

Maternal Separation and Reunion of an Infant Orang-utan

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ABSTRACT. An orang-utan mother-infant dyad was studied for effects of separation and reunion upon the infant's behavior and the mother-infant relationship. Data were obtained during two weeks each of pre-separation, separation and reunion. Typical reflections of protest and despair were observed in the infant during separation. Initial detachment and a subsequent intensification of the mother-infant relationship occurred following reunion. The results are consistent with the view that these reactions to separation and reunion are characteristics of the biological heritage of the *Primates*. Failure to observe detachment in most monkeys that have been studied seems to reflect differences between the behavior of monkey mothers, on the one hand, and great ape and human mothers, on the other hand, in response to the conditions of testing.

INTRODUCTION

Considerable research has been directed toward evaluating the infant monkey's response to separation from its mother for more than a brief period of time (MCKENNA, 1979; MINEKA & SUOMI, 1978; REITE, 1977). Interest in this issue was provoked in part by a behavior syndrome originally described for human children separated from their mothers. SPITZ (1946) described a biphasic reaction to maternal separation consisting of an initial phase of fear and crying followed by a phase of depression and reduced activity. ROBERTSON and BOWLBY (1952) and BOWLBY (1960) expanded on this and identified three phases of response to maternal separation in human infants: (1) a *protest* phase, characterized by agitation; (2) a *despair* phase of reduced activity, social withdrawal and depressed posture; and (3) a *detachment* phase in which the infant established new social relationships and showed a rejection or hostility toward the mother upon reunion. Laboratory studies on several species of monkey reported behavioral reactions comparable to the protest and despair reactions of children (HINDE, SPENCER-BOOTH & BRUCE, 1966; JENSEN & TOLMAN, 1962; ROSENBLUM & KAUFMAN, 1968; SEAY, HANSEN & HARLOW, 1962; SEAY & HARLOW, 1965) but until recently, few data were reported showing detachment by a nonhuman primate infant upon reunion with its mother (PLIMPTON & ROSENBLUM, in press).

Limited but suggestive evidence of detachment in infants of one species of great ape, the lowland gorilla, was presented. In one case, a 9-month-old female, separated from its mother for three months, rejected the initial approaches of its mother at reunion (NADLER & GREEN, 1975). The mother persisted, however, and successfully retrieved the infant after several minutes of infant resistance. In a study of three mother and infant gorilla dyads living in a social group with an adult male, removal of the infants from the group when the infants were 2 years of age resulted in typical reactions of protest and despair (HOFF et al., 1979). When the infants were returned after approximately six months, they initially avoided their mothers and stayed in close contact with one another. When mother-infant contact subsequently was reestablished, heightened attachment was evident for several weeks. Although

these reactions to maternal separation are commonly observed, they may vary somewhat, depending on species, age, developmental stage and environmental conditions (LEWIS et al., 1976; MCKENNA, 1979).

The present study was conducted on an orang-utan mother and infant as part of an ongoing investigation of mother-infant relations and infant development in the great apes (HOFF, NADLER & MAPLE, 1981; MILLER & NADLER, in press). The objectives were to (1) document the responses to maternal separation and reunion in a second (in addition to the gorilla) species intermediate biologically to the monkey and human, (2) determine whether such responses are more closely related to responses of the human than are those of monkeys, and (3) determine whether a juvenile male orang-utan could serve as a surrogate parent for a separated infant, i.e., whether the male would "adopt" the infant.

METHODS

SUBJECTS

The subjects were one wild-born, multiparous female Sumatran orang-utan (*Pongo pygmaeus abelii*), her captive-born, female infant and one unrelated captive-born juvenile male. The mother had lived in captivity at the Yerkes Regional Primate Research Center for at least 15 years and previously had reared offspring successfully. The female infant was 14 months of age at the start of the study; the juvenile male, 4 years of age.

