branching structure thus argue that the relationship between number and classifier is syntactically closer. This argument is based on the fact that the classifiers in Mandarin Chinese are numeral classifiers, suggesting that classifiers should establish a closer syntactic relationship with the

numerals. The semantic dependency between the N and the CL can be maintained through other mechanisms (See discussion in Hsieh, 2008).

However, this structural difference does not affect the discussion and conclusion of the present project and the present study do not attempt to solve the theoretical debate. The main interest in the present study is to see how the classifiers may act as a precursor to the category of the following noun. In other words, the present study focuses on how the classifiers establish the semantic dependency with the associated noun at the syntactic level. According to Zhang (2011, 2012), the right-branch structure has the easier mechanism to maintain the semantic relationship between the classifier and its associated noun. N. N. Zhang (2011, 2012) suggested that the semantic dependency of the classifier can be maintained by the c-command relationship between the classifier and its associated noun. Based on Zhang's statement, the right-branch structure of the demonstrative phrase in Chinese was adopted as the theoretical framework of the present study. Thus, for a pronominal demonstrative phrase as in (25), the syntactical tree structure is presented in Figure 17.

- (25) *zhe ge (ren)*
 this CL_{generic} (person)
 'This (person).'

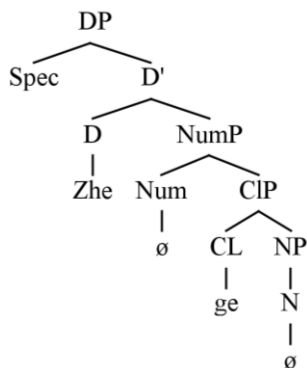


Figure 17. Tree structure of pronominal demonstrative phrase in Chinese

In this syntactic analysis, according to Tang (1990), the semantic feature of the classifier and its associated noun undergo head-to-head checking procedure, and thus the semantic dependency between the classifier and its associated noun is maintained syntactically. Importantly, in this phrasal structure, the occurrence of classifiers is required in both pronominal demonstrative phrases and pronominal demonstrative phrases while numerals appear optionally.

This theoretical assumption has been adopted in the acquisition research on child Chinese. Previous studies have suggested that children seem to possess the knowledge of the phrasal structure within the demonstrative phrase in Chinese (Chang, 2011; Hu, 1993; H. Liu, 2008). In particular, children are aware that the classifier is obligatory in the demonstrative phrases and they never produce demonstrative phrases without classifiers. This leads me to propose that the classifiers may potentially play some role in children's comprehension of demonstratives.

4.2. Chinese classifiers

The current section will provide a detailed review of the classifiers in Mandarin Chinese.

4.2.1. The classifier system in Mandarin Chinese

Mandarin Chinese is a language that uses classifiers, and is thus categorized as a classifier language (Allan, 1977). The classifier languages can be further distinguished into several types, including numeral classifier languages, concordial classifier languages, predicate classifier languages, and intra-locative classifier languages (Allan, 1977). Building upon Allan's categorizations, Grinevald (2000) proposed four different categorizations of classifiers from a morphosyntactic perspective, in which classifiers can be categorized into numeral classifiers, noun classifiers, genitive classifiers, and verbal classifiers. Mandarin Chinese uses numeral classifiers⁹. A numeral classifier is defined as the classifier that occurs in the context of quantification and usually appears with numerals. Consider example (26)-(28). The classifiers all appear in the counting context.

- (26) *san ge nuhai*
 three CL_{general} girl
 'Three girls.'

⁹ Note that researchers (Gong, 2010; Hu, 1993; Tse, Li, & Leung, 2007) argued that Mandarin Chinese also have verbal classifiers. For example, in (1), the classifier *quan* occurs in the predicate phrase and thus the classifier *quan* can be categorized as verbal classifiers.

- (1) *da yi quan* (Gong, 2010, p.19)
 hit one CL_{fist}
 'hit one time with a fist'

However, the classifier *quan* still occurs with numerals and can be used to describe quantity. Thus, whether verbal classifiers exist in Mandarin Chinese is still unclear judging from the example provided.

(27) *zhe jian waitao*

this CL_{outfit} jacket

‘This jacket.’

(28) *zhe wu zhi mao*

this five CL_{animal} cat

‘These five cats.’

Classifiers could be further divided into two types, ‘sortal classifiers’ and ‘measure classifiers’. Lyons (1977) defined ‘sortal classifiers’ as those that individuate the referents and ‘measure classifiers’ as those that individuate the quantity rather than the referent of the noun. Chinese linguists also followed the same categorization, dividing Chinese classifiers into ‘sortal classifiers’ and ‘mensural classifiers’ (Cheng & Sybesma, 1998, 1999; Peggy Li, Barner, & Huang, 2008; X.-P. Li, 2011; Lyons, 1977; Tai & Wang, 1990; H. Zhang, 2007; N. N. Zhang, 2012). However, among the Chinese linguists, the definitions of ‘sortal classifier’ and ‘mensural classifier’ are not clear in the literature (see Zhang, 2012 for review), and the boundary between the two types of classifiers is not consistent across all the studies. Tai and Wang (1990) claim that the so-called ‘sortal classifier’ is semantically related to its associated referent while the ‘measure classifiers’, or ‘measure words’ in their term, do not provide any semantic information of the referent. Cheng and Sybesma (1999) distinguishes ‘sortal classifier’ and ‘mensural classifiers’ based on mass and count distinction, in which ‘sortal classifiers’ go with mass nouns whereas ‘mensural classifiers’ go with count nouns. The current study does not attempt to provide any theoretical insight regarding the debate on the definition of the two types of

classifiers. Rather, the goal of the current study is to explore the role of classifier in children's demonstrative comprehension, with particular interests within the 'sortal classifiers'.

The 'sortal classifiers' can be further divided into general classifier and specific classifiers. The general classifier *-ge* is semantically general; it denotes three-dimensional objects in general, such as cup, bowl, and person, as shown in (29).

- (29) *yi ge beizi/nuhai/pinggou*
 one CL_{generic} cup/girl/apple
 'A(n) cup/girl/apple.'

The general classifier *-ge* can co-occur with many kinds of objects. Some researchers have even suggested that the general classifier is the default classifier (Myers, 2000) and it behaves as a placeholder in the syntactic position (N. N. Zhang, 2012). In other words, the general classifier *-ge* classifies nouns from a variety of semantic categories, such as person, objects, and concepts. Abstract nouns and nouns for new concepts were also suggested to occur with the general classifier *-ge* (Zhang, 2012). In addition, even nouns that already can be classified by specific classifiers may occur with the general classifier *-ge*. For instance, in (30), the bike occurs with the classifier *-liang* which classifies vehicles, but the general classifier can also occur with it.

(30) ..., *qi-zhe yi ge jiaotache, shi yi liang hen keai de xiao*
 ride-PRG one CL_{generic} bike be one CL_{vehicle} very cute DE little

de jiaotache (Zhang, 2012, p.35)

DE bike

‘From there comes a child, riding a bike, (it) is a very cute little bike.’

Specific classifiers, on the other hand, are semantically specific. Each specific classifier classifies a generalizable set of objects that share the same feature. The classification is identified based on the semantic domains, such as shape, animacy, and function (Hu, 1993; Lee, 1996). For example, the classifier *-zhi*, which is a classifier whose classification is based on animacy, classifies noun referents whose denotation is animals as in (31) and the classifier *-jian*, which is the classifier whose classification is based on function, only classifies outfits for upper body as in (32).

(31) *yi zhi xiong/*beizi/*maoyi*
 one CL_{animal} bear/*cup/*sweater

‘A bear/*cup/*sweater.’

(32) *yi jian maoyi/*beizi/*xiong*
 one CL_{outfit} sweater/*cup/*bear

‘A sweater/*cup/*bear.’

In (31), the classifier *-zhi* can only occur with nouns that denote animals, such as bears, cats, and birds, but becomes semantically anomalous if it co-occurs with other types of noun referents. Thus, when the classifier *-zhi* co-occurs with cup or sweater whose denotation is not an animal, the sentence is semantically anomalous. Similarly, in (32), the classifier *-jian* can only occur with nouns whose denotation is an outfit of the upper body, such as a jacket, blouse, and sweater. Therefore, when the classifier *-jian* occurs with nouns such as cup, which is a three-dimensional object, and bear, which is an animal, the sentence would be semantically anomalous.

Among a number of ‘sortal classifiers’, the current study selected the general classifier *-ge* as in (29) and two specific classifiers *-zhi* and *-jian* as in (31) and (32) respectively as the testing cases to explore how these classifiers may interact with children’s demonstrative comprehension. In the next two sections, I will first present the discussions on how adults use the semantics of classifiers in online processing and following that I will discuss children’s acquisition of classifiers, particularly on the classifiers selected as the focus of the current study.

4.2.2. Classifiers as a cue in adults sentence processing

As discussed in the previous section, there is a semantic dependency between a classifier and its associated noun. In recent neuro- and psycho-linguistic studies, the classifier-noun match is argued to be processed through genuine semantic computation. (e.g., C.-c. Hsu, Tsai, Yang, & Chen, 2014; Jiang & Zhou, 2012; Qian & Garnsey, 2014; S.-H. Tsai, 2009). For example, Tsai (2008) investigated Chinese-speakers’ lexical processing while recording their brain activity measuring the Event-related potential (ERP). In the study, participants were shown different word pairs, such as category-noun pair, and classifier-noun pair. In the category-noun pair, she

provided items that the target noun matched with the category label (e.g., dictionary-book pair as if the dictionary was the target noun, the matched category label was book) and target noun that mismatched with the category label (e.g., dictionary-animal pair as if the dictionary was the target noun, the mismatched category label was animal). In the classifier-noun pair, she used the items that the target noun matched with the classifier (e.g., *ben*-dictionary pair as the target noun is still the dictionary while the matched classifier was *-ben*) and the target noun mismatched with the classifier (e.g., *xi*-dictionary as if the target noun is dictionary, the mismatched classifier was *-xi* which classifies clothing). The results revealed that when compared with the match items, both classifier-noun mismatch and category-noun mismatch elicited N400 (i.e., a negativity around 400 millisecond which is argued to indicate the semantic incongruence), suggesting that the agreement between the classifier and the noun is semantically constrained. Several other studies, such as Jiang and Zhou (2012), Quin and Garsney (2014), and Tsai (2008), tested the classifier-noun agreement in sentential contexts using ERP. The results of these studies all elicited N400 while processing the mismatch between the classifier and the noun in the sentence, confirming that the classifier-noun agreement is semantically-based. Results from these studies may also suggest that when processing sentences with classifiers, the listener expects a noun to be semantically congruent with the classifier; thus, when they encountered a noun that did not match with the classifier, N400 was elicited.

Given these results suggested in the neurolinguistic studies, it is not surprising to see that the semantic dependency created between a classifier and its associated noun serve as a linguistic cue allowing one to predict the semantic feature of the following noun in adult psycholinguistic studies (e.g., C.-c. N. Hsu, 2006; Wu et al., 2009). Previous studies have revealed that when processing sentences containing classifiers, adult native speakers use the semantic information

from the classifiers to anticipate the semantic feature of the upcoming nouns (Chinese: C.-c. N. Hsu, 2006; Wu et al., 2009; Japanese: Yoshida, 2006). Most of the studies investigated adults' processing of relative clauses, as in (33a).

- (33) a. *yi ben [RC laoshi tuijian t_i de shu_i]*
 one CL_{volume} teacher recommend t_i DE book
 'A book that is recommended by the teacher.'

- b. *yi ben laoshi....*
 one CL_{volume} teacher....

The relative clause creates a temporal semantic clash of classifier-noun mismatch (Wu, Luo, & Zhou, 2014). For example, in (33), the classifier *-ben* co-occurs with nouns that denote "volume/book volume" (Chien et al., 2003, p.93) such as book. Thus, when the participant read upon *laoshi* 'teacher' as in (13b), the phrase is semantically incongruent since teacher was not the noun whose denotation is volume. However, when the participants continue reading the sentence, the entire sentence as in (33a) is revealed to be grammatical and semantically congruent as the classifier *-ben* is associated with the noun *shu* 'book' at the end of the phrase rather than the adjacent noun.

Several studies (C.-c. N. Hsu, 2006; Wu et al., 2009; Wu et al., 2014) tested Chinese speakers' reading of the sentences like (33), and showed a reading time slowdown when the classifier did not match with the noun. In particular, it was reported that when participants reached the first classifier *ben*, they anticipated a noun that denotes 'volume/book volume' such as *shu* 'book' to appear next. Thus, when they saw the following noun *laoshi* 'teacher' which does not match with the classifier *ben* in the sentence, a reading time slowdown was observed,

exhibiting a mismatch effect. Results from this line of research suggest that classifiers can be considered as a linguistic cue that provides the listener semantic information of the upcoming noun and thus allows the listener to anticipate the semantic category of the upcoming noun.

Other online sentence processing studies have also shown a similar anticipatory effect. Some visual-world eye-tracking studies have shown that the semantics of classifiers also led listeners to anticipatorily move their eyes onto the object that was the upcoming part of the auditory linguistic stimuli (Huettig, Chen, Bowerman, & Majid, 2010; Tsang & Chambers, 2011). For instance, in Huettig et al (2010), participants heard the spoken stimuli that contained classifiers (e.g., "Do you know if there is another name for one *ba* scissors", in which the classifier *-ba* classifies handheld objects/tools), while they were presented with four pictures, including a chair, a nose, a candle, and a framed painting. Critically, among the four pictures, only the chair can be associated with the classifier *-ba*. Huettig et al. have reported that when adult native speakers of Chinese heard the classifier which precedes the noun, they quickly looked at the picture of the chair that was consistent with the classifier before hearing the noun that referred to the visually presented object. The same effect was also found in Tsang and Chambers (2011) who tested Cantonese classifiers.

Taken together, the results from recent neurolinguistic and psycholinguistic studies with adult speakers suggest that the classifiers constitute semantic dependency with their associated nouns, and their semantics can be used as an anticipatory cue for the upcoming noun and even can be used as a cue to pick out the referent that matches with the semantic category the classifier. Given that the classifiers seem to be a useful cue in adults' sentence processing, classifiers may also be a useful cue for children when comprehending demonstratives, as the classifier is an obligatory component in the demonstrative phrase in Chinese. Thus, the current

study aims to explore the role of classifiers in children's comprehension of Chinese demonstratives. In what follows, I will discuss the studies on children's acquisition of classifiers.

4.2.3. Children's acquisition of classifiers in Mandarin Chinese

Children acquire the semantics of some basic classifiers in the early stages of their language development, demonstrating that they have the knowledge of the semantic relationship between the specific classifiers and the referent of the associated nouns (Chien et al., 2003; Erbaugh, 1986; Gong, 2010; Hu, 1993; H. Liu, 2008; I. Y. Tsai, 2008). Erbaugh (1986) conducted one of the first studies that examined Chinese-speaking children's use of classifiers. She conducted a longitudinal study recording the spontaneous speech from four two-year-old Chinese-speaking children. According to her corpus, children preferred to use the general classifier over specific classifiers; in fact, children rarely used specific classifiers before they were two and half years old. Yet, children's use of specific classifiers increased dramatically after two and a half years. She reported that children grasped the meaning of shape classifiers very early, such as classifier *-zhang* which classified a two-dimensional flat object such as 'a piece of paper.' In addition to the shape classifiers, children also produced specific classifiers such as *-zhi* for animals and *-jian* for outfits before age three. Overall, the results may indicate that children understand the semantics of the specific classifiers around age three.

Studies such as Erbaugh (1986) and Fang (1985) investigating children's acquisition of classifiers only focused on children's production of classifiers. Hu (1993) conducted one of the studies that examined both production and comprehension of specific classifiers by Chinese-speaking children aged three, four, five, and six using linguistic tasks. In the production task, children were asked to perform a counting task; in the task, each time children were asked a

question as in (34a), they were presented a picture which featured more than one of the same object.

- (34) a. *tupian li you duoshao X?*
 picture inside have many X
 ‘how many Xs were there in the picture.’

- b. *san ge (X)*
 three CL_{generic} (X)
 ‘Three (X).’

As can be seen in the example (34), the question in (34a) was formed without a classifier, but a classifier is required to answer the question in (34b) because Chinese classifiers are numeral classifiers and reporting the number of objects will elicit the use of the classifiers to the object. As in (34b), reporting the number of objects with or without the noun requires a classifier to co-occur with the numerals. In the comprehension task, children were presented five pictures, such as pictures of a dryer, a truck, a blouse, a pair of scissors, and a pen as the filler. Then, they were given an instruction that only has number and classifier such as ‘one-CLASSIFIER’ (e.g., *yi-jian* in which *-jian* is the classifier for outfit) without mentioning the noun. Children in the task were asked to select the picture that followed the classifier in order to complete the noun phrase given by the experimenter. Note that the same set of picture was used repeatedly for four classifiers and another set of five pictures was presented and tested with another four classifiers. The results from the production task revealed that the general classifier was the most productive

classifier as compared with other specific classifiers. This also indicates that children tend to overgeneralize the use of the general classifier, regardless of whether they are three or six years old. Note that in Hu's observation, although children did not always use the most appropriate specific classifiers and instead used general classifier to fill the position, they never produced a general classifier in an incorrect syntactic position, showing that they knew the syntactic structure of the nominal phrases. Based on this observation, Hu argued that children acquired the general classifier early because they learned from the syntactic distribution of general classifier and children's use of general classifier in the context where specific classifiers are required is simply fulfilling the syntactic structure; thus, the general classifier is a place-holder in that syntactic position to children. Among the production of specific classifiers, the classifier *-zhi* for animals was the most productive one across all the age groups. Other specific classifiers such as *-shuang* for paired objects (e.g., shoes), *-zhang* for two-dimensional flat objects (e.g., paper), *-jian* for outfits (e.g., blouse), and *-ba* for handheld tools (e.g., scissors) were also productively used by a great number of children. Regarding children's comprehension of the specific classifiers, children associated the classifier *-jian* with outfit most accurately following *-shuang* for paired objects, *-ba* for tools with handheld, and *-zhi* for animals. From the findings of the two tasks, Hu concluded that there is a gap between the comprehension and production in that while *-zhi* for animal was the most productive specific classifier, children's comprehension on *-jian* was much better than *-zhi*. However, the comprehension task used in Hu's study may cause problems for children. In her task, particularly in the set of pictures testing classifier *-zhi*, she included a picture of a cow, of an eagle, and of a horse. The intended correct answer was the picture of eagle; yet, both cow and horse could also be classified by *-zhi*. This may have resulted in a lower accuracy in the comprehension of *-zhi*.

