

Mother-Infant Interaction of Chimpanzees During the Presentation of Unfamiliar Objects: Evidence for Social Referencing in Chimpanzees

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ABSTRACT

Captive mother-infant chimpanzee pairs were observed in order to investigate the interaction between mother chimpanzees and infant chimpanzees during the presentation of unfamiliar objects. It was found that the infant chimpanzees' responses to the objects were affected by the attention their mothers paid to the objects. It is argued that these data imply social referencing in infant chimpanzees that is closely related to that of human infants.

There are many reports of "social referencing" in human infants (Campos & Stenberg, 1983; Feinman, 1982, 1983; Rosen, Adamson, & Bakeman, 1992; Walden & Baxter, 1989). Social referencing was defined by Feinman (1982) as one person using another person's appraisal of a situation in order to form an understanding or interpretation of that situation. Such referencing occurs with unfamiliar objects, strangers, or in ambiguous situations, for example, visual cliff situation (Bretherton, 1984; Campos, 1983; Feinman, 1982; Feinman and Lewis, 1983; Sorce, Emde, Campos, and Klinnert, 1985). Is social referencing then shown in non-human primates? How about in chimpanzees? A lot of works support the findings that chimpanzees' cognitive abilities, including language, are similar to those of humans (Itakura, 1992a, b; Matsuzawa, 1986; Premack, 1976; Rumbaugh, 1977; Savage-Rumbaugh, 1986). The ability of chimpanzees to follow the direction of another's gaze had been reported by Menzel & Halperin (1975) and Byrne & Whiten (1991). Chimpanzees could also infer another person's mental state and choose appropriate behavior (Premack & Woodruff, 1978), so they were said to have a "theory of mind." These social-cognition abilities seem to have a strong relationship with social referencing. From the developmental perspective, Plooji (1983) reported that the infant chimpanzees vocalized more toward adults or showed a fear of selected adults strangers. This was evidence that infants differentiated adults from juveniles, and furthermore, that they recognized some individuals. In non-human primates, there is only one report which

shows evidence for social referencing in a chimpanzee (Evans and Tomasello, 1986). They observed a captive chimpanzee group in order to investigate the effect of the mother's relationship with other female adults on the interaction of her offspring with those adults. According to Evans' and Tomasello's observations, infant chimpanzees' social interactions were affected by their mother's relationship with other adult group members. They concluded that infant and juvenile chimpanzees possess a social-cognitive ability to discern their mothers' relationships to various individuals and to adjust their behavior accordingly.

In the experiments of social referencing in human infants, unfamiliar objects, such as toys, strangers, or special situations, visual cliff were used as stimuli. In the present study, unfamiliar objects were used as stimuli and we investigated how the infant chimpanzees and mother chimpanzees responded to the stimuli and what kind of interactions occurred between infants and mothers.

METHOD

Subjects

Six pairs of mother-infant chimpanzees in the KUMAMOTO RESEARCH INSTITUTE OF SANWA KAGAKU KENKYUSHO CO. LTD. The mean age of mother chimpanzees was 17.7 year olds and that of infant chimpanzees was 24.3 month old (see Table 1). All infant chimpanzees were born in captivity.

Table 1 List of mother-infant pairs

Mother	Age at test in years	infant	Age at test in months
Yoshiko	22	Yshizu	35
Aki	19	Azuki	29
Kumiko	16	Koni	29
Mina	18	Minato	18
Ichigo	13	Goku	18
Miko	18	Mikota	17

Each mother-infant pair was housed in a 3.5 m x 2.0 m compound, with access to a small room. During the day time, the chimpanzees were in the large room and during the night time they slept in the small room.

Stimuli

Three unfamiliar objects, as follows, were used as novel stimuli. 1) a toy dog which could walk and bark, 2) a toy bear which could walk, blow a whistle, and hit a drum, 3) a radio controlled car which could make the sound of an engine. All stimuli were completely novel to the subjects.

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Procedure

Experiments started with the presentation of one of three stimuli to the mother-infant pair by putting it at the front of the cage. The distance of the position of the stimulus was just 1 m from the front of the cage. The chimpanzee could not reach the stimulus. The stimulus was presented for 150 sec per session. Five sessions were conducted for each pair, so the total sessions were 30. The toy dog and radio controlled car were used for two sessions each and the toy bear was used for one session, because the two former stimuli were more effective in inducing the response of the chimpanzee than the later one.

The whole session was videotaped starting 1 min prior to the session until 1 min following the end of session. Two students who did not know the purpose of this experiment were employed to analyze the behavior from the videotape. Over all agreement was 87%.

