Introduction

Adults’ behavior toward infants has a strong commonality across cultures. Contingent turn-taking with eye-contact, for example, is known to be an important factor in mother-infant interactions (Csibra, 2010; Csibra & Gergely, 2009). Speech directed at infants, “infant-directed speech” (IDS), is characterized by high pitch, short length of utterances, exaggerated intonation contours, and content simplification (e.g., Fernald, 1985; Stern, Spieker, & MacKain, 1982). Adults’ object-related actions with infants, “infant-directed actions” (IDA), are typically slow and involve high levels of repetition and exaggerated movements
A recent theory, Natural Pedagogy, has focused on these adult behaviors as ostensive cues that signal the occurrence of learning situations (Csibra & Gergely, 2006, 2009). According to this theory, human infants are adapted to transfer relevant cultural knowledge spontaneously and quickly through a human social learning system.

Ostensive cues overtly indicate the communicative intention to manifest new and relevant information. Previous studies that have examined the effect of ostensive cues have reported that infants tend to follow gaze shifts only when they are preceded by an ostensive cue such as a directed gaze or infant-directed speech (Gliga & Csibra, 2009; Senju & Csibra, 2008). In those studies, which were conducted in controlled laboratory settings, infants’ gaze toward a video-monitor which displayed cues produced by an actor was measured. In daily life, however, mothers use cues in a non-controlled way. Although mother-infant interactions and communication play a critical role in social cognitive learning during infancy, there has not been much research on effects of daily usage of ostensive cues. Observing the ostensive cues mothers use should clarify the influence of the cues on their infants’ behavioral change.

Infants with autistic disorder are known to have difficulty in social interactions and communication. Many previous studies have demonstrated that infants with autistic disorder differ from infants with typical development with respect to orienting to their name, looking at the faces of others, joint attention, and affect sharing (e.g., Baranek, 1999; Stone, Ousley, Yoder, Hogan, & Hepburn, 1997; Werner, Dawson, Osterling, & Dinno, 2000; Wetherby, Woods, Allen, Cleary, Dickinson, & Lord, 2004). Because of such differences, ostensive cues might have a smaller effect with infants with autistic disorder compared to infants with typical development. The theory of natural pedagogy hypothesizes that infants have a natural sensitivity to ostensive cues. However, it does not mention autistic disorder specifically. An understanding of effects of ostensive cues on infants with autistic disorder may lead to a means of intervention.

The present study investigated the frequency and types of ostensive cues used by two mothers, and compared the responses of an infant with autistic disorder and an infant with typical development. Some research has demonstrated that mother-infant interactions vary extensively across situations (e.g., Reissland, Shepherd, & Stephenson, 1999). Play and eating are common kinds of interactions with infants at home. Thus, those two conditions were chosen for observation in the present study. For both conditions, two kinds of objects were compared, those that the infants liked and disliked, because disliked objects should be more suitable for investigating learning situations than liked ones. Thus, the present study compared two conditions (play and eating) and two stimuli (liked and disliked) in an infant with autistic disorder and an infant with typical development.
Method

Participants

Two mother-infant dyads participated in this study. Both infants were one-year-old boys. Based on the classification of the Autism Diagnostic Observation Schedule (ADOS; Lord, Risi, Lambrecht, Cook, Leventhal, DiLavore, Pickles, & Rutter, 2000), one infant was an infant with autistic disorder, whereas the other was not (infant with typical development). Both infants had no developmental delays according to the Bayley Scales of Infant and Toddler Development—Third Edition. Informed consent was given by both mothers. The present study was approved by the Institutional Review Board for Clinical Research at Osaka University Hospital.

Setting

The study was conducted in a quiet and plain-looking room at Osaka University. In the room, there was a rectangular table, a chair for the infant, and two video cameras. One video camera was focused on the mother and the other on the infant.

Procedure

The mother-infant interactions of each pair of participants were recorded for approximately 20 minutes on one day.

The observation procedure consisted of two semi-structured conditions: play and eating. Each pair sat facing each other diagonally at the corners of the table. The infant was seated in the chair; the mother was seated on the floor. Each condition was videotaped for approximately 10 minutes. The order of conditions was counterbalanced across the two participants. Irrespective of the condition, the mothers were instructed to interact with their infants as usual, while following the researchers’ instructions.

For the play condition, two kinds of toys were brought from home by the mother. One was a toy that the infant liked, and the other, a toy that he disliked, based on the judgment of his mother. Both of the toys were placed on the table in front of the infant. The mother was instructed to encourage her infant to play with both toys for the same amount of time. If the infant did not want to play with one of the toys, the mother was instructed to encourage her son to become interested in it, but she was told not to force him to play with it.

