PRIMATES, 19(2): 343–351, April 1978

Social Interactions Between Adult Male and Infant Rhesus Monkeys in Nepal

HENRY TAYLOR, JANE TEAS, THOMAS RICHIE, CHARLES SOUTHWICK
Johns Hopkins University
and RAM SHRESTHA
Tribhuvan University

ABSTRACT. In 1,506 hours of field observations on free-ranging rhesus monkeys in Kathmandu Valley, Nepal, in 1974 and 1975 18 cases of favorable social interactions between adult males and infants were observed. Eleven of these were brief encounters of play or grooming; seven were more extended cases of male care. One of the latter was a complete adoption of a neonatal orphan by a dominant male. This adoption was possessive and restrictive and it resulted in the death of the infant by starvation within three days. A similar adoption involving the same male occurred in 1976 and it also resulted in the death of the infant. Most of the favorable male-infant interactions occurred during the winter and spring when the infants were 6 to 12 months of age. These favorable social interactions involved eight males in six different troops, out of a total of about 48 males in 12 troops in our study population of approximately 600 monkeys. These observations are discussed in light of current sociobiological theories.

INTRODUCTION

During a 12-month study of rhesus ecology and behavior in Kathmandu, Nepal during 1974 and 1975, we found that social interactions between adult males and infants were uncommon, but several notable cases did occur. A number of short-term interactions were observed which involved play and grooming episodes or brief aggressive encounters. We also observed seven cases of extended encounters between adult males and infants. Three of these were instances of males comforting and babysitting infants, three were examples of males carrying and grooming infants, and one was an unsuccessful adoption of a neonatal orphan by a troop leader. One year later, in June of 1976, a similar unsuccessful adoption by the same male was observed.

Most field studies of rhesus monkeys have shown that favorable social interactions among adult males and infants are infrequent, whereas aggressive encounters are more common (LINDBURG, 1971; SOUTHWICK, BEG, & SIDDIQI, 1965). In 762 hours of field observations on Aligarh temple monkeys, only three occasions were seen in which infant rhesus played and associated peacefully with adult males (SOUTHWICK, BEG & SIDDIQI, 1965). In 900 hours of observation on forest and parkland rhesus groups around Dehra Dun, LINDBURG (1971) saw only two occasions when adult males carried infants, though he did see many instances where males and infants sat together and occasionally groomed each other.

In KAUFMANN's study of rhesus on Cayo Santiago (1966), adult males were never seen to approach infants, but infants occasionally contacted and climbed on males. In most of these instances, males withdrew, threatened, or slapped the infant, but in a few cases, males cradled them in their arms.

These studies led REDICAN (1977) to conclude, "In summary, if one were to characterize adult males in their relations with infants in free-ranging rhesus groups, one would describe them as generally indifferent, somewhat sensitive to approach and contact, occasionally aggressive, and rarely affiliative."

Some species of macaques have been observed to show considerably more male care of infants. Paternalistic[1] care is most pronounced in the Barbary macaque (*Macaca sylvana*), where it is a conspicuous and important part of the social structure within that species (LAHIRI & SOUTHWICK, 1966; BURTON, 1972; TAUB, 1975). Paternalistic care has also been observed as a consistent form of behavior in some groups of Japanese macaques (*M. fuscata*) though not in all (ITANI, 1959; KAWAMURA, 1959). In the Japanese macaque, paternalistic care centers on yearlings, not newborn infants as in Barbary macaques.

This paper contributes to the literature on paternalistic behavior in free-ranging rhesus by reporting on observations made on natural groups in Kathmandu, Nepal. Considerably more paternalistic behavior was observed in these groups than in rhesus in comparable habitats in India.

STUDY SITE AND METHODOLOGY

Free ranging temple rhesus were observed in two locations on the outskirts of Kathmandu city, Nepal (alt. 4,400 ft). Both populations live on the grounds of ancient and revered temple sites, and interact closely with the human community in and around the temples. One population, of approximately 280 monkeys in five social groups, lives at Swayambhu, a Buddhist temple area 2,500 years old on a hill to the west of Kathmandu city. The other population of about 325 monkeys in nine social groups ranges more extensively over a complex of residences, temples and parkland at Pashupati, a Hindu temple site more than 2,000 years old to the east of Kathmandu. The areas are about 8 km (5 mile) apart. Parkland environments with well-spaced trees and shrubs, moderate numbers of people and livestock, and a few buildings surround both temples, covering about 10 hectares at Swayambhu and about 15 to 20 hectares at Pashupati.