PROCEDURE

The mother-infant dyad and the juvenile male were observed for one year prior to initiating the present study as part of an investigation of mother-infant relations and infant development. They were housed together in a cage consisting of an indoor, temperature-controlled compartment 2.4 m × 2.4 m × 2.0 m high, and an outdoor compartment 2.4 m × 4.0 m × 2.4 m high, interconnected by a guillotine door. During the relatively colder months, the temperature was maintained between 20°C and 24°C, whereas during the warmer months, it was allowed to rise no higher than 29°C. The indoor compartment was illuminated daily by overhead lights from 0800 hr to 1800 hr, and the adjacent corridor was illuminated by dim night lights from 1800 hr to 0800 hr. For the present study, observations were made while the subjects were confined to the inner compartment, either in mid-morning or mid-afternoon, which are reported to be times of maximal activity for orang-utans in the field (MACKINNON, 1974; RODMAN, 1979). Testing procedures involved recording individual and social behaviors during (1) a 2-week pre-separation condition, (2) a 2-week period of separation from the mother and (3) a 2-week period of reunion. The subjects were observed for 30 min, three to five times per week, throughout the six weeks. Behavioral data were collected on a modified HANSEN (1966) checklist by a trained observer who sat 5–10 feet in front of the subjects' cage. Behaviors of interest were scored as present or absent for each 1-min interval of the 30-interval (min) test. A variety of behavioral categories were scored, but the only ones considered in this paper are ventro-ventral contact, nipple contact, total contact, distress vocalizations, active climbing, inactive hanging and object examination. Protest in the infant was defined by distress vocalizations, despair by inactive hanging from the cage bars and detachment by a failure of the infant to approach its mother upon reunion. Use of these terms is not intended to

imply the presence of cognitive concomitants previously attributed to humans. Although activity level is frequently used as a measure of protest, the infant in this study was already exhibiting high levels of activity prior to separation. Because the orang-utan is an arboreal species, inactive hanging (from the cage) was used as a measure of despair, rather than a depressed posture commonly used with terrestrial species.

The physical separation of mother and infant was done with a minimum of handling and trauma. The mother and infant were placed in a squeeze cage, and the mother was anesthetized with ketamine HCl (5 mg/kg). The infant was then taken from the mother and returned to the home cage in which it was born and reared, and which contained the juvenile male. Observations were initiated immediately following the return of the infant to its cage. The mother was placed in a separate cage some distance from the infant. The infant and mother were visually separated from each other and since the mother did not vocalize, the separation can be considered as total. During the first week of separation, the infant was observed with the juvenile male in the cage, whereas during the second week, the infant was observed alone. The juvenile male was removed for the duration of each observation session because of its persistent attempts to interact with the infant, which compromised our ability to evaluate independently the infant's activities related to separation. Prior to removing the male each day, it was observed with the infant for several minutes for evidence of adoption. The possible effects of the juvenile male's presence during the first week's tests are considered below. Following the 2-week period of separation, the mother initially was placed in a transport box and positioned in front of the infant and juvenile's cage, providing the subjects with visual, but not physical, contact for a duration of 10 min. Following this initial assessment, the mother was released into the home cage with the infant and juvenile male, and observations continued for 30 min. Observation sessions were then continued for two weeks following the reunion.

RESULTS

MOTHER-INFANT AND JUVENILE MALE-INFANT RELATIONS

Pre-separation

At the time the present study was initiated when the infant was 14 months of age, the mother-infant relationship was waning in terms of the degree of contact between the mother and infant (Fig. 1). During the two weeks prior to separation, the infant spent a considerable amount of time off the mother, climbing on the cage and examining various objects in the cage. Ventro-ventral contact occurred relatively infrequently, representing only 12% and 3% of the 1-min intervals per 30-min test during the first and second weeks pre-separation, respectively. Nipple contact, even less frequent, occurred during only 7% and 2% of the observed time, respectively, for the same 2-week period. Total contact was relatively stable during this period at 25% of the observed time.

Separation

During the period of separation, the juvenile male made frequent attempts to interact with the infant, climbing in tandem with the infant, pulling it from the bars, examining various parts of its body, and rubbing its genitals on the infant. The infant responded to these overtures through most of the separation period by climbing away from the juvenile and vocaliz-

