

Cooperative behaviour in rhesus monkeys living in urban and forest areas

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Abstract. Two urban and two forest groups of rhesus monkeys (*Macaca mulatta*) were observed for their behaviours like social grooming, social play, coalition relations and consort relations. Adult females played a major role in grooming all other age-sex classes. The grooming between adult males and females increased during mating season. Social play was confined to infants and juveniles. Young adult males participated in play during non-mating season. Adults of both sexes participated in coalition and consort relations.

Keywords. Social grooming; social play; coalition relations; consort relations; rhesus monkey; *Macaca mulatta*.

1. Introduction

Rhesus monkeys seek help from one another for food, movement, and to attack and defend themselves from predators (Pirta 1982). These exigencies could lead to the genesis of cooperative behaviour patterns. The hypothesis that hunting worked as a selective force in the evolution of cooperative life (Schaller 1972) may only be partially true (Teleki 1973). On the other hand, the fear of being hunted should have certainly favoured some kind of group life (Thorpe 1974). The coherence of a group requires development of strong interpersonal attachments or affectional bonds (Harlow and Harlow 1965). Observations on four behaviour patterns, which seem essential in the development of these affectional bonds, are reported here.

2. Methods

The details of study areas, groups observed, definitions of behaviour units, and methods of recording and analysis are given elsewhere (Pirta 1981). In brief, two forest groups, comprising 27 and 38 individuals, and two urban (temple) groups comprising 68 and 129 individuals, were observed from August 1977 to July 1978. The study areas were, Chakia Forest and temples (urban) located in Varanasi district of Uttar Pradesh. A total of 425 and 465 observational hr were spent on the forest and urban monkeys respectively. The *ad libitum* and sequence sampling were employed to collect data. Four types of behaviours are discussed in this paper: (i) Social grooming. One individual solicits, or is stimulated to solicit by another individual, and the latter then starts discretely picking and spreading its fur. (ii) Social play. Two or more individuals come together and engage in mutual chasing, running, sham biting, etc. (iii) Coalition relations. An association between two or more members of the same or different age-sex classes, identified by such behaviours as maintenance of proximity, reciprocal following, mutual defence, etc. (iv) Consort relations. An association between adult male and adult

Table 1. Episodes of social grooming observed in forest (F) and urban (U) monkeys.

	Duration (min)			Type		Place	
	0-1	1-5	5-15	Complete	Incomplete	Ground	Above ground
Forest	35 (29.9)	62 (53)	20 (17.1)	117 (22.12)	412 (77.88)	220 (41.6)	309 (58.4)
Urban	93 (27.3)	173 (50.7)	75 (22)	341 (24)	1082 (76)	489 (34.4)	934 (65.6)

Groomer		Groomee				Total
		Male	Female	Juvenile	Infant	
Male	F	22(40.7)	30(55.6)	2(3.7)	0	54(10.2)
	U	41(22.4)	117(64.3)	15(8.2)	10(5.5)	183(12.9)
Female	F	41(11.3)	140(38.6)	133(36.6)	49(13.5)	363(68.6)
	U	203(20.7)	459(46.8)	214(21.8)	105(10.7)	981(68.9)
Juvenile	F	4(3.6)	86(78.2)	13(11.8)	7(6.4)	110(20.8)
	U	53(23.1)	135(59.0)	33(14.4)	8(3.5)	229(16.1)
Infant	F	0	0	2(100)	0	2(0.4)
	U	11(36.7)	18(60.0)	1(3.3)	0	30(2.1)
Total	F	67	256	150	56	529
	U	308	729	263	123	1423

Numerical values denote number of episodes and its percentage (in parenthesis) for all tables.