The year was separated into four seasons of three months each. Summer (June–Aug.) corresponded to the monsoon rains with hot and humid weather and partly cloudy skies. Fall (Sept.–Nov.) was sunny and increasingly cool. Winter (Dec.–Feb.) was again sunny and cold with thunderstorms in early February as the temperatures began to rise and new plant growth appeared. Spring (Mar.–May) became increasingly hot, hazy, and dusty with the heat tempered by the monsoon rains in the latter part of June.

Sexual behavior of the monkeys began in late October, peaked in December, and tapered off during February. The first birth in 1975 was noted in the middle of April, most occurred in May and June, and tapered off during July, with the last newborn infant observed in mid-August.

Written notations describing male-infant relationships were made during 1,506

1) The term "paternalistic" is used here to refer to paternal-like care, although there is usually no way of determining actual biological paternity.

hours of field observations by TAYLOR, TEAS, and RICHIE from June 1974 to June 1975, and by SHRESTHA during May and June 1975 as part of a larger study focusing on behavioral profiles of rhesus in different habitats. Field notes were supplemented by still and cine photography which permitted subsequent analysis of interactions and positive identification of individuals involved.

Four age/sex classes were defined. Adult males and females were distinguished by the presence of red sexual skin with males also showing descended testes. Juveniles were smaller and not yet sexually mature. Infants were defined to be less than one year of age and dependent on their mothers. Once new infants were born in the spring, population counts distinguished between yearling and newborn infants.

Additional data were obtained in May and June of 1976 during a second unsuccessful adoption of a neonatal orphan by an adult male named *Spock*.

RESULTS

Our observations confirmed previous findings that rhesus males have relatively few interactions with infants in the wild. Males appeared tolerant of infants, and there was nothing unusual about an infant being close to a male or approaching him. Actual physical contact between a male and an infant was uncommon, however.

In 1,506 hours of field observations, we recorded 18 cases of favorable adult male-infant contact. Eleven of these were brief play or grooming encounters; seven were more extended cases of male parental care (Table 1). During the first half of this period, we observed 26 cases of conspicuous male aggression toward infants.

The most common physical interactions between adult males and infants were grooming and aggressive encounters. Data on grooming pair composition for June through December 1974 showed less than 1% (2/311) of the adult male grooming encounters were directed towards infants. Aggressive encounters were more common, with 5% (26/476) of adult male attacks directed toward infants. These aggressive encounters were primarily mild slaps and hits. A few involved bites, but none resulted in serious injury.

Most of the favorable male-infant interactions occurred in late winter and spring, when infants were 6 to 12 months of age, and when their mothers were in the latter stages of pregnancy or actually preoccupied with a newborn sibling. Thus, this behavior seemed to be associated with the weaning process, and represented an expansion of the infants' social relationships within the group.

The seven cases of more extended parental care involved protection, "babysitting", and more meaningful forms of care. Many of them, in fact, involved most of the eight levels of adult male-infant social interactions defined and classified by MITCHELL and BRANDT (1972): (1) approaching, (2) touching, (3) grooming, (4) carrying, (5) playing with, (6) caring for and protecting, such as cuddling or cradling during a rain storm or cold wind, providing parental threat toward another monkey, and (7) complete adoption. The only category of MITCHELL and BRANDT's classification we did not observe was retrieval, though one instance approached that.

The cases of male parental care observed in this study involved eight males in six different troops. Approximately 16% of the adult males in the total population engaged in male parental care, but these males represented 44% of the groups.