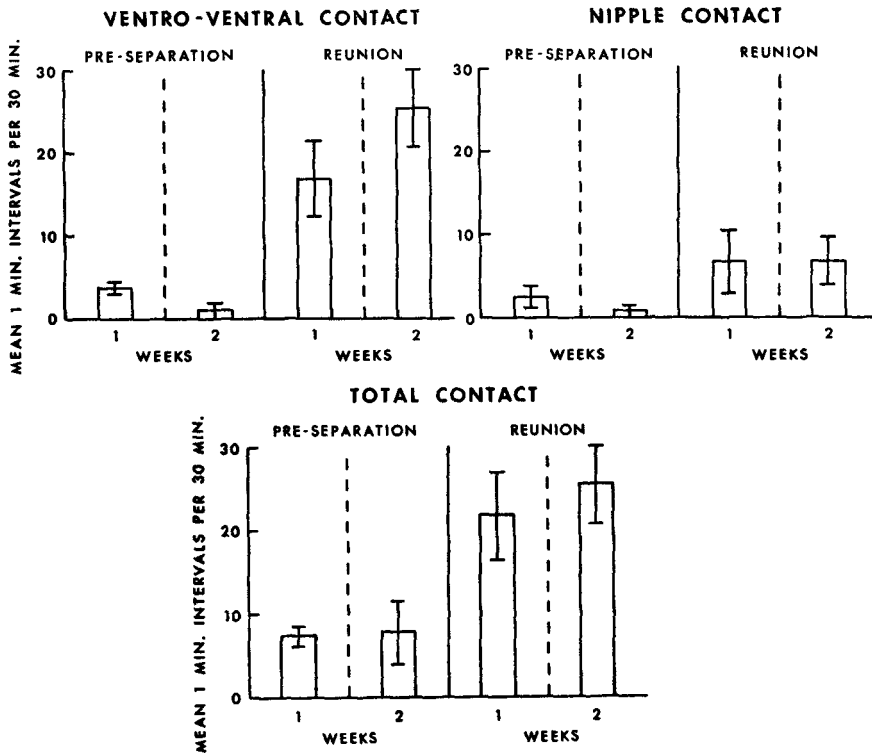


Fig. 1. Contact (attachment) between a mother and infant orang-utan two weeks prior to separation and two weeks following reunion. Columns reflect mean \pm S.E.

ing in distress. When observed immediately prior to reunion, however, the infant was clinging ventro-ventrally to the juvenile male (adoption).

Reunion

When the transport box containing the mother was wheeled in front of the cage containing the juvenile male and infant, the male, with the infant clinging ventrally to it, came to the front of the cage and looked in the direction of the mother. The male then climbed to the top and rear of the cage, the furthest distance possible from the mother, and remained suspended therefrom. The infant glanced at the mother several times initially while maintaining its hold on the male, but made no effort to leave the male or approach its mother (detachment). The mother looked in the direction of the infant and shook the transport box in an apparent attempt to gain closer proximity to the cage.

When, after 10 min, the mother was released into the cage, it looked toward the male and infant, and moved in their direction. The male remained pressed against the top of the cage, obviously avoiding the mother, and the infant continued clinging ventrally to the male (detachment). The mother did not make any direct attempt to retrieve its infant during this initial period of reunion, and the infant did not try to leave the male. This relationship continued for fully 10 min before the infant relinquished its hold on the male and approached and established ventral contact with its mother.

Once contact was established between the mother and infant, there was an intensification of mother-infant attachment, as reflected in the measures of contact described above. Ventro-ventral contact increased nine-fold, from an average of 7.5% of the observed time intervals pre-separation to 70% following reunion. Nipple contact increased from an average of 1.5% pre-separation to 60% observed time on the first day of reunion, and then stabilized at 22% for the entire two weeks of reunion. Total contact increased approximately three-fold, from 25% pre-separation to 78% during reunion.

INFANT BEHAVIORS

Pre-separation

As noted above, the infant spent much of its time pre-separation independently climbing on the bars of the cage, and it vocalized little (Fig. 2). It frequently examined objects in the cage (e.g., the bars, walls, food scraps, etc.) and it spent relatively little time hanging inactively from the cage bars (Fig. 3). Active climbing was observed during approximately 75% of the 1-min intervals per 30-min test; vocalizing, only 11%. Object examination was observed in about 64% of the intervals, and inactive hanging occurred during only 16% of the observed time.

Separation

On the first day of separation, active climbing and distress vocalizing increased to near maximal levels (protest), whereas inactive hanging and object examination were rarely observed. During the first week of separation, active climbing and vocalizing occurred on the average during 57% and 48% of the observed time, respectively, and declined sharply to 19% and 7%, respectively, during the second week. Inactive hanging occurred at 52% of the time during the first week of separation and increased to 90% during the second week (despair). The infant had a rather listless expression on its face while hanging inactively and its eyes appeared partially closed. Object examination occurred at only 6% of the observed time during the first week, but partially recovered to 37% by the second week.

Reunion

Vocalizations by the infant on the first day of reunion with the mother were infrequent and occurred at about the same frequency as they had during pre-separation and the second week of separation. Active climbing, inactive hanging and object examination were not observed at all on that day. For the entire two-week period of reunion, the infant remained in close contact with the mother most of the time (heightened attachment), and only infrequently engaged in any other activities, e.g., active climbing, inactive hanging or object examination. The frequencies of vocalizing and inactive hanging were approximately the same as during pre-separation, whereas active climbing and object examination were reduced by approximately 78% and 65%, respectively, from pre-separation values.