Hu's finding is further supported by Chien, Lust and Chiang (2003) using a modified comprehension task. Hu's comprehension task has two potential confounding factors that may interact with children's performances. First, Hu used the same set of pictures to test children's knowledge of different classifiers. More specifically, within the same set of pictures, one picture was the target of one particular trial, but would be a filler in the other trial. Thus, in Chien et al. (2003), instead of providing the same set of pictures to test different classifiers, the researchers provided three different pictures each time, in which one of the pictures matched with the instruction while the other two were fillers. Second, Hu's instruction to elicit children's response was ungrammatical without context support. In Hu's instruction, the noun following the classifier was omitted for children to 'fill in the blank' by selecting one of the picture. Chien et al. (2003) modified the task by using stories in which the main character, Mickey Mouse, was described as a learner of Chinese. In this way, Mickey as a learner may say ungrammatical sentences or code-switch between English and Chinese. In Chien et al. (2003), Mickey used 'something' in English to replace the noun after the classifier such as (35a). Then, after describing what Mickey wanted, the experimenter provided the instruction such as (35b) to the child asking the child to pick out what Mickey wanted.

(35) a. *Milaoshu shou ta yao yi-tiao something* (Chien et al., 2003, p.102)

Mickey Mouse say he want one-CL something

'Mickey Mouse says he wants something.'

b. *gaosu laoshi Milaoshu yao yi-tiao shemo*

tell teacher Mickey Mouse want one-CL what

'Tell teacher what Mickey Mouse wants.'

If children know the meaning of the classifier *-tiao* which semantically requires a long and flexible object, such as rope, as the denotation of its associated noun, they would be able to pick out the correct items. Chien et al. (2003) found that children at age three were about 50% accurate on average in selecting a correct object that semantically matched the tested specific classifiers, while four-year-olds' accuracy increased to about 70% on average and six-year-olds were almost adult-like. Particularly, accuracies on the items testing *-jian* for outfits and *-zhi* for animals for the four-year-olds were 81% and 70% respectively, which slightly minimized the differences presented in Hu which reported *-jian* at 83% accuracy and *-zhi* at 67% accuracy.

Regardless of the discrepancies between production and comprehension of each specific classifier, the findings of previous studies suggest that children have knowledge of the semantic relationship between the classifier and the denotation of the noun. Particularly, children seem to acquire the two selected classifiers early on, that is they understand that *-jian* classifies outfits, thus they performed well in comprehension tasks, and understand that *-zhi* classifies animals, thus were able to use it most accurately. Assuming that children have the knowledge of the specific classifiers, especially the two selected classifiers for the current study, the question is raised if children are able to use the semantics of the classifiers as a semantic cue to help them resolve the referent of the demonstrative phrase in Chinese. The next section reviews children's use of semantic cues in language comprehension.

4.3. Children's use of semantic cues in language comprehension: can they utilize the semantics of the classifier in Chinese demonstrative to improve their comprehension?

Language comprehension is an incremental process. When comprehending sentences, listeners integrate information as the sentences unfold rather than waiting until the end of the sentence to interpret the sentence as a whole. Therefore, listeners use every single linguistic element in the sentence to help them successfully comprehend the sentence. Developmental psycholinguists have been interested in how children use linguistic elements, or linguistic cues, during sentence processing, such as phonological cues (e.g., Zhou, Su, Crain, Gao, & Zhan, 2012) (e.g., the use of intonation in Mandarin Chinese to resolve syntactic ambiguity), prosodic cues (e.g., Choi & Mazuka, 2003) (e.g., the use of prosodic cues such as tonal patterns in Korean, pauses, and VOT to resolve word-segmentation ambiguity and syntactic ambiguity), and semantic cues (e.g., Arnold et al., 2007) (e.g., the use of gender specification in English pronouns to resolve the referent for pronouns). The current chapter focuses on semantic cues of Chinese classifiers in language comprehension, and thus discusses studies investigating children's use of semantic cues when comprehending linguistic expressions in which children often have non-adult-like interpretation.

Many studies reported that children are able to use semantic cues to comprehend linguistic expressions. A number of studies have discussed whether children could use various semantic cues in resolving referents for pronouns, which are suggested to be ambiguous. For example, one study conducted by Pyykkönen, Matthews, and Järviö (2010) showed that children were able to use verb semantics, such as the verb transitivity, when identifying the antecedent of pronouns. In the study, children were presented with different levels of verb transitivity, which is defined as the likelihood of the agent- and patient-likeness, and exhibited

different behavior for verbs of higher and lower transitivity respectively. For example, the verb ‘hit’ has a higher transitivity level because in terms of thematic roles the subject of the verb is prototypically an agent and the object of the verb is prototypically a patient. In contrast, the verb ‘see’ has lower transitivity level because the subject is less likely to be an agent and the object is less likely to be a patient; in fact, for most of the lower transitivity verbs, the object tends not to be a patient. Pyykkönen et al. (2010) showed that children are sensitive to the level of verb transitivity to identify the antecedent of the ambiguous pronoun. In particular, for verbs with higher transitivity, children showed stronger preference toward the subject, that is, they looked at the subject more often in the visual stimuli. Pyykkönen et al. (2010) thus argues that children are able to pick up the verb semantics as a cue in pronoun resolution.

In addition to verb semantics, other studies examined whether children were able to use semantic-morphological cues to resolve the ambiguous pronouns. For instance, a series of studies by Arnold and her colleagues (Arnold et al., 2002; 2007) revealed that English-speaking children can use the gender specification in English such as *he* and *she* as a cue to resolve referents for pronouns. They presented pictures with two characters that had different genders. The results show that children were able to rapidly match the gender of the pronoun with the character right after they heard the pronoun rather than waiting until the end of the sentence. Dispaldro, Ruggiero, and Scali (2014) further extended this line of research examining children's use of grammatical gender and number information as a cue in resolving Italian pronouns. They have shown that Italian-speaking children were more successful at using number information in identifying the correct referent of pronouns when compared with the grammatical gender. Their claim is that the association between grammatical gender and referent is arbitrary in that it is independent of the biological gender, whereas the number information corresponds to the

conceptual level of quantity which is might be easier. Therefore, Italian-speaking children in their study did not use the gender information as successfully and as early as in Arnold et al. (2007), which focused on English gender specification in pronouns that describes the inherent property of the referent.

Studies discussed above suggest that children are able to use various semantic cues to identify the referent of referring expressions. In line with their argument, I hypothesize that the classifiers, in which their association with the referent was established based on conceptual categories such as animals and outfit, may also be a useful cue when children are comprehending demonstratives in Chinese. In section 4.2.2., I have already established that the classifier semantic is argued to be used in adults' processing (Hsu, 2006; Wu et al., 2009; Huettig, et al., 2010; Tsang & Chambers, 2011; Wu, Luo, & Zhou, 2014); this raises a question regarding whether children can also utilize the semantics of classifiers, particularly for demonstrative comprehension, the exact focus of the current dissertation. Moreover, as is discussed above, the semantic information of classifiers is similar to the gender specification in English and number marking in Italian. Each classifier was associated with a particular semantic category which was formed based on the shape, animacy, or function of a set of noun referents. Therefore, once children established the semantic dependency between the classifier and the noun referents, they should be able to use it as a semantic cue to identify the correct referent for pronominal demonstratives in Chinese.

4.4. The present study

Unlike English demonstratives that are monomorphemic, Chinese demonstratives co-occur with classifiers that may provide extra semantic information regarding the referents. The

semantic information provided by the classifiers is particularly informative when it comes to a *pronominal demonstrative phrase*, in which the noun is not pronounced. Take (36) for example.

(36) *wo xiangyao zhe zhi (mao)*

I want this CL_{animal} (cat)

‘I want this (cat).’

The demonstrative *zhe* picks out an object closer to the speaker and the classifier *zhi* picks out a kind of animal. Taking the two pieces of information together, one can infer that the pronominal demonstrative phrase *zhe-zhi* points to an animal (e.g., a cat) close to the speaker, even though a noun is not pronounced. When this sentence is uttered in the context where a pair of a coat and a cat are placed both near and apart from the speaker, the listener uses meaning of the demonstrative to limit the intended object to a coat and a cat near the speaker, and crucially s/he could use the classifier to further narrow down the referent to the cat near the speaker. This is a strategy that the listener can follow in Chinese, as given above, but not in English, in which demonstratives do not contain classifiers; an English pronominal demonstrative similar to (36) above (e.g., ‘*I want this.*’) could only express the speaker’s intended position, and it does not clearly express whether the coat or the cat in that position could be the speaker’s intended referent. Therefore, the semantics of the classifiers may potentially play a role in children’s demonstrative comprehension, particularly in the pronominal demonstratives phrase where the noun is not overtly pronounced. To this end, the current study focused on the pronominal demonstratives phrase in Chinese in order to examine whether and to what extent the classifier semantics could help children’s demonstrative comprehension.

Recall that children have difficulty comprehending demonstratives when the speaker has a different perspective and tend to exhibit egocentric demonstrative comprehension. Most of the previous studies focused on children's comprehension of *pronominal demonstrative phrases*, in which the noun was presented in the demonstrative phrase, such as 'I want this cat.' Children's comprehension of pronominal demonstrative phrases as in (36) above has been far less studied; to date, Zhao (2007) was the first study that investigated Chinese-speaking children's comprehension of pronominal demonstrative phrases. Zhao conducted a comprehension task, revealing that children exhibit the egocentric comprehension of pronominal demonstrative phrases when the speaker has a perspective different from children's own. However, Zhao did not control the context in the comprehension task to manipulate classifier semantics. In her study, only the general classifier *-ge* was used as the linguistic stimuli. Unlike specific classifiers that provide specific semantic categories of the upcoming noun, the general classifier *-ge* tested in Zhao's study does not necessarily provide useful semantic information as it broadly classifies general objects. Thus, the possible role of the semantics of classifiers in children's demonstrative comprehension was out of the scope in Zhao's study, and the question remains if the classifier semantics may interact with Chinese children's demonstrative comprehension. Since specific classifiers are suggested to anticipate the category of the following noun, the classifiers in Chinese demonstrative phrases may provide semantic information about the referent the demonstrative is depicting. As discussed in 4.2.3 and 4.3, children may be equipped with the semantic knowledge of some of the classifiers and their potential ability to grasp the semantic cues to resolve referent. Given the discussions in previous sections, the classifier semantics may be helpful to children when comprehending demonstrative phrases, particularly pronominal demonstrative phrases. Therefore, the first goal of the current study is to explore whether the

classifiers can function as a useful semantic cue that children can take advantage of when comprehending demonstrative phrases.

If children were able to use the semantics of the classifier when comprehending demonstrative phrases, another intriguing question is how effective the classifier semantics may be in children's demonstrative comprehension. A recent study suggested that children were able to take advantage of semantics cues in certain domains, and that the benefit children gained from the semantic cues may be robust enough to be generalized. For example, Jincho et al. (2008) have shown that children were able to use a cue to facilitate their comprehension of certain linguistic expressions. They tested children's comprehension of ambiguous sentences in Japanese. For instance, the sentence '*sanbanme-no inu-wa dore?*' ('Which is the third dog?') has two interpretations: (i) subset interpretation (e.g., among a set of cats and dogs, it is the third one among the dogs); (ii) local interpretation (e.g., a set of cats and dogs, it is the third one among all the animals that happens to be the dog). Children tend to exhibit the local interpretation; thus, the authors provided children a visual context that bias them toward the subset interpretation and examined whether children could shift from the local interpretation to the subset interpretation. Results show that many children were able to switch their interpretation from local to subset within the context when the contextual cue was available, and even when the contextual cue was no longer available, children were able to interpret the ambiguous sentence in an ambiguous context with subset interpretation. Interestingly, the authors reported that the extent to which each child may benefit from the carried-forward effect of the facilitative cues may be related to their development of EF, particularly mental flexibility. Thus, the present study also aimed to investigate the strength of the classifier cue and whether children's ability to carry over the effect of the cue to other contexts is related to their development of EF, particularly mental flexibility.

Taken together, the current study aims to explore how the semantics of classifiers impact Chinese-speaking children's comprehension of demonstratives. In particular, the current study has two goals: (i) to discover whether the semantics of the classifiers in a demonstrative phrase serve as a cue to help children comprehend demonstratives uttered by a speaker whose perspective is different from their own, and if the cue is helpful, (ii) to explore to what extent is the classifier semantics able to rescue children's adult like demonstrative comprehension.

To these ends, I created two types of experimental contexts in which pronominal demonstrative phrases are uttered while the classifier plays different roles in specifying the speaker's intended referent. In one context, the classifier semantics clearly suggests which of the specific entities the speaker intends to refer to, even without uttering a noun; this type of context is called *Classifier-Cue-Sufficient Context*. In another context, the classifier semantics does not allow the listener to identify a specific entity as what is being mentioned by the speaker; this type of context is called the *Classifier-Cue-Insufficient Context*. Figures 18 and 19 below are examples for these contexts, respectively.



Figure 18. Classifier-Cue-Sufficient Context

Figure 18 illustrates the Classifier-Cue-Sufficient Context. There is a t-shirt (outfit) and a bear (animal) in this context. The t-shirt is specified by the classifier *-jian* while the bear is specified by the classifier *-zhi*; thus, when speaker A said ‘*wo xiangyao zhe-zhi*’ (‘I want this-CL_{animal}’),

owing to the semantics of the classifier *-zhi* which specify the referent is a kind of animal, the listener could infer that the speaker referred to the bear, rather than the t-shirt, which is classified by another classifier *-jian*, solely based on the classifier semantics. As the semantics of classifier is robust in this way, children are expected to correctly pick out the referent, which is the bear that is located near the speaker, even if they *failed* to incorporate the speaker's perspective successfully and thus may have failed to correctly comprehend the demonstrative *zhe*. In this way, the classifier semantics may have helped children to pick out the correct referent and thus overcome their difficulty to incorporate the speaker's perspective that may lead them to pick out the wrong referent.

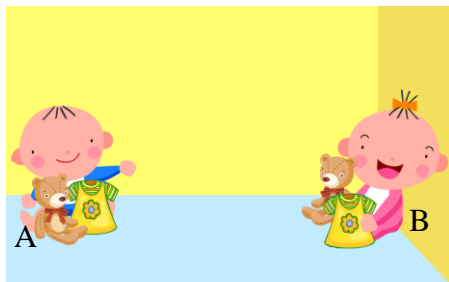


Figure 19. Classifier-Cue-Insufficient Context

Figure 19 is an example of the Classifier-Cue-Insufficient Context. Unlike Figure 18, Figure 19 has two objects, namely an animal (classified by *-zhi*) and an outfit (classified by *-jian*), in each of the distance domains from the speaker's position; that is, an animal-clothe pair is located at both near the speaker and apart from the speaker. Therefore, in a context such as Figure 19, if the speaker said '*wo xiangyao zhe-zhi*' ('I want this-CL_{animal}'), the semantics of classifier which specifies the category of the intended object would no longer be as informative as in the context shown in Figure 18. Notice that there are two animals in the discourse domain, one near the speaker and the other apart from the speaker. Thus, even though the listener could infer that the

speaker referred to an animal, by means of the classifier semantics, he/she still needed to correctly incorporate the speaker-object distance information expressed by the demonstrative in order to correctly identify which animal was being mentioned. In brief, in order for the listener to correctly interpret the demonstratives uttered by the *speaker*, he/she was required to incorporate not only the semantics of the classifier, but also the distance contrast of the demonstrative, which has been suggested to be challenging for children.

In the current study, I adopt the two contexts discussed above in the experiment and examine children's comprehension of demonstrative phrases uttered in those contexts. First, adopting the Classifier-Cue-Sufficient Context, the current study examines whether children are able to utilize the classifier semantics to infer the object being mentioned by the demonstratives uttered by the speaker with a perspective different from their own. In addition, by sequentially showing the Classifier-Cue-Sufficient Context (Figure 18) and then showing the Classifier-Cue-Insufficient Context (Figure 19), the presentation sequence allows me to examine whether children can benefit from the preceding exposure to the semantics of classifiers as in the Classifier-Cue-Sufficient Context (Figure 18). In this context children can take advantage of the classifier semantics to guide them correctly to comprehend demonstratives and may be carried forward to the subsequent context, (Figure 19), in which children are required to incorporate classifier semantics and demonstrative specification. In this way, the exposure to the Classifier-Cue-Sufficient Context as in Figure 18 will serve as 'training' for children.