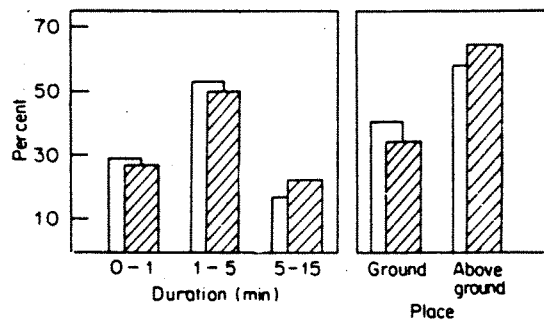


Figure 1. Social grooming in forest (empty bars) and urban (hatched bars) monkeys.

female, identified by such behaviours as maintenance of proximity, reciprocal following, mutual grooming, courtship, etc.

3. Observations

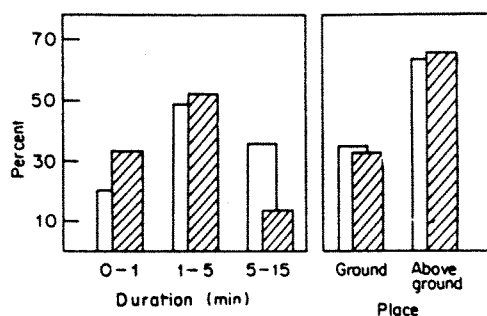
3.1 Social grooming

All age-sex classes participated in grooming. A total of 529 episodes in forest and 1423 episodes in urban monkeys were observed (table 1, figure 1). Sometimes

Table 2. Episodes of social grooming observed in urban monkeys during non-mating (NS) and mating season (MS).

	Duration (min)			Type		Place	
	0-1	1-5	5-15	Complete	Incomplete	Ground	Above ground
Non-mating season	59 (34.5)	89 (52.0)	23 (13.5)	171 (19.3)	715 (80.7)	297 (33.5)	589 (66.5)
Mating season	34 (20.0)	84 (49.4)	52 (30.6)	170 (31.7)	367 (68.3)	192 (35.8)	343 (64.2)

Groomer		Groomee				Total
		Male	Female	Juvenile	Infant	
Male	NS	33(24.6)	79(59.0)	12(9.0)	10(7.4)	134(15.1)
	MS	8(16.3)	38(77.6)	3(6.1)	0	49(9.1)
Female	NS	107(17.9)	284(47.6)	124(20.8)	82(13.7)	597(67.4)
	MS	96(25.0)	175(45.6)	90(23.4)	23(6.0)	384(71.5)
Juvenile	NS	33(25.4)	71(54.6)	23(17.7)	3(2.3)	130(14.7)
	MS	20(20.2)	64(64.6)	10(10.1)	5(5.1)	99(18.4)
Infant	NS	11(44.0)	14(56.0)	0	0	25(2.8)
	MS	0	4(80.0)	1(20.0)	0	5(0.9)
Total	NS	184	448	159	95	886
	MS	124	281	104	28	537

**Figure 2.** Social grooming in urban monkeys during mating season (empty bars) and non-mating season (hatched bars).

grooming was reciprocal. In all, 214 episodes of simultaneous reciprocation, and 126 episodes of delayed reciprocation, were observed among the identified individuals of both habitats.

There were differences in grooming during mating (November to February) and non-mating (March to July) seasons. This analysis was done on urban monkey data only. The percentage and duration of male-female grooming episodes were greater during the mating season than during the non-mating season. The male-male, male-juvenile, and male-infant grooming increased during non-mating season while the male-female grooming decreased (table 2, figure 2).

Table 3. Episodes of social play observed in forest and urban monkeys.

	Duration (min)			Type		Place		
	0-5	5-10	10+	Complete	Incomplete	Ground	Tree	Mixed
Forest	4 (50)	4 (50)	0	8 (8.1)	91 (91.9)	12 (12.1)	81 (81.6)	6 (6.1)
Urban	19 (67.9)	5 (17.9)	4 (14.3)	28 (5)	535 (95)	280 (49.7)	220 (39)	63 (11.2)
	Participants*				Number			
	I-I	J-J	J-I	J-I-Y	2-5	5-10	10+	
Forest	25 (25.3)	48 (48.5)	25 (25.3)	3 (3)	85 (85.9)	14 (14.1)	0	
Urban	138 (24.5)	202 (35.9)	166 (29.5)	73 (13)	383 (68)	149 (26.5)	31 (5.5)	

