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“What is this?” Gesture as a potential cue to identify referents in discourse

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Abstract

This study explores whether caregivers follow the discourse-pragmatic principle of information status of referents (given vs. new) in their gestures and how children respond to their caregivers' gestures. Chinese and American caregivers were videotaped while interacting spontaneously with their children. Their speech and gestures were coded for referential expressions. Even though Chinese caregivers gestured more often than American caregivers, we found that both groups produced more gestures when asking their children to identify new referents than when asking their children to identify given referents. In addition, both groups of children were sensitive to the gestures accompanying new referents and using these gestures to identify the referents. Thus, we conclude that gesture serves as a potential cue for both caregivers and children to identify referents according to the discourse-pragmatic principle of information status.

In early childhood, children learning different languages have developed sensitivity to discourse-pragmatic features. For example, children learning Chinese, English, Hindi, Italian, Inuktitut, Korean, and Spanish use overt arguments like nouns to indicate new referents but less overt arguments like pronouns or even null arguments to indicate given referents (e.g., Allen, 2000; Allen & Schroder, 2003; Serratrice, 2005; Clancy, 1993; Narasimhan, Budwig & Murty, 2005; Paradis & Navarro, 2003; So, Demir & Goldin-Meadow, 2010). Interestingly, the children also displayed sensitivity to discourse in their gestures. Previous findings showed that English- and Chinese-speaking children produced gestures more often when indicating new referents than when indicating given referents (So, Demir & Goldin-Meadow, 2010).

Yet recently Guerriero, Oshima-Takane, and Kuriyama (2006) reported different results. In their longitudinal study, they followed two English-speaking and two Japanese-speaking children for more than a year (from 21 months to 36 months), observing spontaneous conversations between the children and their parents. They looked at the referential forms in speech as well as gestures (e.g., point to a referent) as a function of information status of referents. The findings showed that the speech and gestures produced by the English-speaking children showed mastery of discourse-pragmatic strategies as early as 24 months whereas those produced by the Japanese-speaking children did *not* show such sensitivity even as late as 36 months. Specifically, the Japanese-speaking children produced null arguments¹ and nouns *equally* to convey new referents. Such result is contradictory to most of the previous findings which showed that young children are sensitive to the information status of referents in discourse.

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¹Unlike English, Japanese allows optional omission of arguments. Japanese does not mark verbal agreement too but it does mark case on top of arguments. However, when argument is omitted, case marker is also omitted. Thus, recovery of null argument in Japanese is based on discourse contexts (Guerriero, et al., 2006).

Then why did the Japanese-speaking show delay in learning discourse-pragmatic strategies? Guerriero et al. (2006) suggested that it was possibly because their caregivers did not consistently use appropriate forms of referential expressions. When interacting with their children, the Japanese caregivers used *both* null arguments and nouns when representing new information. In addition, they did not supplement the null arguments referring to new information with pointing gestures². Thus, Japanese-speaking children might have learned these referential patterns from their caregivers. In contrast, the English-speaking caregivers consistently followed the discourse-pragmatic principle in their speech and gestures, using nouns more frequently than pronouns for new information and supplementing pronouns referring to new information with additional pointing gestures. The findings thus suggested that the caregivers' inputs would affect their children's development of discourse-pragmatic strategies. Children who are exposed to more variable inputs from caregivers learn discourse-pragmatic strategies later than those who are exposed to consistent inputs.

Then to what extent the caregivers follow discourse-pragmatic principles in their referential expressions? While Guerriero et al. (2006) reported that not all the caregivers used discourse appropriate strategies, Paradis and Navarro (2003)'s longitudinal study showed that caregivers did follow discourse-pragmatic principles in their referential expressions. Paradis and Navarro (2003) followed two Spanish monolingual children from 20 to 23 months and from 20 to 31 months respectively, and one Spanish-English bilingual from 21 to 30 months, observing spontaneous conversations between the children and their parents. Their findings showed that the caregivers produced nouns to indicate new referents (i.e., the referents that were not previously mentioned), referents that were absent from physical context (i.e., the referents that were not visible in a here-and-now context), referents that were in contrast (i.e., the referents that were similar to other potential referents in the forms of physical appearance or properties), and referents that were in query (i.e., the referents that were the subjects of or responses to questions).