The hypothesized mechanism of the training, which I call the *Implicit Training*, is described as follows. As the semantics of some classifiers such as the two of particular focus are suggested to be acquired early, children may be able to successfully identify the correct referent using classifiers when they are informative enough to associate the demonstrative

(accompanying the classifier) and the intended object, as in Figure 18. If children are able to successfully identify the correct referent based on the semantics of the classifier in the demonstrative phrase while hearing the demonstrative (*zhe-* or *-na*) uttered simultaneously by the speaker several times children may be able to *implicitly* learn the association between the demonstrative and the referent's location relative to the speaker. That is, *zhe* is associated with the object closer to the speaker while *na* is associated with the object apart from the speaker. The current study, examines children's comprehension of pronominal demonstratives uttered particularly in the aforementioned two contexts, the Classifier-Cue-Sufficient context and the Classifier-Cue-Insufficient context. The goal of the study is to understand whether, and to what extent, children's comprehension of pronominal demonstratives may benefit from the presence of a classifier, whose semantics could be informative enough to associate the demonstrative and the intended noun.

4.5. The experiment

In order to test children's use of the classifier cues in demonstrative comprehension, I administered the Act-out Task and the Judgment Training Task. Following Jincho et al. (2008), I also executed the Dimensional Change Card Sort (DCCS) (Zelazo, 2006) measuring children's development of Executive Function, which was exactly the same one used in the studies in Chapter 3. Additionally, a Classifier Comprehension task was conducted as a baseline task to ensure children's knowledge of selected classifiers; I also conducted a Classifier Production task, which was used as a picture norming task with adults and also was use to confirm adults' use of classifiers with those items in the pictures.

4.5.1. Participants

Fifty-four Chinese-speaking children aged 4-, 5-, and 6-years-old participated in the study (mean age = 5;4, age range = 4;1 - 6;3). A group of 25 native Chinese-speaking adults also took part in the study (mean age = 28;0, age range = 20;2-40;2). Child participants were recruited in Taipei and Chiayi, Taiwan. Adult participants were recruited in Taipei, Taiwan, except one adult participant was recruited in Chiayi, Taiwan.

4.5.2. Tasks

4.5.2.1. Classifier Tasks: baseline tasks for classifier knowledge

Two Classifier Tasks, including a Classifier Comprehension Task and a Classifier Production Task, were used as the baseline task to ensure children's knowledge of classifiers as well as adults' uses of classifiers. The Classifier Comprehension task was used to confirm that children know the meaning and its semantic dependency of the classifiers used in the current study. The Classifier Production Task was used to examine whether adult's use of classifiers for the objects used in the current study matched with the classifiers selected in the task.

The Classifier Comprehension Task (Chien et al., 2003; Hu, 1993; I. Y. Tsai, 2008) examined children's comprehension of the two classifiers, *-jian* and *-zhi*, that appeared in the demonstrative stimuli used in the main demonstrative comprehension tasks in the current study. The classifier *-jian* classifies outfits for the upper part of the body; for example, a t-shirt goes with the classifier *-jian*. The classifier *-zhi* classifies animals; for example, a cat goes with the classifier *-zhi*. Both *-jian* and *-zhi* belong to the specific classifier category and they are known to be acquired around age 4 (Chien et al., 2003; Hu, 1993). In the Classifier Comprehension Task,

children were given three different pictures, one target picture and two distractor pictures, in each trial and were asked to pick out the picture that completes the instruction such as (37).

(37) *wo xiangyao yi jian /zhi _____*

I want one CL_{outfit}/CL_{animal} _____

‘I want one _____’.

Note that the instruction as in (37) is not a complete sentence and thus ungrammatical in the given context. Children were asked to select an object which semantically matched the classifier and pick a picture that depicted that object to grammatically complete the sentence. In order for children to pick out the picture that makes the sentence grammatical as well as semantically congruent, they need to know the semantic categories the classifiers are associated with. As the instruction was not a complete sentence, the task was administered as a story in order to make the instruction felicitous in the task. In the story, the main character was a boy named Pipi, who was still learning Mandarin Chinese and therefore might produce sentences that were incomplete. In each trial, the boy put up three different pictures on a blackboard and asked the child to help him pick up the object he wanted. He was described as an absent-minded person who often forgot the name of the objects, and thus, omitted the noun in the sentence. Therefore, the child was asked to do his/her best to guess what the character wanted by listening to sentences such as (37), in which the noun was not produced. In order to correctly pick out the object the character wanted, children needed to have knowledge of the classifier semantics. In one trial, in which the target was the animal, the child was shown three pictures including a picture of a tree, a picture of a rabbit, and a picture of a cake, and listened to (38).

- (38) *wo xiangyao yi zhi* _____
 I want one CL_{animal} _____
 ‘I want one _____.’

Then, the child had to pick up the picture of the object whose semantic category matched the classifier’s semantic property. In this case the classifier *-zhi* denotes animals. Among the three pictures, only the rabbit is a kind of animal. Thus, the child was expected to select the picture of a rabbit as correct response; if the child selected other pictures, his/her response was coded as wrong. In each trial, the set of three pictures contained a correct object that match with the given classifier and two incorrect objects that did not match with the given classifier. There were six trials including three that tested *-zhi* and three that tested *-jian*. The objects that were used are listed in Table 20. The full list of the objects in each trial is presented in Appendix III.

Table 20. Target objects that go with the selected specific classifiers

Objects go with classifier <i>-zhi</i>	Objects go with classifier <i>-jian</i>
cat	sweater
monkey	jacket
bear	coat
rabbit	t-shirt

The Classifier Production Task (Hu, 1993; Kuo, 2003) was used to examine adults' use of classifiers regarding the objects selected for the current study. Chinese classifiers co-occur with numerals as well as demonstratives, as shown in (39a) and (39b).

(39) a. *san zhi mao*

three CL_{animal} cat

'Three cats.'

b. *zhe zhi mao*

this CL_{animal} cat

'This cat.'

Thus, in order to elicit adults' use of numeral classifiers, a counting task was used as the Classifier Production Task. In the task, participants were shown pictures of same objects with multiple numbers in a row and they were asked to write down the number of the objects in Chinese, which would require the use of classifier. For instance, in one trial, participants were shown pictures of three cats and read a question such as in (40a), and the participants' task was to write down the number of objects such as in (40b).

(40) a. Question: *you duoshao mao*

have many cat

‘How many cats are there?’

b. Expected Answer: *san zhi*

three CL_{animal}

‘Three (cats)’

Since counting in Chinese also requires classifiers, their answer was expected to provide their selection of the classifier they naturally use to count the object in the pictures. All eight objects used in the current study were tested and an additional eight objects that go with different specific classifiers were included as filler items; there were 16 trials in total (See Appendix IV for the full task).

4.5.2.2. The Act-out Task

The Act-out Task was used as the basis to see whether children had already established the distance contrast of pronominal demonstratives based on their own perspective. Since this task was used to test whether children knew the meaning of demonstrative words based on their own perspective, the general classifier *-ge*, was used in the linguistic stimuli in order to create the context in which the semantics of the classifier does not play any role in the listeners’ comprehension of demonstratives. The basic experimental setting is illustrated in Figure 20.

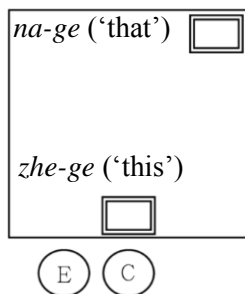


Figure 20. The experimental workspace for the Act-out Task

The basic set-up of the task was the same as the Act-out Task discussed in Chapter 3, except for the following two modifications made in the current version in order to accommodate the use of general classifier in the act-out instruction. First, instead of using two boxes, the current Act-out Task has two Lego blocks placed in the workspace for each trial. Second, the speaker of the act-out instruction was a puppet manipulated by the experimenter. The puppet, in the task, was building a house using the building blocks and he asked the child to help him pick up one Lego block each time. The act-out instruction uttered by the puppet is shown in (41).

- (41) *keyi qing ni ba zhe-/na- ge na gei wo ma*
 Can please you BA **this/that** CL_{generic} take for me Q
 ‘Can you pick *this/that* up for me?’

In the task, when children were asked to pick up *zhe-ge* (‘this (one)’), if they selected the block near themselves and the speaker, their response was coded as correct; but if they selected the block apart from themselves and the speaker, their response was coded as wrong. When children were asked to pick up *na-ge* (‘that (one)’), if they selected the block apart from themselves and the speaker, their response was coded as correct whereas if they selected the

block near themselves and the speaker, their response was coded as wrong. There were 6 trials in total, with three trials testing *zhe-ge* ('this (one)') and three testing *na-ge* ('that (one)'). The items were presented in a fixed order.

4.5.2.3. Judgment Training Task

The Judgment Training Task was used to examine whether, and to what extent, the semantics of classifiers could facilitate children's comprehension of pronominal demonstrative phrases based on a different perspective. In particular, the primary focus in this task is to investigate whether children are able to incorporate the semantic dependency of the classifier in the pronominal demonstrative phrase in Chinese, in order to utilize it as a semantic cue to correctly associate the object being pointed to by the speaker, whose perspective is different from children's own.

4.5.2.3.1. The Contexts used in the Judgment Training Task

Like the Judgment Task used in the study in Chapter 3, the Judgment Training Task was also presented as a series of picture stories with the demand-paint fulfillment story plot. A Great Wizard and a Student Wizard were the main characters. In the stories, the Great Wizard uttered demands with a demonstrative such as (42) and the Student Wizard tried to fulfill the demand. The Student Wizard sometimes successfully fulfilled the demand (Match items) while other times unsatisfactorily (Mismatch items). The child's task was to judge whether the Student Wizard's painting fulfillment matched the Great Wizard's demand. Since the Great Wizard in the story had a different perspective from the children, children's judgment of the painting

fulfillment reflected how children comprehended pronominal demonstratives based on a different perspective.

- (42) a. *ba zhe/na ge tu cheng lanse*
 BA **this/that** CL_{generic} paint as blue
- b. *ba zhe/na zhi /jian tu cheng lanse*
 BA **this/that** CL_{animal}/CL_{outfit} paint as blue
 ‘Paint *this/that* blue’

Note that in (42a) and (42b), the selection of the classifiers depends on the semantic category of the referent (which cannot be translated into English, as can be seen). Whereas the general classifier *-ge* as in (42a) does not specify the detailed category of the associated object, the classifiers appearing in (42b), *-zhi* and *-jian* each classify a specific semantic category of the noun referents. *-Zhi* requires an animal in the noun denotation, and *-jian* requires an outfit of the upper body in the noun denotation as in (42b). Given the characteristics of the classifiers, these specific classifiers in the demonstrative phrase may serve as a cue for listeners to infer what category of object the entire demonstrative phrase is pointing to.

Two contexts, the Classifier-Cue-Sufficient Context (e.g., Figure 18 in previous section) and the Classifier-Cue-Insufficient Context (e.g., Figure 19 in previous section), were adopted in the story discourse. Recall the design in Figure 18 presented previously, in the Classifier-Cue-Sufficient Context, both the semantics of the specific classifier as well as the demonstrative words can solely serve as a cue to specify what object is being referred to; this design is adopted in Figure 21a, which was presented in a demand-fulfilling story.



Figure 21. The visual stimuli in the Classifier-Cue-Sufficient Context

In this type of context, the classifiers itself may be sufficient enough to identify the referred object. Consider the context in Figure 21a and imagine that the Great Wizard (the old wizard) uttered the demand as in (43).

- (43) *ba zhe zhi tu cheng lanse*
 BA **this** CL_{animal} paint as blue
 ‘Paint this blue.’

Even though the noun is not overtly present, one can infer that the Great Wizard was pointing to the bear, based on the two pieces of information: (i) the demonstrative word *zhe* (‘this’), which picks out the object near the speaker; (ii) the classifier *-zhi* which classifies an animal, not an outfit. Importantly, even if children were egocentric when comprehending demonstratives, failing to correctly interpret *zhe* (‘this’) uttered by the Great Wizard (whose perspective was different from their own), the semantics of the classifiers may have helped them to make the correct inferences on the object the Great Wizard pointed to.

In this context, I manipulate the success/failure of the painting event by the Student Wizard in response to the Great Wizard's demand; this was set out as 'Match' and 'Mismatch'. For Match items, acceptances of the fulfillment of painting were expected as an adult-like response (e.g., Figure 21b with the demand in (43)). For Mismatch items, rejections of the fulfillment were expected (e.g., Figure 21c with the demand in (43)). Note that in terms of the position of the type of objects, half of the visual stimuli had an animal placed near the Great Wizard and an outfit placed apart from the Great Wizard while the other half of the visual stimuli placed the animal and the outfit in the reverse way.

Regarding the Classifier-Cue-Insufficient Context, which was presented in Figure 19 previously, the semantics of the specific classifiers is not informative enough to resolve the referent, as illustrated the Figure 22 here.

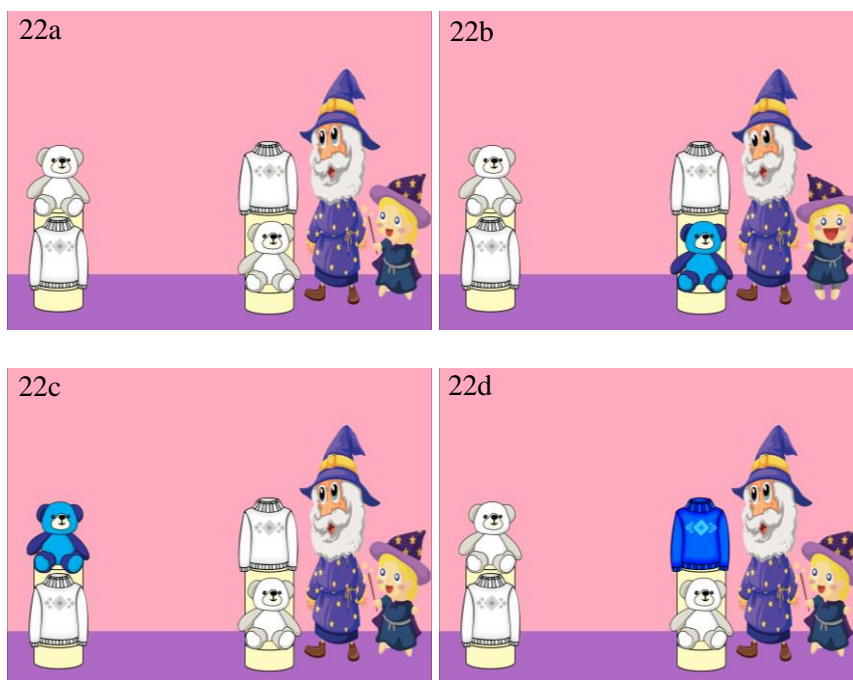


Figure 22. The visual stimuli of the Classifier-Cue-Insufficient Context

To identify the object being referred to, information from both the specific classifier and the demonstrative word were equally important. In such type of context, children thus need to consider both the classifier semantics and demonstrative meaning, in which they are required to incorporate the speaker's perspective. Consider the context in Figure 22a and imagine that the Great Wizard uttered the demand as in (43), which is repeated in (44).

- (44) *ba zhe zhi tu cheng lanse*
 BA **this** CL_{animal} paint as blue
 'Paint this blue.'

As presented in Figure 22a, there are two objects (i.e., the two bears) that semantically matched the classifier *-zhi*, and crucially, one is located near the Great Wizard and the other one is apart from the Great Wizard. Thus, in such a situation, children cannot solely rely on the semantics of the classifier to resolve the referent, because there are two objects in the whole context that match the classifier semantics; they need to compute which of the position the demonstrative word uttered by the speaker was designating. Therefore, in this case, children were expected to integrate both information from the demonstrative *zhe* ('this') which picks out the object near the speaker and the classifier *-zhi*, which classified animals to identify that the bear near the Great Wizard was the correct referent.

In this context, Match (see Figure 22b) and Mismatch items were manipulated in the following way. Regarding the Mismatch items, since both demonstrative meanings and classifier semantics are required to pick out the correct referent for demonstratives, I manipulated the Mismatch items in two ways. One type of Mismatch items was created based on the

incongruence of the demonstrative and its designated distance domain (see Figure 22c); thus, this type of item is called a Demonstrative Mismatch item. The other type of Mismatch items was the semantic mismatch between classifier and the category of the entity (see Figure 22d); thus, this type of items is called a Classifier Mismatch item. For example, in the Demonstrative Mismatch item such as Figure 22c, if the Student Wizard painted the bear apart from the Great Wizard, children were expected to reject the outcome since the position of the bear did not match with the demonstrative word in the demand, although the classifier *-zhi* classified animals. In the Classifier Mismatch item such as Figure 22d, if the Student Wizard painted the sweater near the Great Wizard, children were also expected to reject the outcome since the sweater was an outfit, which does not match with the classifier *-zhi* in the demand, although the demonstrative picked out the object near the speaker.

4.5.2.3.2. The Block Design adopted in the Task

These two contexts, the Classifier-Cue-Sufficient Context and the Classifier-Cue-Insufficient Context, were presented in a sequential order in order to examine children's use of the classifier semantics during demonstrative comprehension and whether the classifier semantics cue could be expanded to other contexts. I adopted the block design from Snedeker and Yuan (2008) and Jincho et al. (2008), setting up the following three blocks: Block 1, the *Pre-training Block*, where the Classifier-Cue-Insufficient Context (Figure 22) was presented; Block 2, the *Training Block*, where the Classifier-Cue-Sufficient Context (Figure 21) was presented; Block 3, the *Post-training Block*, where the Classifier-Cue-Insufficient Context was again presented.

To examine the first research question, whether children could use classifier cues to improve their demonstrative comprehension, I further adopted a between-subject design which includes an Experiment Group and Control Group. The difference between the two groups is in the context provided in the Block 2: Training Block. The Experiment Group was presented with the Classifier-Cue-Sufficient Context in the Training Block, as was described above. Regarding the context for the Control Group, I created a Control Context as shown in Figure 23.