Although the infant was alert and appeared to be healthy throughout this study, it was observed to be lethargic two days after the end of the study. It was taken from the mother, given a physical examination and placed in the Center's nursery for treatment of strongyloides hy-

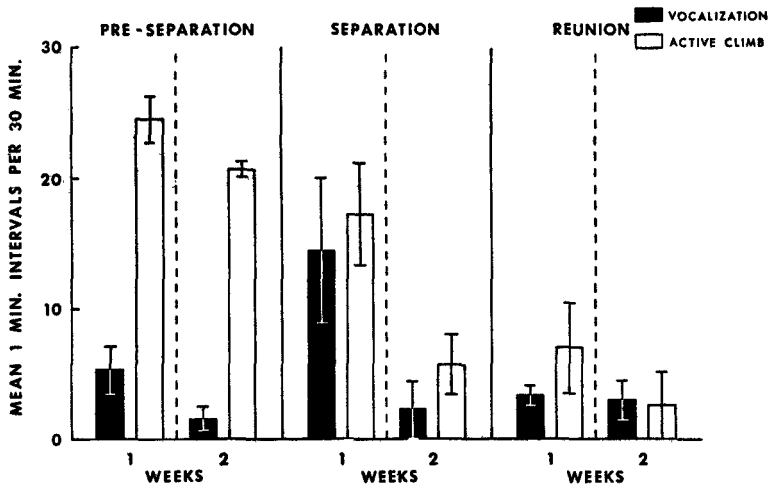


Fig. 2. Distress vocalizations (protest) and active climbing by an infant orang-utan for two weeks each prior to separation from its mother, during separation and following reunion.

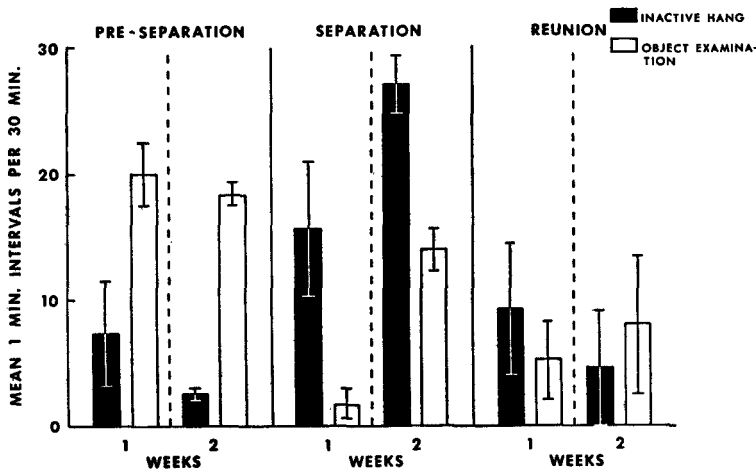


Fig. 3. Inactive hanging (despair) and object examination by an infant orang-utan for two weeks each prior to separation from its mother, during separation and following reunion.

perinfection. Despite the treatment, the infant died five days later of a massive pulmonary hemorrhage.

DISCUSSION

The present findings of distress vocalizing and active climbing by an infant orang-utan following separation from its mother are similar to the agitation described as "protest" in other nonhuman primate and human infants (BOWLBY, 1973; MINEKA & SUOMI, 1978; ROSENBLUM & PLIMPTON, in press; SPITZ, 1946). Active climbing *per se* did not increase over pre-separation values, but the behavior associated with climbing differed for the two conditions. During

pre-separation, climbing was exploratory in character, associated with object examination. When exhibited during the first week of separation, climbing was associated with distress vocalizations and there was an absence of object examination. Although the young male in the cage with the infant appeared to account, in part, for some of its distress the first week of separation, much of the infant's climbing and vocalizing occurred independent of the male's instigation. The findings of reductions in these activities and the increased inactive hanging prominent during the second week of separation are comparable to the behaviors described as "despair" in separated infants of other species (BOWLBY, 1973; MINEKA & SUOMI, 1978; ROSENBLUM & PLIMPTON, in press; SPITZ, 1946). The infant's involvement in object examination during the second week of separation may reflect some degree of recovery from despair, but the near-maximal level of inactive hanging during that period suggests that recovery was far from complete.