Thus far, previous findings have not yet reached consensus of whether caregivers display sensitivity to discourse-pragmatic principles in their speech and gestures when interacting with their children. In addition, previous studies who have examined this issue involved small sample sizes (Paradis & Navarro, 2003; Guerriero, Oshima-Takane, and Kuriyama, 2006). Hence, the present study, first of all, adds to the existing literature and asks whether caregivers follow discourse-pragmatic principles during interactions with their children. We look, in particular, at the discourse-pragmatic feature of information status (given vs. new) of the referents being identified (Clancy, 1993; Greenfield & Smith, 1976). A referent needs to be specified explicitly, e.g., by gestures, when it was not previously mentioned. We ask here whether the caregivers would gesture the referent that was not previously mentioned when they ask their children to name that referent. Previous findings showed that English- and Chinese-speaking children were sensitive to discourse-pragmatic principle of information status when they were interacting with parents (So, et al., 2010). This study extends previous research, examining whether their parents (i.e., English- and Chinese-speaking caregivers) follow such principle in their speech and gesture.

Secondly, we also investigate whether children are responsive to their caregivers' pragmatic behaviors, particularly gestures. Imagine that a child has been talking to his mother about a puzzle piece and says, "I like this one." Then his mother asks the child to name the puzzle piece and says, "What is it?" Even though the mother does not point to the puzzle piece (because it is given information), the child should be clear which object the mother is asking about and be able to respond to the question. Now consider another scenario in which both

²The authors explained that Japanese caregivers did not use null and overt arguments distinctively according to the discourse-pragmatic principles because of the shared background knowledge and familiarity between the caregivers and children.

the child and his mother have not been talking about the puzzle but the mother asks him to name one of the pieces. Because the puzzle piece is new information, the mother should say, “What is it?” and point at the puzzle piece. Being guided by the pointing gesture, the child can single out which object her mother is asking about and respond to the question by either naming the puzzle or simply saying, “I don’t know”³. However, if the mother does not point to the puzzle piece, the child could not respond to the question. In the present study, we ask whether the children can respond to their caregivers’ object-identifying questions that are accompanied or not accompanied by gestures.

Altogether, the present study explores whether caregivers’ speech and gestures are sensitive to the information status of referents and whether their children are responsive to caregivers’ pragmatic behaviors. To address these issues, we videotaped Chinese-speaking caregivers in China and English-speaking caregivers in America who were spontaneously interacting with their children, and looked at the utterances that involved question-response sequences. In particular, we focused on the utterances in which caregivers asked their children to label a particular referent among all objects, e.g., “What is this?” (“*Zhe4ge shi4 shen2me le?*”); “Tell me what it is.” (*Gao4su wo3 ta1 shi4 shen2me*). And the children were expected to respond to these questions.

Method

Participants

The participants were ten Chinese and eight American children, living in Nanjing, China, and Chicago, USA, respectively, in middle-class families. The Chinese children were, on average, 4;1 (years;months) old (ranging from 2;10 to 5;3). Six of them were male and 4 of them were female. The American children were, on average, 4;2 (years;months) old (ranging from 3;7 to 5;2). Four of them were male and 4 of them were female. All but two American children had school experiences. None of the children had a major sensory or hearing problem. Families were recruited from postings and were paid for their participation.

Procedure—The children participated in free play activities and spontaneous conversations with their caregivers. For the Chinese children, five of them were interacting with their mothers, 3 of them were interacting with their fathers, and 2 with her grandparent. For the English children, five of them were interacting with their mothers, 3 of them were interacting with their fathers.

The caregivers were told that we were interested in studying caregiver-child interactions and instructed to interact naturally with the children. A standardized bag of toys, books, pictures, and puzzles was brought to each taping session to facilitate communication. Each session lasted for approximately 30 minutes and was videotaped by the experimenter who was not engaged in the conversations between caregivers and their children.

All conversations between children and caregivers were transcribed by research assistants who were native speakers of American-English or Mandarin-Chinese. In each language, all transcripts were then checked by a second coder who was a bilingual speaker in both English and Mandarin-Chinese. Breaths, pauses, and speech dysfluencies such as self-interruptions, self-corrections, and repetitions were included in the transcriptions. The stream of speech was segmented into utterances. Each utterance contains a verb (action verb or copular verb) and possibly a subject and / or an object. Utterances that contained yes-no

³The child might not necessarily be able to verbally label the referent as requested since it depends on whether the child has acquired the name of referent before. However, the gesture can help the child to understand which object the mother is referring to.

questions and corresponding responses, imitations (direct imitations or immediate self-repetitions), unintelligible sounds, songs, or poems were excluded from the analyses.