Figure 23. The visual stimuli of the Control Context

The Control Context was presented together with the sentence such as (42a), which is repeated in (45).

(45) *ba zhe ge tu cheng lanse*

BA **this** CL_{generic} paint as blue

‘Paint this blue.’

Note that sentence (45) contains the general classifier *-ge* which is suggested not to provide any specific semantic information of the associated noun. Additionally, both objects used in the Control Context are always classified by the general classifier *-ge*. Thus, children cannot use the

classifier as a semantic cue to infer the referent of the demonstrative phrase; instead they need to use the information from demonstratives, incorporating the speaker's perspectives. In this context, I also created Match items (e.g., Figure 23b) in which the fulfillment matched the demonstratives in the demand and Mismatch items (e.g., Figure 23c) in which the fulfillment did not match the demonstratives in the demand. Children were expected to accept Match items as an adult-like response while they were expected to reject Mismatch items. Let me now turn back to the between-subject design between the Experiment Group and Control Group.

As discussed earlier, the Experiment Group was presented with the Classifier-Cue-Sufficient Context, in which children may be able to use the classifier semantics as a cue to identify the correct referent, whereas the Control Group was presented with the Control Context, in which children need to rely on their knowledge of demonstratives and incorporate the speaker's perspective in order to correctly pick out the referent. In brief, the crucial difference between the Experimental Group and the Control Group is in the Training Block, in which the classifier semantics as a sufficient cue is presented in Experimental Group, but not in the Control Group. Given this difference between the two groups, comparing children's performances between these two Groups in the Training Block allowed me to see whether children who were given the classifier cue could have a better performance than children who did not have the cue.

If children were able to use the classifier cues when comprehending demonstratives as shown in the Training Block, the second research question investigates to what extent the classifier cues may have an effect on children's demonstratives. In particular, I would like to know whether children could carry over the classifier effect from one context to another. Thus, the focus is on whether the exposure to the classifier cue in the Classifier-Cue-Sufficient Context could help children to perform better in the Classifier-Cue-Insufficient Context. As discussed

above, the Training Block provided the Classifier-Cue-Sufficient Context in the Experiment Group. Within that type of context, children may have been using classifier cues to identify the referent. While they were using the classifier cues to pick out the referent, they heard the different demonstrative words throughout the block and may have ‘*implicitly*’ learned that the correct referent picked out by the classifier does not always appear on the same location. Then, children may have learned the association between demonstrative words and the location of the referent relative to the speaker. Therefore, the exposure to the Classifier-Cue-Sufficient Context in the Experiment Group serves as the *Implicit Training*. In contrast to the Experiment Group, children in the Control Group were shown the Control Context where the classifier cues were not available. Therefore, they received no classifier cue training. In order to examine whether the effect of the cue is carried forward to a different context, I compared children’s performances before and after the exposure to the cue to determine whether there was any improvement after the exposure. Recall that Pre-training Block and Post-training Block both provided the Classifier-Cue-Insufficient Context, in which children need to identify the correct referent for demonstratives by incorporating both (i) the speaker’s perspective, and (ii) the classifier semantics. If children in the Experiment Group showed improvement from Pre-training Block to the Post-training Block, it may be a piece of evidence that children learned the association between the position of the object and demonstratives via the Training Block (the Classifier-Cue-Sufficient Context); in other words, they may have been able to associate *this*-phrase with the object whose position is near the speaker and associate *that*-phrase with the object whose position is distant from the speaker. However, if children showed any improvement from the Pre-training Block to Post-training Block in the Control Group, children’s improvement in either Experimental Group or the Control Group may have been related to the practicing effect. Given

that the Control Context did not provide any classifier cues, children who were exposed to this type of context in the Training Block would not be trained to associate the location of the object with the demonstrative phrase. Thus, improvements shown in the Control Group would be due to the practice effect.

4.5.2.3.3. The Design: Summary

The following two figures present a summary of what context each condition used in each block. Figure 24 demonstrates the contexts used in each block in the Experimental Condition and Figure 25 shows the contexts in the Control Condition.

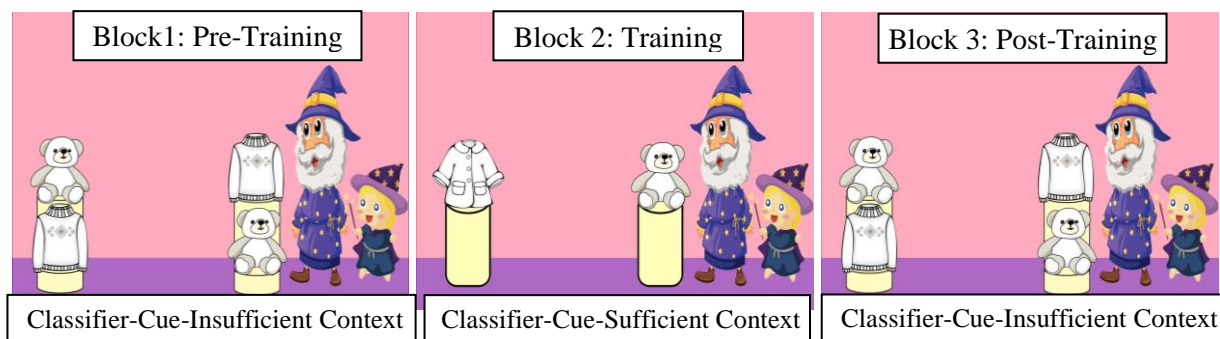


Figure 24. The design of the Experimental Group in the Judgment Training Task

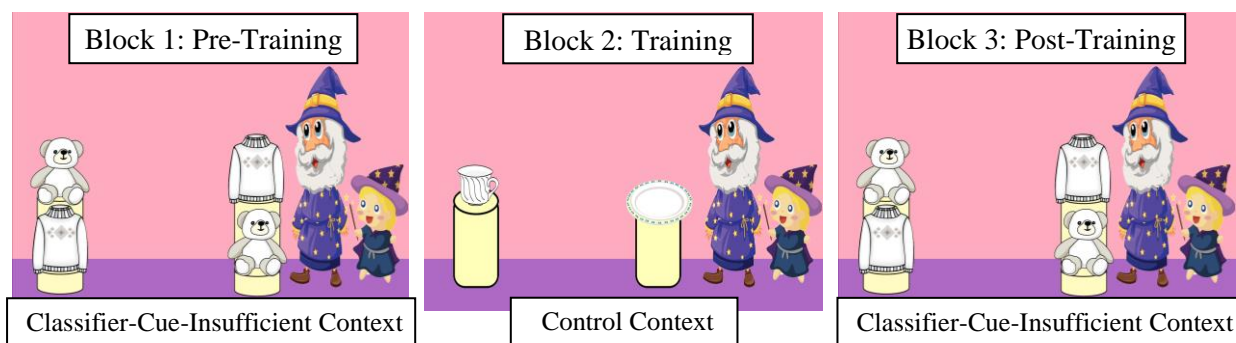


Figure 25. The design of the Control Group in the Judgment Training Task

Each Block had eight items, totaling 24 items presented per participant. In the Pre-training and Post-training Blocks, in which the Classifier-Cue-Insufficient Context was presented, the two specific classifiers each appear four times in each block. Each block has four Match items and four Mismatch items, which include two ‘Classifier Mismatch items’ and two ‘Demonstrative Mismatch items.’ The positions of the objects were counterbalanced throughout the items; that is, in one trial, the animal object near the speaker was on the top shelf while the animal object was on the bottom shelf apart from the speaker; in another trial, the animal object near the speaker was in the bottom shelf while the animal object was on the top shelf apart from the speaker. In the Training Block of the Experiment Group, in which the Classifier-Cue-Sufficient Context was presented, each specific classifier also appeared four times. In this block, there were four Match items and four Mismatch items. The positions of the objects were also counterbalanced through the items as discussed previously. In the Training Block of the Control Group, in which the Control Context was presented, only the general classifier *-ge* was used. Four Match items and four Mismatch items were created. Note that for all Match and Mismatch items, if children rejected the outcome, the experimenter asked a subsequent question to the child to elicit the reasons as to why they made such a judgment.

Two order lists were created to counterbalance the presentation order of the two specific classifiers in the Classifier-Cue-Insufficient Context which was presented in the Pre-training and Post-training Blocks. Block A starts with the classifier *-zhi* while Block B starts with the classifier *-jian* (See full items in Appendix V). As I manipulated the presentation order in the Pre-training and Post-training Blocks to control the Classifier-Cue-Insufficient Context, creating Block A and Block B, two order lists, namely List 1 and List 2, were created within each Group. In List 1, Pre-training Block started with Block A while Post-training Block had Block B. In List

2, Pre-training Block started with Block B while Post-training Block had Block A. Thus, in total, there were four lists, including Experimental List 1, Experimental List 2, Control List 1, and Control List 2.

In addition to the 24 testing items, two additional practice items were also included in order to elicit ‘correct’ and ‘wrong’ responses in the task. One practice item was designed to elicit children’s ‘correct’ responses. In the item, the demand matched with the fulfilment (e.g., if the demand was ‘paint a triangle blue’, the Student Wizard painted a triangle blue). The other practice item was designed to elicit children’s ‘wrong’ response. In the item, the demand mismatched the fulfilment (e.g., if the demand was ‘paint a triangle blue’, the Student Wizard painted a circle blue). Note that the demands in the practice items did not contain both demonstratives and classifiers. Additionally, children were given feedback for the practice items, but no feedback on the testing items.

4.5.2.4. DCCS

All the children participated in the DCCS. The DCCS was administered in exactly the same way as the studies discussed in Chapter 3.

4.5.3. Procedure

Children participated in the tasks with the following order: they took the Act-out Task first, the Judgment Training Task second, following the Classifier Comprehension task and the DCCS. Adult control groups took parts in the Act-out Task, and the Judgment Training Task and following the Classifier Production task and the Classifier Comprehension task. In the Judgment Training Task, both children and adults were pre-assigned to either the Control Condition (List 1:

N = 11, mean age = 5;6, age range = 4;7-6;3; List 2: N = 10, mean age = 5;4, age range = 4;2-6;2) or Experimental Condition (List 1: N = 10, mean age = 5;6, age range = 4;7-6;1; List 2: N = 11, mean age = 5;4, age range = 4;1-6;1). Child participants were invited individually to a quiet classroom in their preschools, with the exception of one child who participated in a room at his home. All adult participants were invited to a conference room individually.

4.5.4. Results

4.5.4.1. Results of the classifier tasks

Recall that there were two classifier tasks administered to examine children's knowledge of the selected classifiers and adults' uses of the selected classifiers. In this section, the results on the Classifier Comprehension Task will be reported first following the results on the Classifier Production Task which was only used with adult participants.

The Classifier Comprehension Task was used to ensure children have the knowledge of the classifiers used in the Judgment Training Task. Table 21 shows the mean percentages of the correct comprehension of classifiers, as measured by the correct selection of the picture that matched with the classifier in the instruction.

Table 21. The mean percentages of correct responses in Classifier Comprehension Task (% (*SD*))

	Items of <i>-zhi</i>	Items of <i>-jian</i>
Children (N = 54)	99.07 (4.77)	98.61 (7.55)
Adults (N = 25)	100.00 (0.00)	99.00 (5.00)

As shown in the table, adults' performance is almost at ceiling, indicating that the pictures selected matched with the uses for both classifiers *-jian* and *-zhi*. Regarding children's performances, their performances were near ceiling. Children's almost-adult-like responses were expected. Both Hu (1993) and Chien et al. (2003) reported that children grasp the meaning of classifier *-zhi* and *-jian* before age four. The goal of this task is to use as a baseline ensuring children's knowledge of classifiers; thus, I categorized children into 'Classifier passers' who showed the understanding of the semantics of the selected classifiers and 'Classifier failers' who seemed not to understand the semantics of the selected classifiers. Children were categorized as 'Classifier passers' if they returned correct responses on three out of four items for *-zhi* as well as for *-jian*; otherwise, they were categorized as 'Classifier failers.' Among the 54 children, only one child was categorized as 'Classifier failers' because the child returned three correct responses on items of *-zhi*, but only returned two correct responses on items of *-jian*. Note that all other 'Classifier passers' were 100% accurate on both *-zhi* and *-jian*, except two children who wrongly selected the object in one item. From the categorical analysis, one child was excluded from the following analysis; thus, only the 53 'Classifier passers' who demonstrated adult-like knowledge of the classifiers will be reported in the remaining results section.

Let me now turn to the results of the Classifier Production Task. The Classifier Production task was used to examine whether adults' uses of classifiers to describe the selected objects matched with the selected classifiers. Overall, the mean correct percentage for items of *-zhi* is 97% while the mean correct percentage for items of *-jian* is 100%. It is worth to note that only three adults put the general classifier *-ge* in the very first item testing on *-zhi* and thus were coded as incorrect, but from the second item on *-zhi* they correctly put *-zhi* as the classifier.

Regarding the filler items, the mean correct percentage is 92%. It is not surprising to see the mean accuracy on the filler items was not 100%. Some adults used the general classifier for too many objects. For example, ‘table’ is suggested to be categorized by the classifier *-zhang*, but some adult used the general classifier to classify it. Some other cases may be related to the influence of Taiwanese. For example, ‘ship’ is suggested to be categorized by the classifier *-sou*, but some adult used *-tiao* to describe it. In Taiwanese, ‘ship’ is classified by *-tiau* which is translated as *-tiao* in Mandarin Chinese. Thus, for some speakers, they may use the classifiers interchangeably between the two languages. Regardless of the some overgeneralization of the use of general classifier and the influence of Taiwanese on the filler items, adults’ uses of the classifiers on the target pictures were consistent with the selected classifiers.

4.5.4.2. Results of the Act-out Task

The Act-out Task was used to examine whether children understand the distance contrast between the two pronominal demonstrative phrases, *zhe-ge* (this-CL_{gen} ‘this’) and *na-ge* (that-CL_{gen} ‘that’), based on their own perspective. In the task, if the act-out instruction was ‘pick up *zhe-ge* (this-CL_{gen} ‘this’)’ and the child selected the block near himself/herself and the speaker, the response was coded as correct; if the act-out instruction was ‘pick up *na-ge* (that-CL_{gen} ‘that’)’ and the child selected the block apart from himself/herself and the speaker, the response was coded as wrong. The mean percentages of participants’ correct responses were first calculated. The results are summarized in Table 22.

Table 22. The mean percentages of correct responses in the Act-out Task (% (*SD*))

	Items of <i>zhe-ge</i> (this-CL _{gen} 'this')	Items of <i>na-ge</i> (that-CL _{gen} 'that')
Children (N = 53)	93.87 (17.15)	77.16 (37.66)
Adults (N = 25)	100.00 (0.00)	97.33 (9.23)

Overall, adults' performance was near ceiling. Adults' results established the ground that adults are able to contrastively comprehend *zhe-ge* and *na-ge* in the context of the Act-out Task. That is, *zhe-ge* refers to the block near the child and the speaker while *na-ge* refers to the block apart from them. Children's overall performance replicates the finding in previous literature (Clark & Sengul, 1978; Tanz, 1980; Webb & Abrahamson, 1976; Zhao, 2007), showing an asymmetrical performance between *zhe-ge* and *na-ge*. Table 22 illustrates that children have more difficulty in the interpretation of *na-ge* while they achieved almost-adult-like performance for the interpretation for *zhe-ge*.

As the purpose of the Act-out Task was to ensure children's knowledge of distance contrast between the two demonstratives based on their own perspective so I could further analyze their performances in the Judgment Training Task, a categorical analysis was conducted. I categorized children as 'Act-out passers' and 'Act-out failers' based on their performances. Children who returned correct responses on two out of three items on *zhe-ge* and two out of three items on *na-ge* were categorized as 'Act-out passers'; otherwise, they were categorized as 'Act-out failers.' Based on the criteria, 42 children were categorized as 'Act-out passers' and 11 children were categorized as 'Act-out failers'. Among the 11 'Act-out failers', 9 children consistently selected the block near themselves throughout the task. One child exhibited random choice and another child selected the block apart from him/her consistently throughout the task.

The successful performances of the ‘Act-out passers’ indicates that these children understand the distance contrast between *zhe-ge* and *na-ge* based on their own perspectives.

In the following analysis, only data from 42 children who were categorized as ‘Classifier passers’ as well as ‘Act-out passers’ are reported. These 42 children were considered as having the knowledge of semantics of the selected classifiers and were also considered as understanding the distance contrast between the two demonstratives based on their own perspective.

4.5.4.3. Results of the Judgment Training Task

The Judgment Training Task was used to examine whether children can use the semantics of the classifiers as a cue to facilitate their comprehension of pronominal demonstrative phrases. The data from adults were examined first. The mean percentages of adults’ correct responses in each block within each Group were calculated and presented in Table 23.

Table 23. Descriptive results in the Judgment Training Task by adult controls

		<i>N</i>	<i>M</i>	<i>SD</i>
Pre-training Block	Experimental Group	11	93.94	13.48
	Control Group	12	100.00	0.00
Training Block	Experimental Group	11	97.73	7.54
	Control Group	12	100.00	0.00
Post-training Block	Experimental Group	11	90.15	14.35
	Control Group	12	100.00	0.00

Note. Control Group (N = 12); Experimental Group (N = 11).

As shown in the table, adults' performances were at ceiling, suggesting that the context used in the task was indeed testing the distance contrast between *zhe-ge* ('this') and *na-ge* ('that') based on a perspective different from one's own.