* I-I = infant-infant; J-J = juvenile-juvenile; J-I = juvenile-infant; J-I-Y = juvenile-infant-young adult males

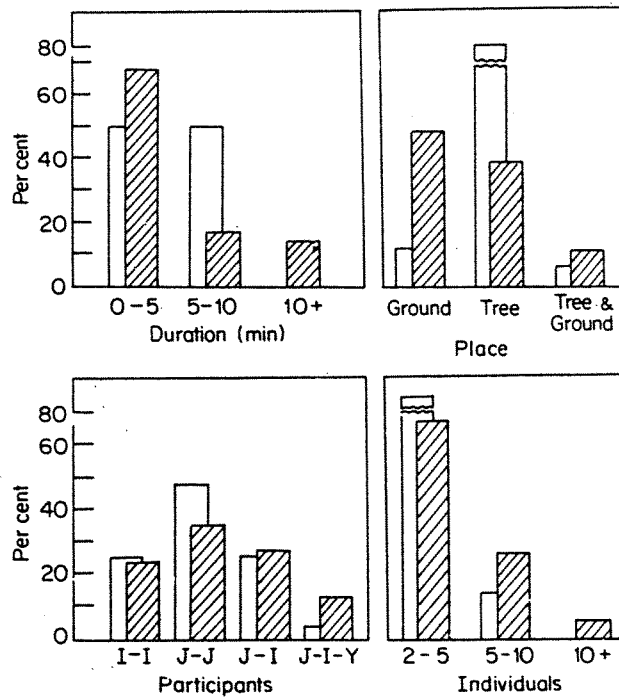
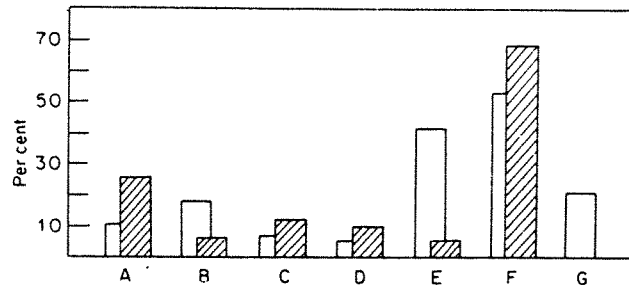


Figure 3. Social play in forest (empty bars) and urban (hatched bars) monkeys. Participants during social play include: I = infants; J = juveniles; Y = young adult males. (The broken bar indicates that the actual length of the bar has been reduced), bars indicate percent.

Table 4. Episodes of coalition relations observed in forest and urban monkeys.

Behaviours		Forest	Urban
Contact maintenance	Grooming	11 (13.6)	26 (43.3)
	Following	18 (22.2)	6 (10)
	Proximity	7 (8.6)	12 (20)
	Contact	5 (6.2)	10 (16.7)
	Searching	0	0
Cooperative attack	Male	9 (20.9)	23 (56)
	Female	23 (53.5)	9 (22)
	Others	11 (25.6)	9 (22)
Communal attack		34 (42)	3 (5)
Communal defence		17 (21)	0
Submissive mount		9 (11.1)	3 (5)

**Figure 4.** Coalition relations in forest (empty bars) and urban (hatched bars) monkeys. A = social grooming; B = following; C = proximity; D = contact; E = communal attack; F = cooperative attack; G = communal defence.

3.2 Social play

Infants, juveniles and young adult males (only in non-mating season) participated in social play while adult males and females did not. This activity included social exploration and manipulation, chasing, pulling, sham biting, claspings, hanging, vocalising, wrestling, aggressive posturing, swimming, snatching objects, etc. A total of 99 and 563 episodes of social play were observed in the forest and urban areas respectively (table 3, figure 3).