Caregivers' speech and gestures

All the caregivers were continuously engaged in conversation with their children on multiple referents in a shared physical context. For example, they were talking about various types of cars on a picture book at the same time or they were playing a toy house that was composed of various types of furniture.

We first examined how the caregivers indicated referents in their object-identifying questions⁴ and categorized each referential expression into the following categories: pronouns (e.g., *it*, *taI*), demonstrative pronouns (e.g., *this*, *Zhe4ge*), and nouns (e.g., *animal*, *dong1wu1*). Pronouns and demonstrative pronouns were considered as less overt arguments while nouns were overt arguments because personal pronouns and demonstrative pronouns are all less explicit than nouns (e.g., Guerriero, et al., 2006; So, et al., 2010). Referents were further classified according to information status: given and new (Chafe, 1994;1996). A referent was considered to be *given* if both caregiver and child were engaged in a conversation on this referent in the preceding 20 utterances and *new* if they had not talked about this in the preceding 20 utterances (Chafe, 1976; Du Bois, 1987).

We analyzed the gestures that co-occurred with the questions asked by the caregivers. These gestures can identify objects (Demir, So, Goldin-Meadow, 2006; Goldin-Meadow, 2003; McNeill, 1992, 2005; So, et al., 2010). We followed Özçalışkan & Goldin-Meadow (2005) in identifying gestures. Hand movements that involved direct manipulation of an object (e.g., placing a toy on a floor) or were part of a ritualized game (e.g., putting a puzzle in a puzzle slot) were not considered gestures. Gestures were of two types: (1) iconic gestures⁵ that bear a resemblance to the referents they represent (e.g., two hands form a circle as a reference to ball) or the actions produced by the referents (e.g., two hands flapped at shoulders, classified as a reference to bird); (2) deictic gestures that refer to objects, people, or places by signaling out the referent (e.g., index finger point to a bottle or hold-up bottle⁶, classified as a reference to bottle). The proportion of referents accompanied by gesture was calculated as the total number of referents accompanied by gesture divided by the total number of referents. All proportions were subjected to an arcsine transformation before statistical analysis.

Children's responses to the caregivers' questions

We then looked at the responses given by the children immediately after the caregivers' questions. Based on their responses produced, we considered that a child could identify which referent his/her caregiver was asking about if the child 1) named the referent in speech as requested and provided a correct answer (e.g., the caregiver was asking about the pig on the picture book and the child was saying "This is a pig"); 2) named the referent in speech as requested but provided a wrong answer (e.g., the caregiver was asking about the pig on the picture book and the child was saying "This is a dog"⁷); 3) told the caregiver he/she did not know the name of the referent (e.g., the child was saying "I don't know" or simply shaking his/her head); and 4) pointed to the referent that the caregiver was asking about.

⁴We did not include the questions that asked the children general comments or opinions, e.g., Do you like it?; What do you think?

⁵Iconic gesture is also known as characterizing or representational gestures (Gullberg, de Bot, & Volterra, 2008)

⁶Hold-up gesture does not manipulate the object but draws the interlocutor's attention (Gullberg, de Bot, & Volterra, 2008).

⁷In this example, we still considered that a child understood what the referent the caregiver was asking about given that there was no dog on the same picture book.

We considered that a child could not identify what referent his/her caregiver was asking about if the child: 1) asked the caregiver for clarification (e.g., the caregiver intended to ask about the motorbike toy but the child was not sure about it. Thus the child was saying “Which one are you talking about?”; 2) gave a random guess of referent (e.g., the caregiver intended to ask about the fire truck on the picture book but the child labeled all different types of trucks on that book); 3) simply ignored the caregiver.

We measured the proportions of time the children identified referents in their caregivers’ questions. It was calculated as the number of responses that identified the referents divided by the total number of responses. All proportions were subjected to an arcsine transformation before statistical analysis.

Reliability

A subset of each transcript (20%) in American and Chinese was independently coded by a second research assistant, who was a bilingual speaker in American and Chinese and was trained to code speech and gesture. Reliability was 98% for the American-speaking children ($N=120$) and 97% for the Chinese-speaking children ($N=140$) for identifying questions; 100% for the American-speaking children ($N=236$) and 100% for the Chinese-speaking children ($N=262$) for classifying referential expressions into categories (noun, pronoun, etc.); 90% for the American-speaking children ($N=236$) and 93% for the Chinese-speaking children ($N=262$) for determining information status of the referents; 85% for the American-speaking children ($N=236$) and 84% for the Chinese-speaking children ($N=262$) for identifying gestures; 95% for the American-speaking children ($N=201$); and 90% for the Chinese-speaking children ($N=220$) for determining types of gestures.