Table 24. Descriptive results in the Judgment Training Task by children

		<i>M</i>	<i>SD</i>
Pre-training Block	Control Group	80.95	16.90
	Experimental Group	75.00	18.45
Training Block	Control Group	77.38	21.87
	Experimental Group	98.24	5.93
Post-training Block	Control Group	78.17	18.54
	Experimental Group	81.75	17.60

Note. Control Group (N = 21); Experimental Group (N = 21).

The mean percentages of the correct responses from the two groups of children in three blocks are presented in Table 24¹⁰. As can be seen, children in the Experimental Condition seem to have performed differently across the three blocks. Particularly, there is a huge improvement from the Pre-training Block to the Training Block followed by a performance drop from the Training Block to the Post-training Block; however, their performance in the Post-training Block did not drop below that of the Pre-training Block. On the contrary, children's performances in

¹⁰ Children in the two counterbalanced lists did not performed significantly differ (Control Group: Pre-training Block ($t(19) = 1.597, p > .05$), Training Block ($t(19) = .716, p > .05$), and Post-training Block ($t(19) = .542, p > .05$); Experimental Group: Training Block ($t(19) = 1.390, p > .05$), Post-training Block ($t(19) = .800, p > .05$)), except in the Pre-training Block in the Experimental Group ($t(19) = 3.426, p < .05$). Although children in List 1 were slightly older than those in List 2, the differences were not significant in both Control Condition ($t(19) = .581, p > .05$) and Experimental Condition ($t(19) = .621, p > .05$).

the Control Condition did not change over the blocks; they remained at around 80% in terms of the mean accuracy. In order to examine whether children's performance was related to the condition they received, a 2 (Condition: Experimental vs. Control) X 3 (Blocks: Pre-training Block, Training Block, Post-training Block) mixed ANOVA was conducted, using the mean of percentages of the correct responses as the dependent variable. The summary of the 2 x 3 ANOVA is shown in Table 25.

Table 25. Results on the 2 by 3 Mixed ANOVA

	<i>df</i>	<i>F</i>	<i>p</i>
Blocks	2	7.556	.001
Blocks * Conditions	2	12.904	.000
Error(Blocks)	80		

As shown in Table 25, a main effect on the Blocks was observed ($F(2, 80) = 7.556, p < .01$). Crucially, there is significant interaction between Blocks and Conditions ($F(2, 80) = 12.904, p < .01$), suggesting that the pattern shown in the Experimental Condition differs from the Control Condition across the three blocks. In particular, children in the Experimental Condition outperformed children in the Control Condition in the Training Block ($t(40) = 4.217, p < .05$), indicating that children in the Experimental Condition benefitted from the classifier cue provided in the Training Block. Recall that the critical difference between the Experimental Condition and Control Condition in the Training Block is that in the Experimental Condition the classifier cue was provided as the classifiers were sufficient enough to resolve the referent whereas in the Control Condition the general classifier was used in the linguistic stimuli and thus

children could only rely on the meaning of the demonstratives to identify the referent. Recall that the first goal of the current study is to examine whether children can take advantage of the classifier semantics to improve their comprehension of demonstratives when the classifier cue is available in the context. The significant differences between the two groups of children in the Training Block shown in the results suggest that children are able to incorporate the classifier cues when comprehending demonstratives and the semantics of the classifiers indeed facilitate children's demonstrative comprehension when the cue is present.

The second goal of the current study is whether the effect of classifier semantics in the Classifier-Cue-Sufficient Context could be carried forward to a different context, the Classifier-Cue-Insufficient Context, in which the classifier semantics and demonstratives are both required to pick out the correct referent. In order to explore the second goal, I examined whether children in the Experimental Condition improved after the exposure to the Training Block by conducting two paired t-tests, comparing the mean percentages of correct responses in the Pre-training Block and Post-training Block within the Experimental Condition and Control Condition respectively. The results of the paired t-tests reveal that the mean percentages of the correct responses in the Pre-training Block marginally differ from those in the Post-training Block for children in the Experiment Condition ($t(40) = -1.718, p = .051$) whereas the performances in the two blocks did not show significant differences for children in the Control Condition ($t(40) = .725, p > .05$). The results indicate that children who received the training with classifier cues showed a tendency of improvement from Pre-training Block to Post-training Block while children who were not exposed to the classifier cues did not improve. These findings suggest that the second goal of the current study is marginally supported with the results as there is a tendency showing

that children may benefit from the effect of classifier semantics in the Classifier-Cue-Sufficient Context and carry over the effect to a different context, the Classifier-Cue-Insufficient Context.

4.5.4.4. Results of the Executive Function Task: the DCCS

Children's performances¹¹ in DCCS were analyzed based on Zelazo's (2006) criteria. Children's correct card sorting in the Pre-switch Phase was first examined. Children who returned five of six correct card sorting responses in the Pre-switch Phase were considered as having passed the Pre-switch Phase; all children in the present study correctly sorted the cards 6 of 6 times. Children who passed the Pre-switch Phase were further categorized as 'EF passers' and 'EF failers' on the basis of their performances in the Post-switch Phase. Children were categorized as 'EF passers' if they returned correct card sorting 5 of 6 times in the Post-switch Phase; otherwise, they were categorized as 'EF failers'. Thirty-seven children were categorized as 'EF passers' and five children were categorized as 'EF failers.' The results by age group are summarized in Table 26.

¹¹ Recall that two sets of materials were used to control the sorting rules. In one set of the material (List 1), the Pre-switch Phase started with the color-sorting rule and switch to the shape-sorting rule in the Post-switch Phase; in the other set of material (List 2), the sorting rules were in the reverse order in that Pre-switch Phase started with the shape-sorting rule while Post-switch Phase had the color-sorting rule. Children were pre-assigned to each list (List 1: 24 children; List 2: 18 children). Result of an independent t-test revealed that children's performances between the two lists did not significantly differ from each other in terms of the correct sorting in the Post-switch Phase ($t = .610$, $p > .05$), suggesting that the order of the sorting dimensions does not affect children's sorting performance.

Table 26. The ratio of passers and failers in Executive Function task (numbers of children/total number of children)

	EF Passers	EF Failers
4yr	81.82% (9/11)	18.19% (2/11)
5yr	94.44% (17/18)	5.56% (1/18)
6yr	84.62% (11/13)	15.38% (2/13)

The age group results are consistent with Zelazo et al. (1996) in which nearly 90% of the four-year-old children passed the task. Interestingly, the pass/fail pattern in DCCS observed in the current study, which is consistent with Zelazo et al.'s findings, was not consistent with the results from another group of Chinese-speaking children who participated in the study discussed in Chapter 3 of the current dissertation. One possible explanation may be the geographic differences because about half of the children in the current experiment were recruited in another preschool and they were from Taipei instead of Chiayi, in the southern part of Taiwan. The geographic differences may affect their better performances, as the languages spoken in these two areas differ slightly and the socioeconomics also differ slightly. However, it is still not clear why there is such a difference between the two groups of Chinese-speaking children. The unknown factor of high passing rate in DCCS thus may not allow me to do further analysis regarding whether children's better performance in the Judgment Training Task is related to their performances in the DCCS¹². Recall that the DCCS used in the current experiment was the

¹² Despite the high passing rate in DCCS, it is still interesting to take a look at the cross-task analysis. I first categorized children into two groups based on whether they showed improvement from Pre-training Block to Post-training Block. I subtracted children's mean percentage of accuracy in the Post-training Block with their mean

standard version, which is suggested to be easier. Future study may extend to the advanced version of DCCS in order to seek a potential reason for which some children benefitted from the Training Block while others did not.

4.5.5. Summary of the results

The overarching goal of the current study is to explore the role of classifier cue in children's demonstrative comprehension. I examined whether and to what extent children's demonstrative comprehension could be facilitated by the semantics of the classifiers. Overall, results of the current study have shown that children can use their knowledge of classifiers-referent dependency as a cue to facilitate their demonstrative comprehension when the demonstratives are uttered by a speaker who has a different perspective. As shown in the results of the Judgment Training Task, children in the Experiment Group outperformed those in the Control Group in the Training Block, suggesting that the classifier cue presented to the

percentage of accuracy in the Pre-training Block. Children were categorized as 'improved' if the subtraction is above zero. Children were categorized as 'no improvement' if the subtraction equals zero or minus zero. Then, I further divided children into EF passers and EF failers within the 'improved' group of children as well as 'no improvement' group of children. The summary of the results were shown in the following Table.

Table 1. The number of EF passers and EF failers showing improvement or not in the Judgment Training Task

	EF Passers	EF Failers
Improved	9	3
No improvement	28	2

As can be seen from the Table, the number of the EF failers was low; thus, no explicit pattern can be drawn from the results.

Experiment Group helped children to pick out the correct referent of demonstratives. Moreover, within the Experiment Group, there was a tendency for children's performances to improve from the Pre-training Block to the Post-training Block; this result indicates that the exposure to the classifier cue in the Training Block may further help children's demonstrative comprehension. That is to say, the semantic effect of the classifiers in the Classifier-Cue-Sufficient Context may be carried over to a different context, the Classifier-Cue-Insufficient Context, where children need to incorporate the semantics of classifiers and demonstrative meanings together in order to correctly pick out the referent. However, it was also not clear whether children's ability to carry over the effect of the classifier cue was related to their Executive Function, since I was unable to perform further analysis on the interaction between DCCS and the Judgment Training Task.

4.6. General discussions

In this section, I will discuss (i) the nature of the training effect, (ii) the role of classifiers in demonstrative comprehension, (iii) understanding children's processing of semantics and pragmatics, and (iv) the role that Executive Function may play in Chinese demonstrative phrases.

4.6.1. The nature of training effect

The Judgment Training Task explored whether children could benefit from the classifier semantics that can help them gain their knowledge of demonstratives. I particularly assessed the type of the training which I call Implicit Learning. Children were expected to use the semantics of classifiers to successfully identify the correct referent of the demonstrative phrase in the Classifier-Cue-Sufficient Context; during the presentation of this particular context, children may implicitly learn the association of each demonstrative with the position of the object relative

to the speaker. According to the results in the Judgment Training Task, children seem to benefit from the training, in that the classifier semantics helped them to have a slightly better demonstrative comprehension in the context, where the classifier cue was no longer sufficient to pick out the correct referent, immediately following their exposure to the Classifier-Cue-Sufficient Context. Children in the Experiment Group, presented with the Classifier-Cue-Sufficient Context during the Training Block, showed a tendency to improve from Pre-training Block to Post-training Block, in which they saw the Classifier-Cue-Insufficient Context in both blocks. On the other hand, children in the Control Group, who were exposed to the Control Context, in which the classifier semantics plays no role, did not show such improvement over those two Blocks. It is worthwhile to note that children who were in the Experiment Group exhibited almost-adult-like performance during the Training Block, suggesting that the classifier semantics facilitate children's comprehension and thus the improvement shown in the Post-training Block is likely to be a carry-over effect of the classifier cue. In fact, all children in the Experimental Condition were 100% accurate in the Training Block, except two children with 88% and 75% accuracy. This indicates that all children in the Experiment Group were able to use the classifier semantics to pick out the correct referent in the Classifier-Cue-Sufficient Context within the Training Block.

The results discussed above show that children may be able to take advantage of the Implicit Training on the classifier semantics. An additional qualitative analysis on children's individual responses within the Experiment Group was conducted in order to further examine how the Implicit Training of the classifier semantics may have worked. I categorized children into groups based on the training effect, measured by the subtraction of the mean percentages of correct responses in the Post-training Block from those in the Pre-training Block for each child.

Four subgroups were identified for children within the Experiment Group, which is summarized in Table 27.

Table 27. Children's individual response patterns in Judgment Training Task

Pattern	Group
Pre-training Block < Post-training Block	'Classifier-cue-advantage' (N = 7)
Pre-training Block = Post-training Block	'Classifier-cue advantage-local' (N = 6)
Pre-training Block > Post-training Block	'Classifier-cue-disadvantage' (N = 3)
Pre-training Block = Post-training Block = 100%	'Adult-like' (N = 5)

The first was children whose mean percentage of correct responses in Post-training Block was higher than that in Pre-training Block (N = 7), indicating that those children improved from Pre-training Block to Post-training Block. The second group had children whose mean percentage of correct responses in Pre-training Block and Post-training Block did not show any differences (N = 6); the difference between the two blocks was zero. This group shows a subset of children who did not carry over the classifier cue to the Post-training Block. The third was children whose performance in the Pre-training Block was higher than that in the Post-training Block (N = 3), indicating that the training did not work as facilitation, rather it affected children's performance in the opposite direction. The last was children who were 100% accurate for both blocks as well as the Training Block (N = 5), showing that their performances were already adult-like. In what follows, I will discuss the results based on the above categorization.

Seven of 21 children in the Experiment Group were categorized into the first group; these children's performances in the Post-training Block were better than that in the Pre-training Block,

in which the differences ranged from 16% to 67%. I label this group as ‘Classifier-cue-advantage’ group, in which the exposure to the available semantic cue further facilitated their demonstrative comprehension in a different context where the cue is no longer sufficient. Recall that the experimenter asked the children for justifications of their judgment in the task. Examining children’s individual reasoning on their judgment may provide a hint for an explanation of why children show such improvement. Children’s individual reasoning could be categorized into three types: (i) children who seem to implicitly learn the association between the location of the referent and the demonstratives (N = 2); (ii) children who showed improvement due to the Classifier Mismatch items (N = 1); (iii) children whose improvement was unclear to explain (N = 4). I will discuss each reasoning pattern in more detail below.

Two children in the ‘Classifier-cue-advantage’ group fall into the first category that seems to show the Implicit Learning. Let’s take a look at one child’s reasoning pattern, which changed from Pre-training to Training Block. In the Pre-training Block, when asked to identify the correct referent if he judged that the Student Wizard painted wrong, the child always pointed to a closer object regardless of the classifier or the demonstrative. For instance, in one Match item, when the demand was ‘paint this-*zhi* (CL_{animal})’ and the fulfillment was painting the animal that was close to the speaker, s/he judged the fulfillment as wrong and pointed to the outfit closer to the speaker; the choice s/he made, however, did not match with the classifier *-zhi* but matched with the demonstrative. In one Classifier Mismatch item, when the demand was ‘paint that-*zhi* (CL_{animal})’ and the fulfillment was painting the outfit apart from the speaker, s/he judged the fulfillment as ‘wrong’ which was accurate; however, s/he pointed to the animal near the speaker, and the choice matched with the classifier whereas it did not match with the demonstrative. Interestingly, when the child proceeded to the Training Block, s/he started using the

demonstratives to correct the fulfillment; for instance, by saying ‘he should paint THIS one’ instead of saying ‘he should paint the cat, not the outfit’¹³. This particular type of response using demonstratives may be an index of the association between the location of the object and the demonstrative word. Once this child built up the association, s/he was able to exhibit adult-like performance in the Post-training Block and indeed was 100% accurate in the Post-training Block. Another child who falls in this group also gave a similar response in the Training Block. When the child was asked to explain why s/he thought the fulfillment was wrong, s/he explicitly said ‘because he was asked to paint THIS-*zhi* (CL_{animal}), but he painted THAT-*jian* (CL_{outfit})’, indicating that the child may associate the position of the object with the demonstratives in the Training Block.

For the second category in the ‘Classifier-cue-Advantage’ group, one child’s reasoning pattern falls into the category of improvement due to the use of classifier cues. This particular child showed improvement at the first glance; however, this child only improved in the Classifier Mismatch items in the Post-training but did not improve in Demonstrative Mismatch items. It is clear that the Training Block was drawing children’s attention to the classifier cues; thus, it is not surprising to see children showed improvement on the Classifier Mismatch items.

Other children in this ‘Classifier-Cue-Advantage’ group fall into the third category. It was not clear why they showed such improvement; their responses were less clear in how and why they took advantage of the Training. For example, two children only incorrectly accepted one Demonstrative Mismatch item in the Pre-training Block, which was also the first mismatch item they encountered; in all other items, they exhibited adult-like performance and correctly accepted

¹³ In fact, many children said ‘he should paint the cat, not the outfit’ as the response and it seems that they tend to focus on the ‘kind’ category of the object. This type of responses will be discussed latter.

Match items and rejected Mismatch items. One possible explanation for this pattern might be because they were not familiar with the Mismatch items and thus accidentally accepted it. In another example, one child pointed to the correct referent on every occasion before the painting happened; however, his/her judgment did not match with his/her selection of the referent. As s/he was exposed to more items, the accuracy increased. To summarize children's reasoning pattern in the 'Classifier-Cue-Advantage' group, although there are some cases children seemed to follow the Implicit Learning as expected, future studies are still needed to explore a more efficient way to train children's association between the location of the object and the demonstratives.

Let me now return to the discussion on the second subgroup categorized within the Experiment Group. Six of 21 children were categorized in the second pattern, in which there was no difference between their performances in the Pre-training Block and Post-training Block. This indicates that even though the classifier cue worked within the Training Block, there was no carry-over effect after the Training Block. I call this group 'Classifier-cue-advantage-local' group, in which the semantic cue works only when the cue is available, and can work as the sole cue for referent resolution. Two response patterns were observed to show that children might use the classifier cue solely to interpret the demonstrative phrase. The first pattern is as follows; when children were asked why they thought that the fulfilment was wrong in the Training Block, they responded to the question using the semantic category of the classifier and ignored the demonstrative word. For instance, when the demand was 'paint this-*jian*' and the fulfilment was to paint the cat apart from the speaker, the child rejected the fulfillment by saying 'because it is a cat, not an outfit.' In another pattern, children demonstrated that they were able to use the classifier cue since they were able to reject the fulfilment in the Classifier Mismatch items in the

Pre-training Block and Post-training Block; however, when they were asked to point to the correct referent, they tended to point to the wrong referent that matched with the classifier but not the demonstrative. For instance, when the demand was ‘paint this-*zhi*’ and the fulfillment was painting the outfit closer to the speaker, children pointed to the animal apart from the speaker as the response to why they thought it was wrong. This type of pattern shows that children have the knowledge of classifier-referent dependency, but they were not able to use it together with the demonstrative.