Table 1. Extended adult male-infant social interactions among rhesus monkey of Kathmandu, Nepal, June 1974 to June 1975.[1)]

Most prominant behavior	Date	Habitat[2)]	Group	Group size	Male	Comments
Carrying and grooming	8/21/74	PP	?	?	?	Male grooms infant, carried it on back, and defended it.
	2/7/75	ST	?	?	?	Male carries infant, cradles and protects it.
	3/8/75	SP	*Cyan*'s	29	*Cyan*	*Cyan* carries young juvenile on belly.
Comforting and playing	2/8/75	PP	*Gandolph*'s	70	*Gandolf*	*Gandolph* threatened and chased a juvenile away from crying infant; then picked it up and held it on his belly.
	?	ST	*Malcolm*'s	38	*Malcolm*	*Malcolm* babysitting and cradling infant.
	1/31/75	PP	*Abraham*'s	42	?	Young male babysitting, cradling, and playing with infant.
Adoption	5/14/75	SP	*Spock*'s	70	*Spock*	*Spock* adopted *Merlin*. See text.

1) This table does not include brief contact, play, or aggressive interactions. 2) PP=Pashupati parkland; SP=Swayambhu parkland; ST=Swayambhu temple.

Spock's ADOPTION OF *Merlin*

Of all the instances of male parental care we observed, the most striking was an unsuccessful adoption of a neonatal infant by an adult male known as "*Spock*." In 1974, *Spock* was a high-ranking male in *Rex*'s troop of 120 monkeys, the most dominant troop at Swayambhu. When *Rex* became sick in early 1975 the troop gradually split up into three subgroups with *Spock* as the leader of the largest subgroup. Although *Rex* clearly maintained his dominance, his influence as troop leader dwindled until he was followed by only two or three monkeys before his death in late March 1975.

On May 14th during a progression of *Spock*'s subgroup, we observed a juvenile male carrying a male neonate about one day old. No female was nearby. We presume this infant (*Merlin*) was the newborn infant of a female who died the day before. The juvenile dropped *Merlin* who rolled down a grassy slope. *Spock* ran down to the nfant and threatened off females who came up to inspect *Merlin*. He subsequently picked up *Merlin* and moved to one side of the troop's feeding place.

Spock cared for *Merlin* for the next two days until *Merlin* died the night of May 16th, probably from starvation. Like many females whose infants die, he continued to carry and groom the dead infant another day.

During the episode, *Spock* behaved much like an inexperienced mother, occasion-

ally grooming the infant, remaining out of fights, and not interacting with the main group. At first he showed considerable care and favorable attention to the infant, even gentleness, but as the infant began to squirm and cry, he became irritated. He held it down on the ground, turned it over, and showed agitation when it continued to cry. He maintained constant contact with *Merlin* to the point of holding him down with a foot while eating. Being a large burly male, *Spock* was far from gentle, shaking or mouthing *Merlin* to quiet his crying. It was not unusual for *Merlin* to be held upside down or carried in the crook of the arm while *Spock* ran to watch a fight. After a while though, *Merlin* was too weak from lack of food to offer resistance. *Spock* made no effort to feed *Merlin,* or offer food to his mouth.

In 1976, the same remarkable event of *Spock* adopting a newborn infant was repeated. TEAS observed *Spock* with a newborn female infant on the morning of 23 June, 1976. Priests from the temple at Swayambhu said that he had had the infant the day before also. We did not get the impression that *Spock* had stolen the infant from one of the females in the troop. Although we never found the remains of the mother, we presume that this infant was also an orphan.

Spock maintained the same restrictive control of this infant, acted in much the same way toward it, and the results were again similar. Figure 1 shows *Spock* holding this infant on the ground on the second day of adoption when the infant was beginning to weaken from a lack of food. The infant died on the third day, and *Spock* carried it and groomed it for one day *post mortem.*

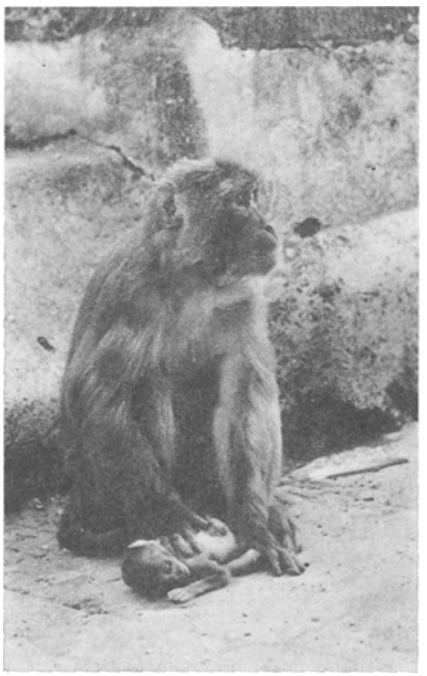

Fig. 1. *Spock* and the female infant he adopted on June 23, 1976. This picture was taken on the second day of the adoption when the infant was weakening from a lack of food. The infant died on June 25, 1976.