Results

Both the Chinese and American caregivers produced similar number of speech utterances. On average, the Chinese caregivers produced 484.56 utterances ($SD=183.22$) and the American caregivers produced 426.24 utterances ($SD=156.44$), $t(16)=1.12$, $p=ns$. We analyzed utterances in which the caregivers asked their children to identify referents. 18% ($SD=5\%$) of utterances were object-identifying questions in the Chinese caregivers while only 8% ($SD=3\%$) in the American caregivers, $t(16)=2.84$, $p=.012$. Thus, during the 30-minutes interaction, the Chinese caregivers asked their children significantly more object-identifying questions than the American caregivers.

The goals of this study were to explore the role of discourse-pragmatic feature, information status, in referential expressions in caregivers’ gestures, and whether their children were responsive to caregivers’ gestures. We first look at how discourse-pragmatic features influenced caregivers’ gestures and we then study children’s responses.

Before we take a look at caregivers’ gestures, we first examine the referential choices caregivers used to ask about referents in their questions. Both groups of caregivers tended to produce pronouns or demonstrative pronouns than nouns when asking their children to identify referents. The Chinese caregivers used pronouns or demonstrative pronouns 94% of time ($SD=.08$). Likewise, the American caregivers use them 93% of time ($SD=.06$), $t(16)=52$, $p=ns$.

More important, the information status of referents (given vs. new) did not affect the choices of referential expressions. Figure 1 shows the proportion of pronouns and nouns for given and new referents in the Chinese and American caregivers. We conducted a repeated-measure ANOVA with the proportion of pronouns that the caregivers produced as the dependent variable and information status of referents (given vs. new) as a within-subject

independent variable, and language (Chinese, American) as a between-subject independent variable. We found no effect of referential category, $F(1,16)=.003$, $p=ns$, no effect of language, $F(1,16)=.72$, $p=ns$, and no interaction, $F(1,16)=.10$, $p=ns$. Since the caregivers intentionally asked their children to label the referents in the first place, it is not surprising they mainly used pronouns or demonstrative pronouns in their questions (e.g., *Tell me what this is*). There were only a few chances the caregivers would explicitly indicate the referents in the form of nouns, e.g., “What is this animal?” (“*Zhe4ge dong1wu1 shi4 shen2me le?*”).

The question of interest is whether caregivers gestured the referents, particularly when asking about the new referents. All caregivers gestured when asking questions. Both groups of caregivers produced deictic and iconic gestures when indicating objects. However, deictic gestures were the most dominant type of gestures and they accounted for 93% ($SD=.07$) of gestures produced by the Chinese caregivers and 89% ($SD=.05$) of gestures produced by the American caregivers.

We then examined whether caregivers’ gestures followed the discourse-pragmatic principle of information status. If so, we would expect the caregivers to produce more gestures when asking about the referents that were not mentioned before than when asking about the referents that were mentioned before. Our findings confirmed this hypothesis. Figure 2 displays the proportion of referential expressions for given and new referents that were accompanied by gestures in both groups of caregivers. We conducted a repeated ANOVA with proportion of expressions accompanied by gestures as the dependent variable, and information status of referents (given vs. new) as a within-subject independent variable, and language (American, Chinese) as a between-subject independent variable. We found a significant effect of information status, $F(1,16)=18.81$, $p=.001$, a significant effect of language, $F(1,16)=12.05$, $p=.04$, and no interaction, $F(1,16)=.02$, $p=ns$. Overall, Chinese caregivers produced gestures more often than American caregivers. Yet both groups of the caregivers produced gestures more often when asking about new referents than when asking about given referents, thus following the discourse-pragmatic principle of information status.

However, not all new referents were clearly specified in gestures by both groups of the caregivers. Around 50% and 80% of new referents were left unspecified in gestures in the Chinese and American caregivers respectively. Then the final question we are going to address is whether the children were able to identify the referents, particularly those that were not mentioned before, in the absence of gestures.