Three of 21 children were grouped into the third category, in which these children’s performances in the Post-training Block were 8% to 16% worse when compared with their performances in the Pre-training Block. Children’s worse performance after the Training Block indicates that the classifier cue in the Training Block may have worked in the opposite direction than I expected. These three children were labelled ‘Classifier-cue-disadvantage’ group, in which the semantic cue in the classifier did not improve their demonstrative comprehension. However, it was not clear why the classifier cue influenced children’s interpretation of demonstrative phrase in a different direction.

Last, five of 21 children were identified as belonging to the fourth category. These children were adult-like throughout the task; particularly, they were 100% accurate for all three blocks. As children who exhibited adult-like performance, this group of children was labelled ‘Adult-like’ group.

As discussed above, the qualitative results thus suggest that some children in the Experimental Group, but not many, indeed showed improvement after the Training Block in the Judgment Training Task. Recall that the statistical analysis revealed that children in the Experiment Group performed marginally better in the Post-training Block when compared with

their performance in the Pre-training Block ($t(40) = -1.718, p = .051$) whereas children in the Control Group did not show any differences ($t(40) = .725, p > .05$). The qualitative results, particularly children identified as belonging to the 'Classifier-Cue-Advantage Group', would serve as support to the quantitative results. From children's individual reasoning across the blocks, the Implicit Training may have worked as expected. As discussed previously, during the Training Block, some children were able to switch their reasoning from the kind category of the referent to the speaker-object distance. Then, their reasoning in the Training Block was further carried over to the next block and helped them successfully avoid the comprehension errors. This shows that children who used classifier semantics to successfully identify the correct object may have been able to implicitly learn the association between demonstratives and the location of the object.

Although the Implicit Training seems to work to some extent, many children still failed to learn the association between demonstratives and the position of the referent. Therefore, further studies are needed to explore whether other types of training could better facilitate children's demonstrative comprehension. One potential direction could be to manipulate the visual material to attract children's attention to the location of the speaker and guide them to associate each demonstrative with the position of the speaker relative to the object. The design of the task could be as follows. In the Training Block, I will adopt the same visual setting in which there is only a cloth-animal pair, one of which is located near the speaker and the other apart from the speaker. Crucially, I will manipulate the location of the speaker across items; in some trials the speaker will appear on the right side of the visual scene, whereas in others, he will appear on the left side. By placing the speaker in different positions in the visual scene, children may need to pay attention to the position of the object relative to the speaker and may further be

able to figure that the position of the speaker is one of the key components to consider in comprehending demonstrative phrases. Additionally, in each item, before the speaker utters the demand, the experimenter will ask the child where the speaker is in order to force the child to pay attention to the speaker's location. If children notice that the location of the speaker is going to be relevant information to incorporate when comprehending demonstrative phrases, they may possibly establish the reference point onto the speaker and further improve their egocentric demonstrative comprehension.

4.6.2. The role of classifiers in demonstrative comprehension

The classifier cue seems to be a useful cue to help children identify the correct referent of demonstratives. The results revealed that children in the Experiment Group who were exposed to the classifier cues in the Classifier-Cue-Sufficient Context in the Training Block outperformed children in the Control Group who received the Control Context, in which the classifier semantics was virtually absent. This piece of evidence indicates that the classifier cue in the demonstrative phrase facilitates children's demonstrative comprehension. This robust effect observed in the Training Block in the Experiment Group also appears in other blocks. Recall that in the Pre-training and Post-training Blocks, the Classifier-Cue-Insufficient Context was provided for both Experiment Group and Control Group. In this context, two types of items that elicited rejection as the correct judgment were created. One was the Demonstrative Mismatch and the other one was the Classifier Mismatch. For the Demonstrative Mismatch items, the object being selected did not match with the demonstrative word in the demand, but matched with the classifier (e.g, the demand was *zhe-zhi* (this-CL_{animal}) but the fulfillment was a bear apart from the speaker). Thus, in order for children to make the judgment, they needed to consider the

meaning of the demonstratives. If children still had difficulty in using demonstrative meaning to make the judgment and thus relied on classifier semantics, they would incorrectly judge the outcome as match. On the other hand, in the Classifier Mismatch items, the object being selected matched the demonstrative in the demand, but did not match the classifier (e.g., the demand is *zhe-zhi* (this-CL_{animal}) but the fulfillment is a coat near the speaker). Thus, if children use the classifier semantics in judging the outcome, their performances would be adult-like. Keeping this in mind, let me now examine children's performances in the Classifier-Cue-Insufficient Context, particularly focused on the Demonstrative Mismatch items and Classifier Mismatch items

Table 28. The mean percentage of correct responses of Mismatch items in Pre- and Post-training Blocks

			M	SD
Pre-training Block	Classifier Mismatch	Control Group	95.24	21.82
		Experimental Group	88.10	31.24
	Demonstrative Mismatch	Control Group	68.25	30.69
		Experimental Group	56.35	30.95
Post-training Block	Classifier Mismatch	Control Group	90.48	25.59
		Experimental Group	97.62	10.91
	Demonstrative Mismatch	Control Group	54.76	49.76
		Experimental Group	50.00	50.00

As shown in Table 28, overall, children's performances on the Demonstrative Mismatch items were around chance level, whereas their performances on the Classifier Mismatch items were much more successful compared with the Demonstrative Mismatch items across the two blocks. As discussed earlier, if children consistently rely on the classifier cues across the items, their

judgment on the Demonstrative Mismatch items and Classifier Mismatch items would show different results. This finding, revealing different response patterns between these two types of Mismatch items, thus suggests that while children are able to use the classifier as a cue to identify the correct referent, they still have difficulty in using the demonstrative meaning to identify the referent.

Furthermore, note that in the Demonstrative Mismatch items, the fulfillment matched with the classifier in the demand but not with the demonstrative. If children used the classifier as a cue, but not demonstrative, they may incorrectly accepted the fulfillment in the Demonstrative Mismatch items. Children's poor performances in the Demonstrative Mismatch items may thus suggest that children may have difficulty incorporating the classifier meaning together with demonstrative meaning when comprehending demonstratives, which would further suggest that the classifier cue may be easier to access than demonstrative meaning.

When comparing the availability between the semantics of classifiers and demonstrative meaning, classifiers seem to be a more readily available cue. That is, children are able to more easily take advantage of the classifier semantics when identifying the referent. As noted previously, children were more likely to judge Classifier Mismatch items correctly than Demonstrative Mismatch items, which suggest that they tended to use classifier cue to make the judgment and may imply that the classifier cues may be a more reliable cue to identify the correct referents.

The idea that classifier cues may be more easily accessible is consistent with the data from adults. One adult in the present study made his/her judgment based on the classifiers throughout the task, that is, even for the Demonstrative Mismatch items, he/she incorrectly accepted the fulfillment. This may indicate that the classifier cue is more readily available or

easier to access when comprehending demonstrative phrases. When examining the nature of classifier cues and demonstrative meaning, we can find that classifier cues are processed simply on semantics while demonstratives requires listeners to examine the context and calculate the distance between the speaker and the objects when resolving demonstrative phrases. Using the demonstrative meaning to identify the correct referent may require extra effort to consider the contextual information, whereas using classifiers cue is simply assessing the semantics category of the classifier categorized without extra steps. Since the classifier cue seems to a cue that is easier to access when identifying the correct referent, as a consequence, children may rely on classifier cues much more than demonstrative meanings when resolving referents for demonstrative phrase. It is not surprising that children tend to rely on the classifier cues, as Huang and Snedeker (2009) have suggested that children tend to use the semantic information instead of pragmatic information.

Given that the classifier cue is semantics-based while demonstrative interpretation requires incorporation of the speaker's perspective and thus is pragmatics-based, the findings are consistent with the imbalanced ease of availability of the cues that are available to children discussed in a number of studies. An existing line of research has showed that children tend to rely on semantics information more robustly than pragmatic information when identifying referents being mentioned. For instance, Arnold et al. (2007) have shown that children are able to use gender specification as the semantic cues to identify referents for English pronouns, while they were not able to use the order-of-mention, which was considered as the discourse contextual cue, to identify the referent in the linguistic stimuli. In addition to referent resolution, another line of research that investigates children's semantic and pragmatic processing focuses on children's comprehension of scalar implicatures (Guasti et al., 2005; Y. T. Huang & Snedeker,

2009; Noveck, 2000; Papafragou & Musolino, 2003). The interpretation of the scalar terms is ambiguous at the semantic-pragmatic interface, in that one interpretation is semantically based while the other is pragmatically based. Several studies have shown that children tend to interpret the scalar terms with their semantic meaning rather than the pragmatic implicature (Guasti et al., 2005; Y. T. Huang & Snedeker, 2009; Noveck, 2000; Papafragou & Musolino, 2003). The results suggest that the semantic information and pragmatic information may have different statuses in processing. The semantic information may be more robust information children rely on as compared with pragmatic information.

In short, the semantics of classifiers per se seem to play an important role in demonstrative comprehension for children. However, it seems to be challenging for children to incorporate classifier semantics together with demonstrative meaning when comprehending demonstratives. One potential reason for the difficulty might be the imbalanced ease of availability between semantic information and pragmatic information. Previous studies investigating children's processing semantic and pragmatic information have suggested that semantic information is more accessible compared with pragmatic information. However, there is still room for further examination regarding the extent to which the classifier cue may be more readily available, compared to demonstrative meaning, which was not clear in the current study, as the current discussion is mainly based on the behavioral responses in the Judgment Training Task.

4.6.3. Understanding children’s processing of semantics and pragmatics: hints from a follow-up study with adult speakers of Chinese

The discussion in the previous section on children’s imbalanced use of semantic information and pragmatic information further raises a question regarding how the classifier semantics and the pragmatic computation involved in the demonstrative-referent association may indeed be used in children’s online processing of the demonstrative comprehension. In this section I will report a follow-up study regarding how adult speakers of Chinese may utilize these two sources of information during the online computation of demonstrative comprehension (Chu & Minai, 2014). Although this study only involved adult speakers as participants, the findings of this study will be taken to provide a ground on the basis of which subsequent studies with children will be generated, seeking better understanding of their online processing of demonstratives. I will discuss those hints in what follows.

I tested 36 adult native speakers of Mandarin Chinese (mean age: 22; age range: 18-30). They were asked to perform a story-based judgment task. The stories were exactly the same as those used in the Judgment Training Task discussed above in the current chapter. There were two main characters in the story, the Great Wizard and the Student Wizard. In each story, the Great Wizard uttered demand such as (46) to the Student Wizard.

(46) *ba zhe/na zhi /jian tu cheng lanse*

BA **this/that** CL_{animal}/CL_{outfit} paint as blue

‘Paint *this/that* blue’

The Student Wizard sometimes successfully fulfilled the demand (Match items), and other times was unsuccessful (Mismatch items). The study was a within-subject design with three conditions, namely, the Experimental Condition, the Demonstrative Only Condition, and the Classifier Only Condition.

The Experimental Condition presented the Classifier-Cue-Insufficient Context that was used in the Judgment Training Task, in which the referent identification requires the two sources of information: (i) the pragmatic information in the demonstratives (i.e., near/far contrast relative to the speaker position) and (ii) the semantic information as in the classifier semantics. Based on each of these information sources, two Mismatch items were created, Classifier Mismatch items and Demonstrative Mismatch items, as well as Match items. In the Classifier Mismatch items, the object the Student Wizard painted matched the demonstrative meaning in the demand, but mismatched the classifier semantics (e.g., The Great Wizard uttered *zhe-zhi* (this-CL_{animal}), and the Student Wizard painted the outfit closer to the Great Wizard; see Figure 26).



Figure 26. Sample visual contexts for Classifier Mismatch item in Experiment Condition

In the Demonstrative Mismatch items, the object the Student Wizard painted matched the classifier semantics in the demand, but mismatched the demonstrative meaning (e.g., The Great

Wizard uttered *zhe-zhi* (this-CL_{animal}), and the Student Wizard painted the animal apart from the Great Wizard; see Figure 27).



Figure 27. Sample visual context for Demonstrative Mismatch item in Experiment Condition

With respect to the Demonstrative Only Condition, the study presented the Control Context used in the Judgment Training Task, in which the demand such as (47) contained the general classifier *-ge*, which is claimed to not have any specific semantic information and thus the demonstrative information was the only source for referent identification.

(47) ba **zhe/na** ge tu cheng lanse

BA **this/that** CL_{generic} paint as blue

‘Paint *this/that* blue’

The Match items and the Mismatch items were also created for this Condition. The Match items were created by the satisfactory painting in response to the demand (e.g., The Great Wizard uttered *zhe-ge* (this-CL_{generic}) followed by *-ge*, and the Student Wizard painted the correct object; see Figure 28a). The Mismatch items showed unsatisfactory painting in response

to the demand (e.g., The Great Wizard uttered *zhe-ge* (this-CL_{generic}), the Student Wizard wrongly painted the object apart from the Great Wizard; see Figure 28b).



Figure 28. Sample visual contexts for (a) Match and (b) Mismatch items in Demonstrative Only Condition

The Classifier Only Condition presented the visual material as in the Classifier-Cue-Insufficient Context, but with a different demand such as (48), which did not have the demonstrative but the numeral *yi* ('one') co-occurring with the classifier.

(48) *ba yi zhi /jian tu cheng lanse*

BA one CL_{animal/CL_{outfit}} paint as blue

'Paint one (animal/outfit) blue'

The Match items and the Mismatch items were also created for this Condition. The Match items showed a correct painting in response to the demand; crucially, Student Wizard painted an object whose semantic category matched the classifier semantics (e.g., The Great Wizard uttered *yi-zhi* (one-CL_{animal}), and the Student Wizard painted an animal; see Figure 29a). The Mismatch items showed a painting of the wrong object whose category did not match the classifier semantics

(e.g., The Great Wizard uttered *yi-zhi* (one-CL_{animal}), the classifier associated with an animal, and the Student Wizard painted an outfit; see Figure 29b).



Figure 29. Sample visual contexts for (a) Match and (b) Mismatch items in Classifier Only Condition

Thus, in this condition, classifier semantics was the only source of information for referent identification. In the task, participants were asked to judge the fulfillment by pressing a mouse button as quickly and accurately as possible. Their reaction time (RT) to the judgment was measured. Note that the last two conditions were Control Conditions designed to obtain the baseline duration for each of the information sources (semantics/pragmatics). In each condition, one of the information sources would be the sole cue to make the judgment (i.e., Demonstrative Only Condition is the condition when demonstrative/pragmatics is the only source for the acceptance/rejection, and Classifier Only Condition is the condition when classifier is the only informative cue to accept/reject the outcome).

The variables of crucial interest here were the RTs for the Mismatch items across three conditions. I directly compared the RTs of the judgment to Classifier Mismatch items and Demonstrative Mismatch items in the Experimental Condition. Since the Experimental Condition provided the context in which both semantics and pragmatics were information sources to identify the correct referent, the RTs to the Mismatch items would reflect how quickly

one could incorporate each of the information sources for referent identification. Additionally, RTs in the other two Control Conditions were also compared, particularly focused on the Mismatch items, namely the Classifier Only Mismatch items and the Demonstrative Only Mismatch items, to see determine whether, by nature, the use of classifier information differs from the use of demonstrative information. The results revealed that the mean RT for the Demonstrative Mismatch Condition (778.03ms) was longer than that for the Classifier Mismatch Condition (716.77ms; $t(36) = -1.801, p = .04$, one-tail) in the Experimental Condition. As the RT reflects how easily adults could use the information to falsify the wrongly picked referents of demonstrative phrases, the shorter RT would suggest a faster use of the information. The results revealed a longer RT on the Demonstrative Mismatch Condition, indicating that using the classifier information to identify the correct referent of demonstrative phrase is easier when compared with using the demonstrative information.

However, the comparison between the other two conditions may complicate the interpretation. There were no significant differences between the mean RT of the Demonstrative-Only Mismatch (702.74ms) and that of the Classifier-Only Mismatch (707.98ms; $t(35) = .137, p = .45$) in the other two conditions. This seems to suggest that when classifier semantics and demonstratives are the sole information to identify the correct referent, the access to each type of the information seems to be equal. Currently, there is no clear explanation as to why this was the case in the current data, and would like to address it as a further issue for a future study. To sum up, the findings suggest that the semantic information from the classifier semantics may be more readily available than the pragmatic information from the demonstratives when resolving the referent for demonstrative phrases in Chinese.

Following this study, future studies with online processing measures, such as eye-tracking using visual world paradigm, would be required to investigate how adults as well as children use the semantics information from classifiers and pragmatic information from demonstratives to process demonstrative phrases in Chinese. Such an online measurement would provide a better understanding of both adults' and children's use of the two sources of information online and further understand the mechanism of demonstrative computation that children may need.

4.6.4. The role of Executive Function in the Implicit Training

Finally, I will discuss the findings from children's data with respect to their Executive Function. The current findings suggest that some children seemed to benefit from the training and improved their demonstrative comprehension in the Post-training Block. Recall that children in the Experiment Group showed marginal improvement in demonstrative comprehension from Pre-training Block to Post-training Block, whereas children in the Control Group did not perform differently for those two blocks. Interestingly, children's performances on the EF task were overall successful; therefore, having the ceiling effects in the task, I was not able to further explore any relationship between children's performance in DCCS and their ability to show the improvement in the Post-training Block in the Judgment Training Task. Given these findings, future studies are needed to further explore the role of Executive Function in demonstrative comprehension and the Implicit Training.