In the eating condition, two kinds of food were prepared at home and brought to the experimental room by the infants’ mothers. As in the play condition, one was a food that the infant liked, and the other, a food that he disliked, based on the judgment of his mother. Both of the foods were placed on the table in the same way as in the play condition. The mother was instructed to encourage her infant to eat the same amount of both foods for the same amount of time. If the infant did not feed himself, the mother was instructed to attempt
to feed her son, but she was told not to force him to eat the food.

**Coding**

The mothers’ cues and infants’ responses to the cues were coded from the videotapes. In order to ensure that the interactions were like those that each mother-infant pair ordinarily had, the interactions during the first 5 minutes of each condition were excluded from the analysis, because the infants may have been tense during that period. Thus, only the latter 5 minutes of each condition were analyzed. The coding categories were as follows:

**Mothers’ Cues**

Only the behavior the mothers used in order to direct their infants’ attention was coded as mothers’ cues. The mothers’ cues in each condition were coded in six categories: infant-directed speech, calling the infant’s name, saying the object’s name, infant-directed action, pointing, and raising the eyebrows.

Infant-directed speech was defined as the mother’s speech to her infant when it was characterized by a higher and broader pitch, amplitude variation, and lower speed (Fernald, 1985). In the case of continuous utterances for which it was difficult to determine a cut-off point, the utterance was divided for analysis if there was a pause longer than one second and/or a complete sentence was formed (Reissland et al., 1999). “Calling the infant’s name” was defined as the behavior when the mother called her infant by his name. “Saying the object’s name” was defined as the behavior when the mother said the name of the object that she wanted to direct her infant’s attention to. Infant-directed action was defined as the mother’s general behavior when using objects as demonstrations, especially the following six components: closer proximity to the infant, higher interactiveness, more enthusiasm, simplified sequences, more repetition, and increased amplitude of movement (Brand, Baldwin, & Ashburn, 2002). “Pointing” was defined as the behavior when the mother pointed to an object with her index finger. “Raising her eyebrows” was defined as the behavior when the mother raised her eyebrows.

The mother’s cues were recorded in relation to the onset and offset times for all the categories in each condition, according to the method of sampling all occurrences of behavior (Altmann, 1974). Next, the number of times each of the six cues occurred was counted. If a mother’s cue simultaneously included multiple elements, all the overlapping elements were counted separately. Additionally, the number of overlapping cues was also counted. For example, if a mother said the name of her infant in a high-pitched voice with emphasized intonation, it was coded as both “calling the infant’s name” and “infant-directed speech”, and the tally was two overlapping cues.

**Infant’s Responses to Mother’s Cue**

Previous studies that have experimentally examined the effect of ostensive
cues measured gaze shift to a monitor on which ostensive cues were shown (e.g., Gliga & Csibra, 2009; Senju & Csibra, 2008). In the present study, we explored effects of the mothers’ ostensive cues on their infants’ behavior in actual face-to-face interactions. The infants’ responses to each cue from their mothers were divided into two categories: positive and negative. The detailed procedure of coding each infant’s responses is described as follows.

First, all the infants’ gazes and actions (i.e., touching and eating) were coded. In other words, what the infant looked at (liked object, disliked object, or his mother) and what the infant touched or ate (liked or disliked object) in each condition, were recorded in terms of the onset and offset times of that behavior. Next, any of the infant’s behavior that occurred within 3 seconds after his mother’s cue was categorized as either positive or negative. Positive responses were defined as a positive change in the infant’s behavior, determined by comparing his behavior before and after his mother’s cue. Conversely, negative responses were defined as a lack of change in the infant’s behavior from before to after the mother’s cue.

For example, while the infant played with toy A, his mother demonstrated how to play with toy B. If, within 3 seconds, the infant looked at and/or played with toy B, the response was coded as positive. On the other hand, if the mother said, “Look at this,” and pointed to toy B while the infant was looking at a toy A, and, within 3 seconds, the infant did not look at toy B, the response was coded as negative.

As a reliability check, another coder independently coded 20% of the data. Inter-rater reliability was sufficient (Cohen’s $\kappa$ coefficient = 0.73).

Results

Mother’s Cues

Each mother’s cues were analyzed and counted in each condition (Table 1). Both mothers used infant-directed action and infant-directed speech frequently,
whereas they were rarely observed to raise their eyebrows. A comparison of each mother’s cues in the play and eating conditions revealed that both mothers used ostensive cues less frequently in the eating condition than in the play condition. The mother of the infant with autistic disorder used ostensive cues more frequently than the mother of the infant with typical development in the play condition. Calling the infant’s name and pointing were observed mainly in the mother of the infant with typical development in the play condition, whereas, in that same condition, infant-directed action was observed more frequently in the mother of the infant with autistic disorder.

The total number of the mothers’ cues was counted with respect to each object (i.e., liked and disliked) (Fig. 1). All cues except raising their eyebrows were demonstrated by the mothers more frequently for the disliked object than for the liked one. Regarding the disliked objects, infant-directed action was most frequently used, followed by calling the infant’s name and infant-directed speech.