Figure 3 shows the proportion of time both groups of children could identify referents. We conducted a repeated ANOVA with proportion of time children identified referents as the dependent variable, information status of referents (given vs. new) and gestures (presence vs. absence) as within-subject independent variables, and language (American, Chinese) as a between-subject independent variable. We found a significant effect of information status of referents, $F(1,16)=10.65$, $p=.005$, a significant effect of gesture, $F(1,16)=67.59$, $p<.001$, insignificant effect of language, $F(1,16)=.71$, $p=ns$, a significant interaction between information status of referents and gesture, $F(1,16)=15.85$, $p=.001$, no interaction between information status of referents and language, $F(1, 16)=1.67$, $p=ns$, and no interaction between gestures and language, $F(1, 16)=.10$, $p=ns$.

In general, both groups of children were more able to identify given referents than new referents. This is not surprising as both caregivers and children were engaging in conversations on given referents. Children tended to be more likely to identify given referents with gestures than given referents without gestures. However, the difference was not significant, Chinese: $t(9)=1.89$, $p=ns$; American: $t(7)=.18$, $p=ns$. When asked about the

new referents, children were more able to identify the referents that were accompanied by gestures than the referents that were not accompanied by any gestures, Chinese: $t(9)=4.57, p=.001$; American: $t(7)=4.56, p=.003$.

Putting new and given referents together, both groups of children were *equally* able to identify new referents that were accompanied by gestures and given referents (with or without gestures). Paired sample t-tests showed that the proportion of time children could identify referents did not differ between new referents with gestures and given referents with or without gestures, Chinese: new referents with gestures vs. given referents with gestures, $t(9)=.87, p=ns$; new referents with gestures vs. given referents without gestures, $t(9)=.58, p=ns$; American: new referents with gestures vs. given referents with gestures, $t(7)=1.75, p=ns$; new referents with gestures vs. given referents without gestures, $t(9)=2.26, p=ns$.

To summarize, both Chinese and American children were responsive to their caregivers' discourse-appropriate gestures. When those gestures were absent, children were less likely to identify the new referents.

Discussion

Our study explored whether Chinese and American caregivers displayed sensitivity to the discourse-pragmatic principle – information status of referents in their gestures when they asked their children to identify those referents. We also examined whether children were responsive to their caregivers' gestures. In terms of caregivers, we found that the Chinese caregivers asked their children to name the referents significantly more often than the American caregivers. More important, the Chinese caregivers also produced significantly more gestures when asking those questions. However, both groups of the caregivers showed the same level of sensitivity to the information status of referents in their gestures. Specifically, they produced more gestures in their questions when asking about the new referents than when asking about the given referents. The findings also showed that the Chinese and American children were responsive to their caregivers' gestures, particularly those accompanying the new referents. Both groups of children were more able to identify the new referents when these referents were accompanied by gestures than when they were not accompanied by gestures. However, they did not show such difference when identifying the given referents accompanied by gestures and those references not accompanied by gestures.

Previous research has shown that Chinese caregivers always ask their children test questions about the referents like *Zhe4ge4 shi4 shen2me?* (*What is this?*) (Tardif, Gelman & Xu, 1999). They are also more likely to gesture the referent than the American caregivers. Our findings replicated previous research that showed Chinese caregivers gestured more often than American caregivers when interacting with children at homes (Goldin-Meadow and Saltzman, 2000)⁸. The reason for cultural difference in gesture rate is unknown, but it is possible that Chinese and American caregivers socialize their children differently. Perhaps Chinese caregivers gesture more to reflect their heightened interest to instruct their children. For example, a Chinese caregiver points to a bird on the book while saying “What is it?” and expects the child to label the referent (bird) “on demand”. In addition, Chinese caregivers might have an explicit goal for what kinds of referent names their children should have acquired. For example, one of the Chinese caregivers in our study *purposefully* “tested” the names of referents her child had acquired in school. Compared to Chinese caregivers, American caregivers test their children less often. Even when they ask their children to name

⁸There was no difference in the amount and complexity of speech produced by the Chinese and American caregivers when they were interacting with their children.

a particular referent, they seldom point to it. It probably suggests that American caregivers treat their children as active learners who acquire knowledge through discovery, exploration, and play (Gardner, 1989).