3.3 Coalition relations

Coalitions or alliances were observed within and between adult males and females. These relationships were multiplex or involved several types of interactions. The partners (mostly two monkeys) played both complementary and reciprocal roles. For analysing the characteristics of coalition relationship, each interaction between a pair or trio was counted as a separate episode. In view of limited data from Chakia Forest, it was supplemented by results from Asarori Forest monkeys. An affectionate relationship by the coalition partners was maintained by such behaviours as grooming, following, proximity and contact. The members of a pair showed cooperative attack and defence to meet the threatening situations. In all 81 and 60 episodes were analysed respectively from forest and urban groups (table 4, figure 4).

Table 5. Episodes of consort relations observed in forest and urban monkeys.

Behaviours		Forest	Urban
Contact maintenance	Grooming	53 (55.8)	113 (42.6)
	Following	72 (75.8)	207 (78.1)
	Proximity	61 (64.2)	137 (51.7)
	Contact	35 (36.8)	88 (33.2)
	Searching	5 (5.3)	9 (3.4)
Cooperative attack	Rival male	6 (40)	14 (30.4)
	Rival female	2 (13.3)	17 (37)
	Others	7 (46.7)	15 (32.6)
Cooperative defence	Rival male	6 (50)	45 (81.8)
	Rival female	3 (25)	6 (10.9)
	Others	3 (25)	4 (7.3)
Courtship		36 (37.9)	71 (26.8)

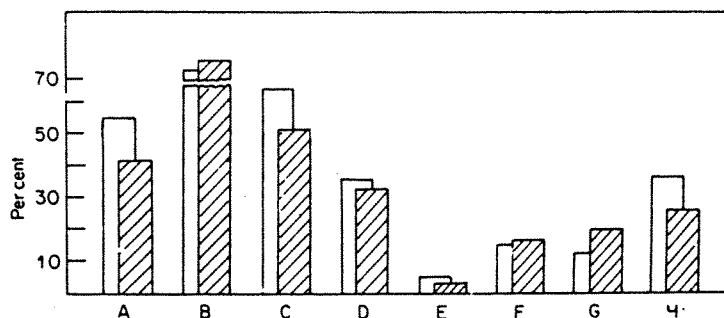


Figure 5. Consort relations in forest (empty bars) and urban (hatched bars) monkeys. A = social grooming; B = following; C = proximity; D = contact; E = searching; F = cooperative attack; G = cooperative defence; H = courtship. (The broken bar indicates that the actual length of the bar has been reduced).

3.4 Consort relations

Pair formation among adult males and adult females was observed during mating season (November to February). These relationships, termed as consort relationships, were multiplex or involved several types of interaction. Both partners of a pair behaved differently (or played a complementary role). The females showed specific preferences for male partners; however, the dominant males made consort relations with most of the females. A female made consort relations several times during the mating season. Each interaction between a consort pair was considered as a separate episode. A consort relationship was determined by such behaviours as grooming, following, proximity, contact, searching, cooperative attack and defence and finally, courtship. In all 95 and 265 episodes were analysed from forest and urban areas respectively (table 5, figure 5).

4. Discussion

The behaviour patterns described above help in the development of stable interpersonal relationships (or affectional bonds) which in turn give rise to a cohes-

sive group. A review of social grooming in Old World monkeys (Goosen 1980) suggests its role as a communicator of affection. Oppenheimer (1979) reported that grooming index seems to be the best indicator of the group's social structure. Social play in infancy and juvenile stages helps in the development of normal adult social relationships (Dolhinow and Bishop 1970; Suomi and Harlow 1971). Almost all cooperative activities seen in the adults were exhibited and practised during play. Bekoff (1978) proposes that social play has evolved primarily as a cooperative venture. Some members of the group form coalitions which help in development of peaceful social environment by monitoring the social field. Coalitions have been reported in several primate species (Boehm 1981). Adults of opposite sexes form short term affectionate relationships (or consortships) during mating season (Lindburg 1971). Consorting appears to be the optimal strategy of reproduction (Tutin 1979).

From this brief discussion it is clear that social grooming, social play, coalition relationship and consort relationship help in the development of cooperative group life in rhesus monkeys.

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