Table 2. Behavior of dominant male, *Spock*, during and following the adoptions of the neonate orphans in 1975 and 1976.

	Percentage of time[1]			
	With infant		Without infant	
	15 May, 1975	23 & 24 June, 1976	15 June, 1975	20 & 22 July, 1976
Looking & standing	51	39.5	50	24.5
Resting	31	20.5	25	42.5
Grooming-Infant	8	26.5	0	0
-Recipient	0	0.5	0	8
-Self	0	2	9	4.5
Feeding self	2	0.5	5	10
Locomotion	5	9	10	8.5
Aggression-Total	1	2	2	0.5
-Threat		1.5		0
-Chase		0		0
-Attack		0.5		0.5
-Fight		0		0
Adjusting infant	3		0	
Time engaged in quiet behavior	90	89	84	79.5

1) The behaviors of *Spock* and the infants were sampled once every 30 seconds from 14:30 to 15:30 in 1975, and once every two minutes from 7:30 to 11:30 in 1976, permitting calculation of 'behavior profiles'.

During both episodes of adoption we obtained some time-sampling data of *Spock*'s behavior. A month after the incidents we observed him for an equivalent amount of time to quantify behavioral differences during the adoption. These data are presented in Table 2.

Given the brevity of the adoptions and their continuously changing character, these data provide only a general indication of *Spock*'s behavior. When he had the infants he spent somewhat more time in quiet activities. He spent more time quietly grooming the infant, and less time feeding himself. His locomotion was less in 1975 with the infant, but not in 1976.

Spock was also alone more during the 1976 adoption. His position relative to the group center did not change significantly, but he was further away from other monkeys when he was with the infant (average distance from another monkey was then 5.5 meters ($p \leqq 0.001$). In both 1975 and 1976, the monkeys closest to him tended to be immatures (juveniles and yearlings) rather than females. He appeared to be interested in females, especially those with newborns, but they seemed to avoid him. They acted unsure of how to treat him.

One further anecdotal interaction provided some personal insight into the dynamics of interactions between adult males and infants. During the course of a study of the feeding behavior of *Agamemnon*'s troop at Swayambhu in the summer of 1976, a two-month old infant female, named "*Kamala*", developed an attachment to the researchers, particularly TAYLOR. This infant would come and play by or on his feet during observation. Occasionally during a fight she would seek refuge near him rather than her mother. Needless to say, this frequently created a tense situation with the adult monkeys of the group which we tried to avoid. Despite maneuvers to avoid her she would still follow. Usually the adults in the troop were tolerant of the situation, confident the infant would not be harmed. However, the infant's mother and

the troop leader, *Agamemnon,* would sometimes get upset and threaten or attack. The infant was unresponsive to attempts to get her to stay away. Minimal success was obtained in training the mother to retrieve her on command. As a last resort, it was possible to lead the infant to a point near the mother who would then retrieve it. This incident showed that the infant itself may influence or even determine the course of its interactions with adult males.

DISCUSSION

Although more paternalistic behavior was seen in the rhesus of Nepal than in comparable populations in India, the overall contribution of adult males to infant socialization in these rhesus remained minor. Most of the interactions between adult males and infants occurred in association with weaning when the infants were 6 to 12 months of age. The most prominent exception to this was the unsuccessful adoption of a newborn infant by *Spock,* and this stands out as an unusual case. *Spock* apparently had a strong drive to acquire and hold a newborn infant—a drive shown in two successive years which in both cases resulted in the death of the infant through starvation. Apart from these instances, most of the adult male rhesus of Swayambhu and Pashupati were indifferent to newborn infants, or at least did not become involved in any significant interactions until the infants were 6 to 12 months of age, and even then only 10% of all males were seen to interact with these older infants.