Overlapping occurrences of ostensive cues were often observed, especially in the play condition (Table 2). In the eating condition, on the other hand, both mothers tended to use cues that fell in only one category (i.e., there were no overlapping cues).

![Figure 1](image_url)  
**FIG. 1**  Number of Mothers’ Cues Toward Two Objects  
*Note.*  IDS = Infant-directed speech; IDA = Infant-directed action.
The differences in the infants’ responses to their mothers’ cues were also analyzed. As described above, the mothers’ ostensive cues often overlapped; infant-directed speech and infant-directed action were the cues that most frequently overlapped other cues. Thus, the responses of the infants to infant-directed speech and infant-directed actions were analyzed. The responses of both infants to their mother’s cues were similar: positive responses accounted for about 60 percent of all responses (Table 3).

### Discussion

The present study suggests that, in mother-infant interactions, mothers use ostensive cues in order to direct the attention of their infants. In the present study, unlike experimental demonstrations in previous studies, it was found that the ostensive cues used naturally by the mothers were varied and often overlapped, especially in the play condition.
In the eating condition, on the other hand, infant-directed actions made up a majority of the cues, and fewer overlapping cues were observed. These findings suggest that the mothers tended to remain relatively inactive and wait while their infants finished eating. This may have been because the eating condition had an obvious purpose.

According to Csibra (2010), all kinds of ostensive cues tend to elicit positive affective responses; this statement is consistent with the present results. In the present study, both mothers used cues, and the cues were directed more frequently toward their infant’s dislikes. In other words, the mothers may have used an ostensive cue to induce a positive feeling in their infants toward something that their infant disliked or found uninteresting, especially when they expected that the infant’s positive feeling would result in an increase in the infant’s attention toward the object.

When the mothers were directing their infants’ attention, infant-directed action was the cue used most frequently. Infant-directed action may assist infants directly in gaining access to the meaning of their mother’s actions and help them to recognize the goals and intentions that motivate action (Brand et al., 2002; Koterba & Iverson, 2009). In contrast, in this study, the mothers were rarely observed to raise their eyebrows, although previous studies have reported that this cue is a useful sign for observing affect (e.g., Schelde & Hertz, 1994). This might be the result of cultural differences, because Asians, particularly Japanese, tend to be less expressive with their faces than Americans (Matsumoto, Consolacion, Yamada, Suzuki, Franklin, Paul, Ray, & Uchida, 2002). A cross-cultural study might provide evidence about cultural differences in facial expressions, including raised eyebrows.

A comparison of the two mothers’ cues with their infants revealed that different patterns were observed; however, the infants’ responses showed similar patterns. The strategies for directing their infant’s attention differed between the mother of the infant with autistic disorder and the mother of the infant with typical development. The mother of the infant with autistic disorder showed more frequent ostensive cues compared to the mother of the infant with typical development.

There was also a difference in the type of cues that the mothers used. In particular, in the play condition, where various kinds of ostensive cues were observed, the mother of the infant with typical development often called the infant’s name and pointed. On the other hand, the mother of the infant with autistic disorder was more likely to use a visible and direct cue (i.e., infant-directed action). The present findings are similar to previous reports that infants with autistic disorder have weak social responses to having their name called and pointing (e.g., Wetherby et al., 2004). It is possible that each mother intuitively and/or empirically chooses an “optimum” cue, depending on her infant’s characteristics (i.e., she chooses a cue that is more likely to elicit a response from her infant).
Ostensive Cues in Mother-Infant Interaction

On the other hand, the responses by both infants were similar. On the surface, this result is inconsistent with previous findings, which reported fewer social responses by infants with autistic disorder (Mundy, Sigman, & Kasari, 1990; Stone et al., 1997). However, in the present study, the two mothers presented different kinds of cues to their infants. As described above, pointing and calling the infant’s name were used frequently by the mother of the infant with typical development, but less frequently by the mother of the infant with autistic disorder. It is possible that infants might show similar responses to cues if the cues were appropriate for each infant.

The present findings are limited with regard to generalizability because this is a case study. If future research attempts to replicate the present results, larger samples should be observed. Nevertheless, the present study is the first report of its kind regarding effects of mothers’ ostensive cues. The present results contribute to previous findings on ostensive cues (e.g., Csibra, 2010). In the present study, the responses of the infant with autistic disorder were similar to those of the infant with typical development when “optimum” cues were used.

In interventional therapy for infants with autistic disorder, ostensive cues can be used effectively to direct their attention. Further studies of various types of ostensive cues may contribute to the development of early intervention therapy that includes effective means for improving the social responses of infants with autistic disorder.

References


—Received August 8, 2011; Accepted December 10, 2011—