The hypothesis of the current study regarding the role of Executive Function, particularly *shifting*, was formed based on Jincho, Yamane, Minai, and Mazuka (2008) study, which showed a correlation between children's adult-like processing in ambiguity resolution driven by a

training and their performance in Executive Function task. Given this, I hypothesized that children's Implicit Learning from the Training Block may be predicted by a better developed mental flexibility. More specifically, if children were able to improve their demonstrative comprehension procedures within the Training Block and further use the improved way to compute the meaning of demonstratives in the subsequent, Post-training Block, they may show better performance in the Executive Function task.

Recall that in the Judgment Training Task, I used the Classifier-Cue-Insufficient Context in both Pre-training Block and Post-training Block (the context in which both demonstrative and classifier needed to be considered to identify the referent), while I used the Classifier-Cue-Sufficient Context in the Training Block (the context in which the classifier was informative enough to find the correct referent). In such a case, since the classifier semantics is a robust and informative cue in identifying the referent, children's meaning computation procedure may be very likely to rely on classifier semantics in the Classifier-Cue-Insufficient Context in the Pre-training Block, while the demonstrative may be ignored, and thus children tend to exhibit comprehension errors. Recall that in this context, classifier semantics cannot be the sole cue to identify the referent; both classifier semantics and demonstrative meanings are required to interpret the demonstrative phrase appropriately. Thus, if children's meaning computation procedure largely relied on the classifier semantics, their interpretation of the whole demonstrative phrase would be incorrect; in particular, children would still exhibit egocentric comprehension for the Demonstrative Mismatch items. Then, in the next Block, the Classifier-Cue-Sufficient Context provided the classifier cue in which classifier semantics was the sole cue to identify the referent. In this Training Block, children may potentially be able to learn the association between the location of the object and the demonstrative via the Implicit Training. If

children learned the association between the objects' locations and demonstratives, they would revise their meaning computation procedure for the Chinese demonstratives, in which they would consider both classifier semantics and demonstrative meaning. Once children revise their meaning computation procedure in the Training Block, they should be able to further apply the revised computation procedure in the Post-training Block, in which the context was once again the Classifier-Cue-Insufficient Context. The whole training process may have required children's *shifting* ability, in that children's initial meaning computation procedure driven from the Classifier-Cue-Insufficient Context in the Pre-training Block may have been revised in the Classifier-Cue-Sufficient Context in the Training Block and further applied to the revised meaning computation procedure in the Post-training Block. As suggested by the findings from Jincho et al. (2008), *shifting* was related to children's ability to revise their initial analysis of an ambiguous linguistic stimulus over the blocks. Thus, children who showed improvement from the Pre-training Block to the Post-training Block may have a better developed *shifting* ability in Executive Function. Meanwhile, children who had difficulty revising their initial meaning computation procedure in the Pre-training Block and showed no improvement in the Post-training Block may still have been developing the *shifting* ability in Executive Function.

Based on the discussion above, the current findings could not speak to the relationship between *shifting* and the revision of meaning computation procedure in the Implicit Training, and the question of whether these two domains are related may still be open for debate. In order to understand the role of Executive Function in the Implicit Training, it may be helpful for future studies to use another Executive Function task, such as a more advanced Executive Function task measuring *shifting* or a task that measures *inhibition/updating*. *Inhibition/updating* is suggested to be related to children's ability to revise their initial analysis (Choi & Trueswell, 2010).

Woodard et al. (2014) showed that children's ability to revise their initial analysis of the kindergarten path sentences was related to their *inhibition/updating* ability. Thus, in addition to a more advanced *shifting* task, another possible task to explore the Implicit Learning effect in the Judgment Training Task would be to examine whether *inhibition/updating* ability may be related to children's ability to revise their attention, from only classifier cues to dual cues, and thus improved their comprehension of demonstrative phrase in Chinese.

Chapter 5. GENERAL DISCUSSIONS AND CONCLUDING REMARKS

Two central issues of the current dissertation are to understand (i) *why* children exhibit non-adult-like comprehension in demonstrative comprehension, with a goal of seeking a language-external factor such as children's cognitive development, and (ii) *what* can help children to avoid the comprehension errors, with a goal of exploring the potential effect from the language-internal factor. Chapters 3 and 4 presented experiments to explore these two issues. In the current chapter, I will first summarize the findings of the experiments I reported in Chapter 3, and will develop a general discussion regarding the cognitive factor in children's language comprehension on the basis of my own findings regarding children's demonstrative comprehension. I will then summarize the findings of the study I reported in Chapter 4, and elaborate on those findings to further discuss language-internal factors that may interact with children's language comprehension. Last, I will present some remaining issues which provide insights for further research.

5.1. Demonstrative and cognitive development: Why do children exhibit egocentric interpretation of demonstratives?

5.1.1. Summary of the findings

The two experiments in Chapter 3 examined children's demonstrative comprehension in relation to their cognitive abilities, such as Theory of Mind and Executive Function. In the experiments, the Act-out Task was used to examine children's demonstrative comprehension based on their own perspectives, ensuring their knowledge of distance contrast between the two demonstratives. Only children who demonstrated understanding of the distance contrast between

the two demonstratives based on their own perspective were studied in the further analysis. These children were tested with their demonstrative comprehension based on the speaker's perspective, which is different from children's own (the Judgment task), together with the Theory of Mind task and Executive Function task, and the correlations among the three tasks were conducted. Results from English-speaking children revealed a significant correlation between children's demonstrative comprehension and their Theory of Mind task performance. However, no significant correlation was found between children's demonstrative comprehension and their Executive Function, which calls for further exploration. In particular, children who passed the Theory of Mind task returned better comprehension of *this*, whereas children who passed DCCS did not show such a tendency. The experiment was cross-linguistically expanded to Chinese-speaking children. Results from the Chinese-speaking children replicate the exact pattern shown in English-speaking children's data. Chinese-speaking children's comprehension of demonstratives, particularly the proximal demonstrative *zhe-ge* (this-CL_{generic} 'this'), significantly correlated with their performance in the Theory of Mind task, but not the Executive Function task. These results suggest that children's demonstrative comprehension may indeed be related to their cognitive ability, particularly Theory of Mind, although the role of Executive Function in demonstrative comprehension remains unclear. From the results of the two experiments, I am in the position to discuss the relationship between language and cognition.

5.1.2. Discussion

The results of the experiments in the current dissertation suggest that children's language comprehension may be related to their cognitive abilities. In particular, I assumed that children's difficulty exhibiting adult-like comprehension was not due to a lack of intact linguistic

knowledge but rather was related to their still-developing cognitive abilities. I would argue that children have knowledge of the meaning representation of demonstratives; however, they may not have a mature cognitive ability to utilize their knowledge. Recall that Lyons (1975) represented the meanings of the two demonstratives as in (7) in Chapter 2, repeated here as in (49).

- (49) this [+D, +entity, -person, +proximate]
 that [+D, +entity, -person, -proximate, +distal]

The results of the Act-out Task in the experiments have shown that children have the distance contrast distinction between the two demonstratives, in that they were able to correctly associate proximal demonstrative *this*, or *zhe-ge*, with the object near themselves and associate distal demonstrative *that*, or *na-ge*, with the object apart from themselves. This indicates that children represented the meaning of demonstratives correctly. However, the results may not directly speak to whether children set the correct value for [+D] or whether they represented the feature [+D] appropriately. The feature [+D] represents the deictic properties in that it points to an entity in the context and also takes control of the determination of the deictic center that is the speaker's orientation. Recall that the Act-out Task is designed so that the speaker and the child shared the same perspective. Children's successful comprehension of demonstratives in this situation thus may be interpreted in at least the following two ways. First, children have the correct value setting for [+D] in which they know that the speaker determines the speaker-object distance for the demonstratives. Second, children do not have the correct value setting for [+D] in that they failed to set [+D] feature as anchoring on the appropriate speaker's perspective and

instead they set themselves as the anchoring point due to the egocentrism. However, since in the situation in the Act-out Task the speaker's perspective happened to be children's own, they would be able to correctly interpret demonstratives because of their egocentric bias toward the interpretation of demonstratives. In sum, the first two possibilities suggest that children have [+D] feature represented in the meaning of demonstratives. In the first possibility, the children represent all the semantic features correctly, including a correct feature value setting for the [+D] feature, while in the second one, children have the [+D] feature in their semantic knowledge, but the value setting for the feature is not specified, or the children set the value anchoring on themselves as the deictic center.

Now consider the results of the Judgment Task. Many children still exhibit non-adult-like comprehension of demonstratives in the Judgment Task. The results show that while children are able to correctly comprehend demonstratives based on their own perspective in the Act-out Task, they still have difficulty comprehending demonstratives based on a different perspective in the Judgment Task. The results are consistent with the second possibility discussed above. That is, children were being egocentric and anchored the deictic center on their own orientation rather than the speaker's. The results from the Judgment Task rule out the first possibility. This is because children were not able to appropriately interpret demonstratives based on a different perspective, which suggests that they do not have correct value setting for [+D].

Now, let me assume that children have [+D] feature in the meaning representation of demonstratives. This raises the question of *why* children could not implement the knowledge in the actual computation of demonstratives, or *why* children could not set the value in an adult-like way. One potential answer is children may not possess the relevant ability to compute the meaning. That is, children may not be able to take the speaker's perspective because (i) they do

not understand that others may have a different perspective from their own, and/or (ii) they are not able to switch from their own perspective to a different perspective. Note that each of the abilities is related to Theory of Mind and Executive Function respectively, which may suggest that children's non-adult-like demonstratives are related to their still-developing Theory of Mind and Executive Function. Results of the experiments partially support this argument in that children's demonstrative comprehension correlated with their Theory of Mind performances, but not their Executive Function. More specifically, children who passed the Theory of Mind task were more likely to exhibit an adult-like demonstrative comprehension. The results may suggest that children's non-adult-like comprehension of demonstratives may very likely be due to their value setting on [+D]. Crucially, children's ability to correctly implement the feature [+D] is closely related to their Theory of Mind. This indicates that this aspect of children's language performances may be related to their cognitive development. The data in the current dissertation could only speak to a relationship between the two domains. Further studies are needed to examine whether the development of Theory of Mind is the source of children's non-adult-like comprehension of demonstratives.

The findings of this dissertation are in line with other studies exploring the interaction between children's language processing and cognitive abilities (J. G. de Villiers, 2007; J. G. de Villiers & Pyers, 2002; Mazuka et al., 2009; Minai et al., 2012; Moore et al., 1990; Papafragou et al., 2007; Woodard et al., 2014). In particular, the two cognitive domains of the particular interest, Theory of Mind and Executive Function, are suggested to be related to comprehension of other linguistic expressions. For instance, Theory of Mind is argued to be related to the linguistic expressions that require the listener to understand the speaker's mental representation, such as the comprehension of mental verbs or epistemic state verbs (Moore et al., 1990;

Papafragou et al., 2007), and comprehension of complement structures (J. G. de Villiers & Pyers, 2002; Rakhlin et al., 2011; Schick et al., 2007). The results of this dissertation add new evidence to this line of research. Additionally, although findings of the current dissertation did not show a relationship between demonstrative comprehension and Executive Function, Executive Function is also suggested to be related to a variety of comprehension of linguistic expressions, particularly those require revisions of the listeners' initial analysis of the linguistic stimuli, such as children's comprehension of kindergarten path sentences (Choi & Trueswell, 2010; Woodard et al., 2014), universal quantifiers (Minai et al., 2012), and potentially scalar implicature (Y. T. Huang & Snedeker, 2009). Future studies exploring the role of Executive Function in demonstrative comprehension may shed some lights in this line of research.

Now, let me turn to the discussion on the framework of the interaction between language and cognition proposed by Slobin, which has been discussed in Chapter 1. In Slobin's framework, particular cognitive abilities may be prerequisite for comprehension of some linguistic expressions. The assumption is that children have the intact linguistic knowledge, but children need to have the appropriate cognitive abilities to correctly utilize their linguistic knowledge. Mazuka et al. (2009) and Huang and Snedeker (2009) further elaborated Slobin's proposal in more detail, arguing that the children's non-adult-like language processing may be related to their processing ability such as children's still-developing Executive Function.

This dissertation examines both Slobin's (1973) and Mazuka et al.'s (2009) proposals, looking at children's demonstrative comprehension in relation to their Theory of Mind and Executive Function, in which Theory of Mind is the ability that would allow children to *know* that the speaker may have a different perspective before utilizing their linguistic knowledge on demonstratives, whereas Executive Function is the processing ability that would allow children

to switch to the speaker's perspective when comprehending demonstratives. The results of the studies support Slobin's proposal because the results revealed a correlation between Theory of Mind and the comprehension of demonstratives. This may indicate that children need to know that the speakers may have a different perspective before they can successfully implement the [+D] feature in Lyons' analysis of demonstrative meaning representation.

On the basis of the discussions above, I hypothesize that successfully comprehending demonstratives may require at least two steps. First, children need to be able to evaluate the physical distance between a speaker and an object and associate the distance distinction with each demonstrative. Children are equipped with the perceptual ability to evaluate the physical distance (H. Clark, 1973); however, children need to "discover the linguistic input" (Slobin, 1973, p.208); that is, children need to map what they perceived onto the semantic features of demonstrative. Therefore, children would first set the [\pm proximate] value for each demonstrative. Second, children need to be able to anchor to the speaker's orientation point to calculate the distance; that is, setting the correct value for [+D]. For children to appropriately anchor to the speaker's orientation in demonstrative comprehension, they need to know that the determination of distance contrast is not absolutely fixated, but is established based on speaker's orientation point which varies across contexts. In order for them to successfully do so, children need to know that the speaker may have a perspective the same or different from their own. Once they know the speaker's perspective, they will be able to establish the distance contrast based on that perspective. Note that when speakers have the same perspective, children's value setting may seem to be correct as they anchored the deictic center on themselves; however, children have difficulty in anchoring a perspective different from their own. Therefore, during the development of setting correct value for [+D], Theory of Mind is required, as it is the ability that allows

children to understand that others' perspectives may differ from their own. Based on the steps children need to take to appropriately comprehend demonstrative, it is possible that children's demonstrative comprehension may require Theory of Mind as a prerequisite cognitive ability to correctly establish the speaker's perspective.

This dissertation particularly focused on languages in which demonstratives implement the two-way distance distinction. As discussed in previous chapters, other languages may have three-way or even four-way distinction, and the semantic features are not always distance contrast. However, demonstratives in those languages still has the [+D] feature (Diessel, 2014); thus, children acquiring demonstratives in those languages may still have difficulty to correctly set the value for [+D]. In addition to the value setting for [+D], demonstratives in those languages may encode more than distance contrast and thus may be more challenging to children, since children are required to implement two or three different semantic features into their demonstrative system. For instance, Turkish has three-way system in which the third demonstrative is neutral to distance but encodes whether the listener's visual attention is on the referent. This language-specific feature indeed is shown to be very challenging for Turkish-speaking children. Küntay & Özyürek (2002, 2006) has revealed that even six-year-old Turkish-speaking children have not achieved adult-like use of the demonstrative *şu* in Turkish, which is distance neutral but used when the listener's attention is not allocated to the referent that the speaker intends to pick out. In brief, children acquiring demonstratives in languages that has more than a two-way distinction still need to set the correct value for [+D], in which Theory of Mind might still be prerequisite for them to master it; additionally, demonstratives in those languages encode more than distance contrast or more fine-grained distance distinction may be more challenging for children.

5.2. Demonstrative and language-internal factor: What can help children overcome the egocentric interpretation of demonstratives?

5.2.1. Summary of the findings

In Chapter 4, I reported the experiment that examined whether and to what extent Chinese-speaking children's comprehension of demonstratives can be facilitated by the semantics of classifiers. Two screening tasks, an Act-out Task and a Classifier Comprehension Task, were used to ensure children's knowledge of distance contrast between two demonstratives and their knowledge of the semantics of the selected classifiers, *-zhi* for animal and *-jian* for outfit. A Judgment Training Task was used to test the research questions in Chapter 4. Data of the Judgment Training Task from children who passed the two screening tasks were analyzed. The results of the Judgment Training Task show that Chinese-speaking children can use their knowledge of semantic dependency between the classifier and its associated noun, which helps them perform better on comprehending demonstrative phrases that are uttered by a speaker who has a different perspective.

In the Judgment Training Task, children exhibited almost adult-like performance when they were provided the Classifier-Cue-Sufficient Context in which the classifier cue could be the sole cue to identify the referent. The effect of the cue is significant in that when compared with children who were provided with no classifier cues (Control Context), children who received the context with classifier cue performed much better in comprehending demonstratives. Moreover, children also show the tendency to carry over the classifier cue effect to the subsequent context, the Classifier-Cue-Insufficient Context, where the classifier cue is no longer the sole cue to identify the referent. Recall that children were asked to perform a training task, which included

three blocks: a Pre-training Block (Classifier-Cue-Insufficient Context), a Training Block (Classifier-Cue-Sufficient Context), and a Post-training Block (Classifier-Cue-Insufficient Context). Children's performance on demonstrative comprehension improved from Pre-training Block to Post-training Block after the exposure to the Classifier-Cue-Sufficient Context in the Training Block.

Additionally, although children's Executive Function was also tested to explore whether children's Implicit Learning is related to their development of Executive Function, their performance was at ceiling. Thus, further analysis was not conducted to explore a potential reason for children's improvement after the exposure to the classifier cue.