RESULTS

When the experimenters appeared at the front of the cage, mother chimpanzees usually stayed at the end of the cage and were not interested in the experimenter, because they were completely habituated to humans. On the other hand, infant chimpanzees came to the front of the cage and looked at the experimenters.

The mean looking time of mother and infant during the time the objects were presented to the subjects are shown in Figure 1.

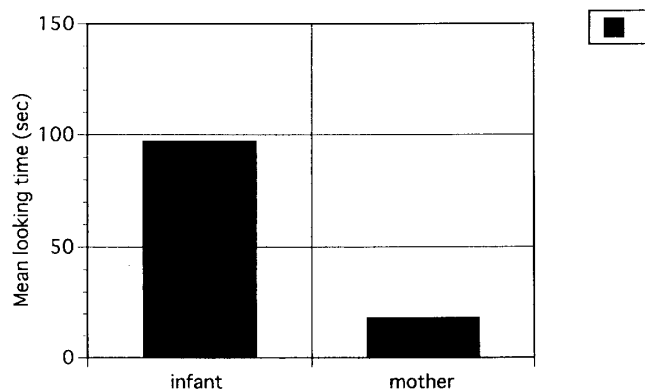


Figure 1 Mean looking time of mother and infant chimpanzees when the objects were presented.

Infant chimpanzees looked at the objects significantly longer than mother chimpanzees ($F=39.2$, $df=1$, $p<0.01$). Generally, infants may be more curious than adults. The number of sessions in which the infants came to look at the stimuli was 29 of 30 sessions, and that of the mothers was 12 of 30 sessions. This revealed that whenever objects were presented, infants came to look at them. Infant chimpanzees were habituated to the

stimulus on the fifth (last) session. The percentage of looking time was 30% in the fifth session (e.g. 1st-65.3%; 2nd-66.8%; 3rd-73.3%; 4th-61.1%).

Figure 2 shows the mean social referencing behavior (turning and looking at the mother or returning to the mother) of infants per minute under the two following conditions, those with the stimulus and those without the stimulus.

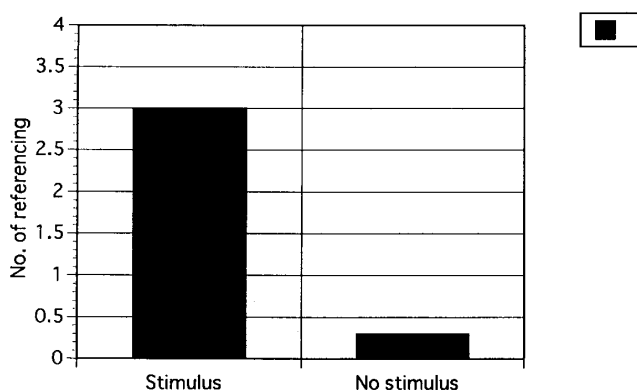


Figure 2 Mean number of referencings of infant chimpanzees to mother chimpanzees.

Infant chimpanzees tended to turn to their mother or return to their mother when the stimulus was presented. Such behavior is more significantly frequent than without the stimulus ($F=4.89$, $df=1$, $p<0.01$). Figure 3 shows what causes made the mother chimpanzees look at the stimuli.

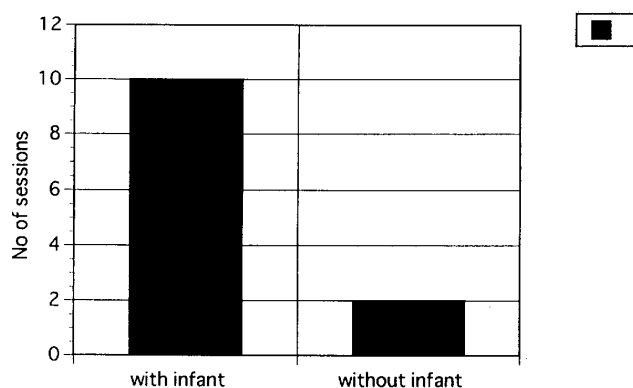


Figure 3 Mother chimpanzees' times of looking at the object under two conditions with infant chimpanzees or without infant chimpanzees.

Mother chimpanzees came to look at the stimuli in 12 sessions of a total 30 sessions and only 2 of the 12 sessions were spontaneous ($x=5.33$, $df=1$, $p<0.05$). Mother chimpanzees looked at the stimuli after infants turned to or returned to their mothers.

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These results revealed that novel stimuli induced the interactions between mothers and infants.