Even though the Chinese caregivers were more likely to point to the target referents than the American caregivers, their gestures appeared to be as sensitive to the information status of referents as the American caregivers'. It shows that caregivers follow discourse-pragmatic principle of information status, despite of the cross-cultural differences in gesture frequency. Besides the information status of referents, caregivers might adjust their gestures based on other discourse-pragmatic features like contrast of referents (Greenfield & Smith, 1976; Clancy, 1993). Specifically, caregivers should produce more gestures when contrasting the target referents against the other referents than when referring to a single referent in a shared physical context. We did not investigate the role of contrast in gestures in this study because almost all the time caregivers were engaged in conversations with their children on multiple referents in a shared physical context. Further study should address this issue by controlling the number of referents in an experimental setting and look at whether caregivers would change their gesture behavior accordingly.

More importantly, we also found that both groups of children were sensitive to their caregivers' gestures and made use of these gestures to identify the referents, particularly those that were not mentioned before. It turns out that they were equally likely to identify the new referents with gestures and given referents (with or without gestures). Thus, the children were paying attention to discourse-pragmatic information in their caregivers' gestures.

Previous findings reported that young children learning different languages *produce* speech and gestures in line with language-specific discourse-pragmatic principles (e.g., Allen & Schroder, 2003; Clancy, 1993; Serratrice, 2005; So, et al., 2010). Our finding further suggested that young children could *comprehend* information from discourse-appropriate gestures in order to identify the referents as requested. Such finding fits in with previous work on gesture showing that interpretation of speech can be affected by gestures. Specifically, gestures accompanying speech can help a listener to comprehend a message (Beattie & Shovelton, 1999; Driskell & Radtke, 2003; Kelly & Church, 1998). For example, when listening to a story, listeners decode the information of size and shape of objects, and direction and manner of movements in speakers' gestures (Beattie & Shovelton, 1999a, 1999b, and 2001). In addition, listeners can combine the information conveyed in speech and gestures to form an integrated message (Goldin-Meadow & Singer, 2003; McNeill, 2005). For example, teachers combine the solutions of conservation and mathematical equivalence problems conveyed in children's speech and gestures (see review in Goldin-Meadow, 2003). Our findings build on this research by extending the phenomenon to the comprehension of information in discourse by gestures.

However, children in our study were more attentive to the gestures when they were accompanying new referents than when they were accompanying given referents. The gestures accompanying given referents did not further increase the proportion of time the children responded to their caregivers. On the one hand, such finding is not surprising because the given referents were sufficiently informative for the children to identify them. Thus, gestures did not provide further assistance to the children under this circumstance⁹.

⁹Note that the proportions of time both groups of the children identified given referents were close to 80% even when the given referents were not accompanied by gestures. So probably the children's performance was almost reaching the ceiling even when gestures were not available.

On the other hand, it highlights that children are selectively paying attention to gestures when it is necessary, i.e., when the referents were not mentioned before.

Our findings have clinical implications. Some children, e.g., aphasic children, might have difficulty in understanding speech. Given that gestures help normally developing children to comprehend speech, it should also help children with aphasia understand what is being said to them. In addition, previous studies have shown that children whose language development is impaired for a variety of reasons (focal brain injury: Sauer, Levine & Goldin-Meadow, 2009; Downs syndrome: Caselli, Vicari, Longobardi, Lami, Pizzoli, & Stella, 1998; Stefanini, Caselli, & Volterra, 2007; Stefanini, Recchia, & Caselli, 2008; Specific Language Impairment: Evans, Alibali & McNeill, 2001; Fex & Mansson, 1998) use gestures to compensate for their communicative deficiencies. We would expect that those gestures do not only facilitate communication but also comprehension of speech among language-impaired children.

To summarize, we have found that caregivers use gesture to identify referents and do so in accordance with discourse-pragmatic principle. They use gestures more often when indicating new referents than when indicating given referents. Moreover, their children selectively pick up information from the gestures to identify referents. Thus, gesture serves as a potential cue for both the caregivers and children to identify referents according to discourse-pragmatic principle.

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Chinese caregivers

American caregivers

Figure 1.
The distribution of pronouns (black bars) and nouns (white bars) referring to new referents (left) and given referents (right) produced by the Chinese caregivers (top) and the American caregivers (bottom)

Figure 2.
The proportion of referential expressions indicating given referents (left) and new referents (right) accompanied by gestures produced by the Chinese caregivers (black bars) and the American caregivers (white bars)

Chinese children

American children

Figure 3.

The proportion of times that the Chinese children (top) and American children (bottom) identified new referents (left) and given referents (right) when they were accompanied by gestures (black bars) and when they were not accompanied by gestures (white bars)