5.2.2. Discussion

The study in Chapter 4 is the first attempt to consider the role of classifiers in Chinese demonstrative comprehension. The results of the experiment reveal that the classifiers serve as a cue to facilitate children's demonstrative comprehension, providing a piece of evidence showing that language-specific properties interact with children's language comprehension. This indicates that children are able to use a linguistic device that they have already acquired to improve their performances on linguistic expressions that are still challenging for them. Results of this study provide converging evidence to support the argument that the language-specific characteristics may impact on children's language comprehension in a positive way, such as the effect shown in Zhou et al. (2012) who found that children took advantage of Chinese-specific property to improve their comprehension. Zhou et al. (2012) examined the use of intonation in Mandarin

Chinese to resolve syntactic ambiguity¹⁴. They showed that Chinese-speaking children were able to use the intonation contour in Chinese to disambiguate the speech act as either a question or a statement. Zhou et al.'s study, as an example, revealed that the language-specific linguistic properties may interact with children's language comprehension. This current dissertation together with Zhou et al.'s (2012) findings may suggest that once children have the knowledge of a particular language-specific characteristics, children are very likely to take advantage of them to help their comprehension on other linguistic expressions that contain them, rather than those language-specific characteristics hindering their correct comprehension of those linguistic expressions that contain them.

Results of the current study are also in line with studies that have shown that children are able to use semantic information in sentences to help them interpret the meanings of the sentences more successfully (Arnold, Brown-Schmidt, & Trueswell, 2007; Dispaldro et al., 2014; Pyykkönen et al., 2010). Recall that in the line of research Arnold et al. (2007) conducted, children were able to use the gender specification in personal pronouns as semantic information to resolve the pronouns in sentences; however, pragmatic information manipulated in the context did not seem to be available to children. Importantly, the authors have shown that children used the semantic information rapidly in online processing of pronouns. This suggests that children can incorporate linguistic information, such as semantic information, in linguistic expressions as cues as they unfold the expressions. The current study also revealed that children could use the semantics of classifiers embedded in the demonstrative phrases to facilitate their demonstrative

¹⁴ Zhou et al. (2012) focused on the interpretation of wh-words, *sheme* ('what'). When *she* in *sheme* received a rising tone, the wh-word forms a question. In contrast, when *she* in *sheme* received a different tone, the level tone, the wh-word has a statement reading.

comprehension, which further suggests that children could use the linguistic properties which they have already acquired to further help their comprehension of other linguistic expressions. While the results shed some lights on children's comprehension of Chinese demonstratives, future studies should further explore how rapidly classifier semantics could be used in demonstrative comprehension for both children and adults using online measurements, such as eye-tracking technique. The current study reported that the effect of classifier semantics is suggestive in children's demonstrative comprehension. Future studies should examine how rapidly children as well as adults could use classifier semantics in resolving demonstrative phrases in Chinese.

In addition, the training task in this study was presented in the format of what I called *Implicit Learning* to children to explore to what extent children could benefit from using classifier semantics. Results of the experiment in Chapter 4 reveal that Chinese-speaking children can take advantage of the semantic dependency between the classifier and its associated referent to help them successfully identify referent for the demonstrative phrase containing the classifier. Furthermore, the effect of the Implicit Learning seems to be observed in the experiment, suggesting that the classifier semantic effect may be carried forward across contexts. This further suggests that children at this stage may already show the Implicit Learning effect on their demonstrative comprehension. Supposing that Chinese-speaking children are able to use classifier semantics, which is a linguistic device that is not available in English, to improve their demonstrative comprehension, Chinese-speaking children would be expected to have a better demonstrative comprehension than their English-speaking peers. Chinese-speaking children have classifiers to help them point to the correct referent for demonstrative phrases while English-speaking children would not have the same input as the classifier does not exist in their language.

This assumes the effect of Implicit Learning serves as the mechanism for Chinese-speaking children to completely overcome their difficulty of demonstrative comprehension.

However, this does not seem to be the case in the cross-linguistic experiments in Chapter 3. Children who participated in the experiments in Chapter 3 were within the same age range as those in Chapter 4, which would suggest that children in Chapter 3's experiments should have been able to make use of the Implicit Learning and show the effect of classifier semantics. Nonetheless, Chinese-speaking children still show the same difficulty as their English-speaking peers in incorporating the speaker's perspective when comprehending demonstratives. This raises questions regarding the nature of implicit learning and the effect shown in Chapter 4. The effect observed suggests that children may possibly establish the association between demonstrative phrase and its referent, but the association may only apply to the context in the task rather than improving children's association at the conceptual level. Hence, children's success in the experiment does not imply that they may also overcome the difficulty in comprehending demonstratives based on a different perspective.

The current study serves as the first to explore Implicit Learning for demonstratives. Future research should investigate the nature of Implicit Learning and explore whether there is an alternative way to train children to expand their uses of classifier semantics in all contexts to improve their demonstrative comprehension. One possible expansion is to provide the Implicit Learning over a period of time, such as three times per week for two weeks. In the training sessions, the Classifier-Cue-Sufficient Context would be provided repetitively. Additionally, another possible expansion is to develop Implicit Learning in an alternative context that might more efficiently train children's association between demonstratives and the location of the referent relative to the speaker. Additionally, if the alternative context successfully improved

children's demonstrative comprehension, it would also be important to understand whether the successful training effect in using linguistic devices is related to an adult-like cognitive ability, or whether it is more related to children's language abilities in general. Future studies thus may need to develop a different kind of training for children to see how it would work; furthermore, cognitive tasks as well as general language assessments should be administered together with the training task to explore the potential reasons behind a successful training.

5.3. Concluding remarks and remaining issues

This dissertation examined two factors in children's language comprehension, particularly focusing on children's demonstrative comprehension. First, two studies reported in Chapter 3 investigated the role of cognitive abilities in demonstrative comprehension by English-speaking children and Chinese-speaking children. Results of the experiments revealed that children's demonstrative comprehension is related to their Theory of Mind. Given that children's success/failure in comprehending demonstratives from a perspective different than their own and their success/failure in the task measuring their Theory of Mind were reported to be correlated, the findings indicate that Theory of Mind may be a prerequisite cognitive ability for children to correctly comprehend demonstratives, particularly those uttered by a speaker who has a different perspective from the children's own. Current findings can only speak to a correlation between Theory of Mind and demonstrative comprehension; future research is needed to explore whether Theory of Mind is indeed a prerequisite for demonstrative comprehension. Second, Chapter 4 presented an experiment that examined the role of language-specific property, the obligatory presence of classifiers in demonstrative phrases in Chinese, in Chinese-speaking children's demonstrative comprehension. Results suggest that Chinese-speaking children can take

advantage of classifier semantics when comprehending demonstrative phrases. Children were able to use the classifier cues to correctly pick out the referent for demonstrative phrases when classifiers could be the sole information to resolve the demonstrative phrase. Furthermore, there was a tendency that the effect of classifier semantics was carried forward to the subsequent context where the classifier semantics was not the sole information children needed to consider. Overall, the classifier in Chinese demonstrative phrase facilitates children's demonstrative comprehension, rather than hinders their comprehension.

While the findings reported in this dissertation reveal important roles that the cognitive factor (development of Theory of Mind) and the language-specific factor (the presence of classifier in demonstrative phrases in Chinese) may play, they also serve as a fertile ground for further research to seek the more precise picture of demonstratives in young children.

First, the current study confirmed the previous findings on children's asymmetric comprehension of the proximal demonstrative (e.g., *this*) and the distal demonstrative (e.g., *that*), adding another piece of evidence showing children comprehend the former better than the latter even based on their own perspective. This is particularly due to the vagueness of the distal demonstrative. Future research should deal with the vagueness of the distal demonstrative and shed some light on children's comprehension of the distal demonstrative. The experiments in Chapter 3 did not provide much insight into children's comprehension of the distal demonstrative due to the vagueness; it is suggested that the distal demonstrative could be used to depict entities apart from the speaker and also any entities in the physical context, as a neutral demonstrative. Webb and Abrahamson (1976) proposed that the vagueness of the distal demonstrative *that* may diminish if *that* and *this* are both used in a contrastive context. For instance, in a sentence such as 'I want *that* bear, not *this* bear', the '*that*' would not be a neutral

demonstrative, but a distal demonstrative that point to the bear apart from the speaker. Future experiments may adopt similar contrastive context to examine children's demonstrative comprehension to see if the manipulation should result in any differences in children's performances.

Second, the current study primarily focused on children's comprehension of demonstratives, and their production of demonstratives was out of the research scope. Indeed, research to date has suggested that children do produce demonstratives quite frequently from early on in their development. Diessel (2006), for example, reported that demonstratives in English are among the first 15 words produced by one to two year olds. E. V. Clark (1978, 2003) also suggested that demonstratives are one kind of function words that are productive among very young children. Whereas researchers have pointed out frequent utterance of demonstratives by young children, it remains unclear whether demonstratives uttered by children would be fully deictic on par with adults' use; for instance, whether children's early productions of demonstratives are indeed exophoric demonstratives, or whether they are able to use demonstratives as non-deictic expressions. To date, only Chen (2009) has analyzed Chinese-speaking children's use of the distal demonstrative *na-ge* ('that') and found that among all kinds of uses, exophoric use is one of the most frequent. Unfortunately, Chen (2009) only examined one of the demonstratives and focused on Chinese demonstratives. More studies are needed to explore children's use of demonstratives and see if exophoric demonstratives are indeed acquired earliest as claimed by Diessel (1999).

APPENDIX I: TRIAL TABLE FOR THE JUDGMENT TASK

#	King's demand	Servant's choice	Condition
1	Paint <i>this plate</i> blue.	this plate	Match
2	Paint <i>this bowl</i> blue.	that bowl	Mismatch
3	Paint <i>that pillow</i> blue.	that pillow	Match
4	Paint <i>this pot</i> blue.	this pot	Match
5	Paint <i>that cup</i> blue.	this cup	Mismatch
6	Paint <i>that bag</i> blue.	that bag	Match
7	Paint <i>this clock</i> blue.	that clock	Mismatch
8	Paint <i>that box</i> blue.	this box	Mismatch

APPENDIX II: FULL SCRIPT OF THE HIDING GAME



The full script of the story, which is the Hider's speech, is described in the following:

Figure a: Now, I have another donut, and I am going to hide it in one of these boxes. Before I hide it, let's do something funny. Brown Bear, I will blindfold you so that you won't see anything for a while.

Figure b: OK, the Brown Bear is blindfolded, and he won't see anything. White Bear, stay with me and watch me hide the donut.

Figure c: Now, I am going to hide the donut. And you can't peek now!

Figure d: I'm done! See, the donut is hidden in one of these boxes. Let's take the blindfold off of the Brown Bear so that he will be able to see again too.

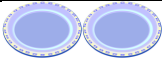









Figure e: Now, before you start finding the donut, let's ask the Brown Bear and the White Bear to help you. Brown Bear and White Bear, which box has the donut? Can you go there?


Figure f: OK. Now, can you find the donut? Which box has the donut?

APPENDIX III: TRAIL TABLE FOR THE CLASSIFIER COMPREHENSION TASK

#	CL	Objects for selections			Correct answer
1	jian	sweater	orange	boat	sweater
2	zhi	tree	rabbit	cake	rabbit
3	jian	coat	bus	chair	coat
4	jian	ball	boy	t-shirt	t-shirt
5	zhi	desk	bike	bear	bear
6	jian	girl	blouse	airplane	blouse
7	zhi	cat	book	flower	cat
8	zhi	apple	car	monkey	monkey

APPENDIX IV: THE CLASSIFIER PRODUCTION TASK

範例(example) :		
有多少 盤子? have many plate 'How many plates are there?'		兩個 (盤子) two CL _(ge) (plate) 'Two (plates).'
問題 (Question)		
1. 有多少 球? have many ball 'How many balls are there?'		三 顆/粒 (球) three CL _(ke/li) (ball) 'Three (balls).'
2. 有多少 熊? have many bear 'How many bears are there?'		四 隻 (熊) four CL _(zhi) (bear) 'Four (bears).'
3. 有多少 背心? have many blouse 'How many blouses are there?'		兩 件 (背心) two CL _(jian) (blouse) 'Two (blouses).'
4. 有多少 船? have many ship 'How many ships are there?'		三 艘 (船) three CL _(sao) (ship) 'Three (ships).'
5. 有多少 猴子? have many monkey 'How many monkeys are there?'		五 隻 (猴子) five CL _(zhi) (monkey) 'Five (monkeys).'
6. 有多少 花? have many flower 'How many flowers are there?'		三 朵 (花) three CL _(duo) (flower) 'Three (flowers).'
7. 有多少 大衣? have many coat 'How many coats are there?'		兩 件 (大衣) two CL _(jian) (coat) 'Two (coats).'
8. 有多少 橘子? have many tangerine 'How many tangerines are there?'		五 顆/粒 (橘子) five CL _(ke/li) (tangerine) 'Five (tangerines).'
9. 有多少 貓? have many cat 'How many cats are there?'		三 隻 (貓) three CL _(zhi) (cat) 'Three (cats).'

<p>10. 有 多少 T 恤 ? have many t-shirt 'How many t-shirts are there?'</p>		<p>三 件 (T 恤) three CL_(jian) (t-shirt) 'Three (t-shirts).'</p>
<p>11. 有 多少 車 ? have many car 'How many cars are there?'</p>		<p>一 輛/台 (車) one CL_(liang/tai) (car) 'One (car).'</p>
<p>12. 有 多少 兔子 ? have many rabbit 'How many rabbits are there?'</p>		<p>三 隻 (兔子) three CL_(zhi)(rabbit) 'Three (rabbits).'</p>
<p>13. 有 多少 書 ? have many book 'How many books are there?'</p>		<p>五 本 (書) five CL_(ben) (book) 'Five (books).'</p>
<p>14. 有 多少 書桌 ? have many desk 'How many desks are there?'</p>		<p>兩 張 (書桌) two CL_(zhang) (desk) 'Two (desks).'</p>
<p>15. 有 多少 毛衣 ? have many sweater 'How many sweaters are there?'</p>		<p>三 件 (毛衣) three CL_(jian) (sweater) 'Three (sweaters).'</p>
<p>16. 有 多少 腳踏車 ? have many bike 'How many bikes are there?'</p>		<p>兩 輛/台 (腳踏車) two CL_(liang/tai) (bike) 'Two (bikes).'</p>

APPENDIX V: TRIAL TABLES FOR THE JUDGMENT TASK

Pre-/Post-Training Blocks: Classifier-Cue-Insufficient Context that has an animal-cloth pair in both proximal and distal position

Block A

#	Item 1	Item 2	This/that	CL	Demand	Fulfillment	Condition
1	bear	blouse	this	zhi	this bear	this bear	Match
2	rabbit	coat	this	zhi	this rabbit	that rabbit	demonstrative
3	cat	blouse	that	jian	that blouse	that blouse	Match
4	bear	sweater	this	jian	this sweater	this bear	classifier
5	monkey	t-shirt	that	zhi	that monkey	that t-shirt	classifier
6	rabbit	blouse	that	zhi	that rabbit	that rabbit	Match
7	monkey	coat	this	jian	this coat	this coat	Match
8	rabbit	t-shirt	that	jian	that t-shirt	this t-shirt	demonstrative

Block B

#	Item 1	Item 2	This/that	CL	Demand	Fulfillment	Condition
1	rabbit	sweater	this	jian	this sweater	this sweater	Match
2	monkey	blouse	this	jian	this blouse	that blouse	demonstrative
3	cat	t-shirt	that	zhi	that cat	that cat	Match
4	monkey	sweater	this	zhi	this monkey	this monkey	Match
5	cat	coat	that	jian	that coat	that cat	classifier
6	bear	t-shirt	that	jian	that t-shirt	that t-shirt	Match
7	cat	sweater	this	zhi	this cat	this sweater	classifier
8	bear	coat	that	zhi	that bear	this bear	demonstrative

Training Block—Experimental Group: Classifier-Cue-Sufficient Context which has an animal and a cloth located in proximal and distal position respectively

#	Close	Far	This/that	CL	T/F	Demand	Fulfillment	Condition
1	sweater	cat	this	jian	T	this (sweater)	this (sweater)	Match
2	blouse	bear	that	zhi	T	that (bear)	that (bear)	Match
3	coat	cat	this	jian	F	this (coat)	that (cat)	Mismatch
4	t-shirt	monkey	that	zhi	F	that (monkey)	this (t-shirt)	Mismatch
5	rabbit	blouse	that	jian	T	that (blouse)	that (blouse)	Match
6	bear	coat	this	zhi	F	this (bear)	that (coat)	Mismatch
7	rabbit	t-shirt	that	jian	F	that (t-shirt)	this (rabbit)	Mismatch
8	monkey	sweater	this	zhi	T	this (monkey)	this (monkey)	Match

Training Block—Control Group: Control Context which has two objects that go with general classifiers located in proximal and distal position respectively.

#	Close	Far	This/that	CL	T/F	Demand	Fulfillment	Condition
1	bowl	bag	this	ge	T	this (bowl)	this (bowl)	Match
2	box	pillow	that	ge	F	that (pillow)	this (box)	Mismatch
3	cup	bowl	this	ge	F	this (cup)	that (bowl)	Mismatch
4	pot	box	that	ge	T	that (box)	that (box)	Match
5	plate	cup	this	ge	T	this (plate)	this (plate)	Match
6	clock	pot	that	ge	F	that (pot)	this (clock)	Mismatch
7	pillow	clock	that	ge	T	that (clock)	that (clock)	Match
8	bag	plate	this	ge	F	this (bag)	that (plate)	Mismatch

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