Figure 4 shows that the behavior of infants was affected by the responses of mothers. Most of the infant chimpanzees followed their mothers when their mothers returned to the place where they were usually positioned, the end of the cage, after looking at the stimulus (9 sessions of 12 sessions, $x=3.0$, $df=1$, $p<0.10$).

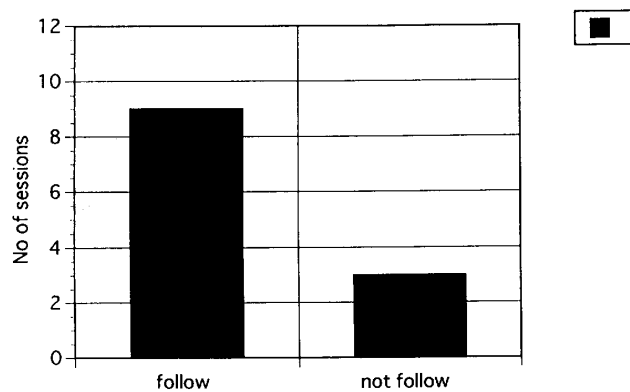


Figure 4 Infant chimpanzees' behavior after the mother was gone.

DISCUSSION

In this study, there are three main findings concerning the mother-infant interaction of chimpanzees during the presentation of unfamiliar objects. First, infant chimpanzees looked at the novel stimuli longer than mother chimpanzees. The general curiosity of younger chimpanzee seems to be higher than older ones. However, such curiosity disappeared session by session. Second, interactions between mother chimpanzees and infant chimpanzees were induced by the presentation of unfamiliar objects. For example, infant chimpanzees' referencing behavior to their mothers was increased after the presentation of unfamiliar objects. On the other hand, mother chimpanzees did not come to look at the stimuli spontaneously. They seemed to look at the object because of their children. Third, infants' responses to the stimuli were affected by the mothers' responses to the stimuli.

From the perspective of social referencing, we also found evidence of social referencing in chimpanzees in situations which were different from Evans's and Tomasello's (Evans and Tomasello, 1986). In our study, infant chimpanzees sought the information from their mothers when unfamiliar objects were presented and their responses to the unfamiliar objects were affected by their mothers' responses to the objects. In the case of human infants, they can understand the emotions of their mothers' from the facial expressions,

and they use such information to form interpretations of the objects or persons or situations by themselves (Campos, 1983). However, Ozawa and Shimojo (1993) suggested the possibility that the "attentional factor" was more important than the "emotional factor" in social referencing. In other words, the infants' regulation of behavior was affected by the mothers' attention to the objects, the infants' attention to the mothers' behavior, and the mothers' responses to the infant rather than the mothers' emotional state.

In light of this, it seems that the attention factor explains well our chimpanzees' behavior. In our experiment situations, mother chimpanzees never expressed any emotional behavior to the objects. Their behavior was either just looking at the stimulus or not looking at it. Shortly after they paid attention or did not pay attention to the stimulus or lost their interest in the stimulus after looking at it. The level of attention must have changed, and the behavior of infant chimpanzees seemed to be affected by the attention level of their mothers. That is suggested by the fact that infant chimpanzees followed their mothers within 5 sec when their mother went back to the usual position in the cage after looking at the stimulus. There was one episode which might support the attention factor, which occurred in Miko (mother) and Mikota (infant) pair. That was the first session with the radio controlled car. Mikota was looking at the stimulus and then Miko came to Mikota and took him away immediately. Mikota came back to the front of the cage at once and looked at the stimulus again. Although Miko went back to Mikota once again, she went back to the first place. Then Mikota followed his mother at once and did not come back to the stimulus. If the infant's behavior is affected by the mother's emotion, negative or positive, Mikota would not come back to the stimulus when Miko took him away, because Miko's behavior, which was taking Mikota away, was a negative reaction to the object. Mikota regulated his behavior according to his mother's attention rather than her emotional state. These mother-infant interactions were reciprocal. Though mother chimpanzees did not look at the object spontaneously, the infant's incentive behavior induced the mother's attention.

In conclusion, we found evidence for social referencing in chimpanzees as did Evans and Tomasello (1986). However, infant chimpanzees referred to their mothers' attention level rather than to her emotional state, unlike those reported in human infants. We suggest that the possibility of the hierarchy of cue, such as the mothers' attention level or emotional state, should be referred to in social referencing situations. Such a possibility may be helpful in understanding the social referencing phenomena in human and non-human primates. More sophisticated experimental approaches are needed to make definitive conclusions.

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