Prior to the day of reunion, there was little, if any, indication of attachment by the infant to the young male. Although they were observed in contact occasionally during the daylight hours and asleep together at night, the infant generally avoided and retreated from the male when the latter attempted to make contact. It came as a surprise, therefore, when the infant was found clinging ventrally to the male on the day of reunion. To what extent this new behavior contributed to the infant's temporary avoidance of its mother upon reunion is not known. The formation of new social relationships and the initial avoidance of the mother upon reunion, however, constitute the main characteristics of "detachment" described in human children (BOWLBY, 1973). The subsequent intensification of attachment between the orang-utan infant and mother following reunion is typical of both human and other nonhuman primates. The transfer of attachment during separation to another conspecific also has been reported in several species of monkey (DOLHINOW, 1980; JAY, 1965; ROSENBLUM, 1971; SPENCER-BOOTH, 1964; ZUCKERMAN, 1932).

The results of this study in certain respects more closely resemble the results of comparable studies with human infants than do most results of the monkey studies. Whereas many of the primates studied exhibited behavior characterized as protest and despair following separation, the infant monkeys did not generally exhibit detachment. It has been suggested that the basis for the differences between monkeys' and humans' responses to reunion may be more apparent than actual (PLIMPTON & ROSENBLUM, in press; ROSENBLUM & PLIMPTON, in press). The conditions under which separation and reunion take place in these species differ considerably (WEINRAUB & LEWIS, 1977). Monkey mothers, moreover, generally run to their infants and retrieve them immediately upon reunion, thereby confounding the expression of avoidance or detachment by their infants. More recent research with monkeys, in which the mothers were prevented from making contact with their infants during reunion by being restrained in wire boxes, revealed that some of these infants temporarily became depressed in the presence of their mothers and were socially withdrawn (PLIMPTON & ROSENBLUM, in press; ROSENBLUM, 1978). Also, when infant monkeys were provided with "foster mothers" during separation, behavior similar to detachment was observed upon reunion with the biological mother. These and related data (ABRAMS, 1969; ROSENBLUM & ALPERT, 1977) led to the proposal that environmental factors play an important role in determining whether or not an infant displays a detachment response (ROSENBLUM & PLIMPTON, in press).

MINEKA and SUOMI (1978) proposed that an interpretation of detachment should be made only when the avoidance response is made by a nonhuman primate infant in a free-access situation, comparable to that used in human studies. Given the many differences that exist be-

tween the nonhuman primate and human studies, such a proposal seems unduly restrictive. The responses described herein as detachment in the monkeys (PLIMPTON & ROSENBLUM, in press), gorillas (HOFF et al., 1979; NADLER & GREEN, 1975) and orang-utan infant of the present study seem quite analogous to those reported for human infants. Whether or not such responses are homologous to the human infant's responses remains to be demonstrated.

A final perspective on the issue of detachment in nonhuman primates relates to the behavior of the mothers at the time of reunion. Whereas the monkey mothers immediately retrieve their infants at reunion irrespective of the infants' responses, the ape mothers appear to be sensitive to their infants' negative behavior. At least, they do not immediately retrieve their infants when the latter show avoidance or fearful behavior. Future research, therefore, might profitably focus on this dimension of the reunion situation as a means of further investigating the basis for detachment in these species and its relationship to the human condition.

The strongyloides hyperinfection that resulted in death of the infant after the study was completed raises the question of whether this condition influenced the infant's behavior during reunion. The question cannot be answered with any certainty, but two facts suggest that the disease probably did not have a major influence on the behavior: (1) strongyloides hyperinfection is a rapidly developing condition in infant orang-utans (MCCLURE et al., 1973); and (2) no clinical signs of disease were apparent until two days after the study was over. Furthermore, there were no conspicuous differences between the first and second weeks of reunion for the categories of behavior measured, which would be expected if the disease was developing during reunion. A separate question raised by this study relates to a possible influence of the experimental treatment (separation) on the development of the disease. Several authors have reported the development of psychosomatic illnesses associated with depression-withdrawal in response to object loss in humans (ENGEL & SCHMALE, 1967; REISER, 1966). It does not appear that the despair reaction of the infant orang-utan during separation contributed to its demise because of the reasons given above and the fact that death occurred almost three weeks after reunion was established. That orang-utan infants are very susceptible to strongyloides in the absence of any experimental manipulations is indicated by a report of two other deaths attributed to this disease (MCCLURE et al., 1973), as well as several others not yet reported (pers. obs.). Since one cannot rule out completely the possibility of an influence by the treatment, however, it would be prudent to maintain close surveillance of the health of infant orang-utans in any further research of this type.

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