Rhesus males have been shown to have greater potential for paternalistic behavior when placed in certain artificial environments or experimental situations. REDICAN and MITCHELL (1973, 1975) showed that males can adequately raise infants when paired with them in cages. When compared to mothers with infants, males retrieved infants less, broke off contact more frequently, and showed more aggressive behavior toward infants, but they also played more with the infants than the mothers did (REDICAN, 1977). In another study, castrate males readily carried and cared for infants, although it is not known if they did so more or less frequently than normal males (WILSON & VESSEY, 1968). When female rhesus in confined social groups were subjected to bilateral lobectomies of the temporal neocortex and subsequently showed reduced maternal care, the dominant male assumed care of the female's infant (BUCHER, 1970). These studies show that rhesus males have considerable potential for infant care under special circumstances.

On the other hand, rhesus males also have the potential to go to the other extreme and kill infants in crowded or disturbed conditions (CARPENTER, in COLLIAS & SOUTHWICK, 1952; MITCHELL & BRANDT, 1972). This was observed in the initial establishment of rhesus on Cayo Santiago before social groups became stabilized.

Spock's behavior of adopting newborn infants resulted in the death of the infants, but it certainly could not be interpreted as aggression. In both cases, the behavior started out as possessive care, very similar to true maternal behavior. It is interesting to speculate in sociobiological terms on whether this is an adaptive behavior that potentially contributes to the inclusive fitness of the rhesus troop. Certainly a totally orphaned newborn infant would die, whereas the adoption of this infant by an adult male would meet some of its needs for survival, namely protection and warmth. It is clearly maladaptive for rhesus males to exhibit no concern or interest in infants in

need of protection and defense. However, the other extreme evidenced by *Spock*'s possessiveness was also maladaptive since it prevented lactating females from feeding or possibly adopting the orphaned infants. In this sense his behavior was pathological —or perhaps in milder terms, a form of potentially adaptive behavior which had been carried too far, which had gone beyond adaptive limits to the point of becoming destructive.

Our observations indicate several factors that seem important in the development of interactions between adult male and infant rhesus in Kathmandu. (MITCHELL & BRANDT, 1972 and GIFFORD, 1967 provide additional discussion of this topic.) *Spock*'s adoption of an infant two years in a row reflects the importance of the male's personality in determining interactions between adult males and infants. Also the fact that the infants were orphaned seems important. *Spock* would rarely interact with infants at other times. The attachment of the female infant to TAYLOR shows how older infants select individuals other than their mother to care for them. The permissiveness of the mother is also important for if she disapproves she restrains the infant or chases the other individual away. This last corroborates impressions from Indian rhesus (SOUTHWICK & SIDDIQI, 1974) where a significant factor in the lack of interactions between adult males and infants appeared to be mother's unwillingness to permit other monkeys to care for their infants.

A major portion of male-infant interactions seen in this study involved dominant or high ranking males. LINDBURG (1971) also noted that most of the significant male-infant interactions he observed involved dominant males. Complete characterization of all the males and an analysis of dominance hierarchies is necessary to further elaborate the effect of dominance.

Based on our observations, we feel rhesus males make relatively infrequent contributions towards infant socialization, but occasionally significant interactions do occur. Males are able to provide much of the non-feeding care required by the infant, although they are rougher than females. Except in unusual circumstances, they leave most of the care to females, and basically tolerate and protect young infants. Thus the major role of the male rhesus in infant socialization appears indirect. Grooming and aggressive encounters are probably most important. More generally, the adult male can exert an important indirect effect when the infant enters the troop social structure as a juvenile through his leadership and protection of the group.

Acknowledgements. We are indebted to Dr. K. R. PANDEY, Chief of the Research Division of Tribhuvan University, and Mrs. BENI PRADHAN, Associate Chief of the Research Division, for many kindnesses and patient consideration in obtaining approval for this project within the University. We are also grateful to Professor D. R. UPRETY, Head of the Department of Zoology, and Professor D. D. BHATT, Head of the Department of Botany for consultation and assistance with the program. Support for the program has been supplied by the National Geographic Society, and we wish to express our appreciation to Dr. BARRY BISHOP, Dr. EDWIN SNIDER, Ms. MARY GRISWOLD SMITH, and Ms. JOANNE HESS of the National Geographic Society for their interest and encouragement with the field work. We are indebted to GEORGE TURNER for cinephotography of these studies.

REFERENCES

BUCHER, K. L., 1970. Temporal lobe neocortex and maternal behavior in rhesus monkeys. Ph.D. Thesis, Johns Hopkins University, Baltimore, Maryland, 158 pp.

BURTON, F. D., 1972. The integration of biology and behavior in the socialization of *Macaca sylvana* of Gibraltar. In: *Primate Socialization*, F. E. POIRIER (ed.), Random House, New York, pp. 29–62.

COLLIAS, N. E. & C. H. SOUTHWICK, 1952. A field study of population density and social organization in howling monkeys. *Proc. Amer. Phil. Soc.*, 96: 143–156.

GIFFORD, D. P., 1967. The expression of male interest in the infant in five species of macaque. *Kroeber Anthrop. Soc. Papers*, 36: 32–40.

ITANI, J., 1959. Paternal care in the wild Japanese monkey. *Primates*, 2: 61–93. (Reprinted in English in *Primate Social Behavior*, C. H. SOUTHWICK (ed.), 1963, D. Van Nostrand Company, New York, pp. 91–97.)

KAUFMANN, J. M., 1966. Behavior of infant rhesus monkeys and their mothers in a free-ranging band. *Zoologica*, 51: 17–27.

KAWAMURA, S., 1959. The process of sub-culture propagation among Japanese macaques. *Primates*, 2: 43–60. (Reprinted in English in *Primate Social Behavior*, C. H. SOUTHWICK (ed.), 1963, D. Van Nostrand Company, New York, pp. 82–90.)

LAHIRI, R. K. & C. H. SOUTHWICK, 1966. Parental care in *Macaca sylvana*. *Folia. primat.*, 4: 257–264.

LINDBURG, D. C., 1971. The rhesus monkey in North India: An ecological and behavioral study. In: *Primate Behavior: Developments in Field and Laboratory Research*, L. A. ROSENBLUM (ed.), Vol. 2, Academic Press, New York & London, pp. 1–106.

MITCHELL, G. D. & E. M. BRANDT, 1972. Paternal behavior in primates. In: *Primate Socialization*, POIRIER (ed.), Random House, New York, pp. 173–206.

REDICAN, W. K., 1977. Adult male-infant interactions in nonhuman primates. In: *The Role of the Father in Child Development*, M. E. LAMB (ed.), John Wiley, New York, pp. 345–385.

——— & G. MITCHELL, 1973. A longitudinal study of parental behavior in adult male rhesus monkeys. I. Observations on the first dyad. *Developmental Psychology*, 8: 135–136.

——— & ———, 1975. Play between adult male and infant rhesus monkeys. *American Zoologist*, 14: 295–302.

SOUTHWICK, G. H., M. A. BEG, & M. R. SIDDIQI, 1965. Rhesus monkeys in North India. In: *Primate Behavior*, I. DEVORE (ed.), Holt, Rinehart, & Winston, New York, pp. 111–159.

——— & M. F. SIDDIQI, 1974. Contrasts in primate social behavior. *BioScience*, 24: 398–406.

TAUB, D., 1975. A study of paternalism in the wild Barbary macaque, *Macaca sylvanus* L. Ph.D. Dissertation, University of California, Davis, California.

WILSON, A. P. & S. H. VESSEY, 1968. Behavior of free-ranging castrated rhesus monkeys. *Folia primat.*, 9: 1–14.

—Received *October 22, 1976*; Accepted *March 11, 1977*

Authors' Addresses: HENRY TAYLOR, JANE TEAS, THOMAS RICHIE, and CHARLES SOUTHWICK, *Department of Pathobiology, School of Hygiene and Public Health, The Johns Hopkins University, 615 North Wolfe Street, Baltimore, MD 21205, U.S.A.*; RAM SHRESTHA, *Department of Biochemistry, Tribhuvan University, Kathmandu, Nepal.*