

## Initial dyadic social behavior in free-ranging rhesus monkeys (*Macaca mulatta*)

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**Abstract.** Initial dyadic social interactions of 13 rhesus monkeys were observed in a free-ranging group of 26 members. Each subject was observed for 900 intervals of 20 sec each by focal animal method. The obtained matrix of approach interactions was separately analyzed in relation to sex and dominance level of interacting animals. Dominance ranks were determined by approach-withdrawal scores and its validity was assessed with other submissive scores. Chi-square analysis revealed a significant preference for opposite sexed animals. High ranked animals initiated more social interactions than was expected; however, other animals approached less towards them. It is concluded that in free-ranging group situations, members do not interact at random, rather their interactions are patterned by individual characteristics, such as age, sex and relative dominance level in the group hierarchy.

**Keywords.** Dominance rank; sex-differences; dyadic social initiation; free-ranging rhesus monkey.

### 1. Introduction

Socially living groups of non-human primates have been studied in a variety of different environments. Vast literature exists at all levels from detailed analysis of specific behaviors (*e.g.*, feeding, play, aggression etc.) to more global studies of group structures (*e.g.*, group cohesiveness; dominance hierarchy; communication network, etc.). Despite this, theories have not been developed to relate and systematize the facts of primate behavior. Hinde (1974) has advanced a conceptual framework, which suggests that primate social structure is a product of content, quality and patterning of interactions and relationships between members. Results of field researches show that monkeys in a group do not interact randomly, but in a patterned and predictable manner (Altmann 1968). Their interactional patterns change with age, sex, attractions and repulsions within a group.

Kummer (1971) concludes that attractions and repulsions in a group space are controlled by dominance structure of the group. Dominance behavior in rhesus monkey groups is highly patterned and serves many functions in group social behavior (Roonwal 1976). Thus, it can be hypothesized that relative dominance level of group members will affect the interactional patterns among them and also, the sex of the interactive animals and the repulsive forces between them. These hypotheses have been tested very parsimoniously by exploring the elementary level of social behavior, *i.e.*, an initial social interaction between two animals. The pattern under analysis was; who approaches whom? and how frequently?

## 2. Material and methods

### 2.1 Group and subjects

A group of 26 rhesus monkeys (*Macaca mulatta*) was observed. The home range was ~ 0.25 km<sup>2</sup>, at the outskirts of a village (Kheri Saad, Rohtak-Haryana) 65 km west of Delhi, which included a water pond, school building and its compound, highway and agricultural fields. Apart from the natural vegetation, the monkeys depend on human offerings. The sleeping site of the group was trees in the school compound. The group did not visit the village for foraging. Being a small group, sub-groups were not formed, however, few affiliative units were prominent.

As established immature animals do not have basic ranks (Koyama 1967), the interactions of infants and juveniles were not analyzed. Thus, 13 adult and subadult/adolescent members served as subjects. Table 1 present data on age-sex characteristics, dominance rank, approach-withdrawal scores and submissive scores of others.

The dominance rank was assigned on the basis of approach-withdrawal scores. This was validated with submissive scores of other animals (fear grimace, lipsmack and submit). Spearman's correlation co-efficient between two hierarchies was 0.892.

## 3. Procedures

Observations were made on dyadic interactions between subjects by focal animal and one-zero time sampling of behaviors' (Altmann 1974). Individual subjects were observed between 0600-1800 hrs at 10 min intervals. Each animal was observed for 30 sessions during the study period (July to October 1979). A check-list was used to record the interactions which was divided into 30 successive 20 sec intervals. The code letter of the interacting animal (approached or approacher) was recorded on the check list.

Table 1. Particulars of the subjects.

Animal Code	Age-sex class	Approach withdrawal scores*	Dominance rank	Others submissive scores
A	Adolescent F	7	10	0
B	Mature adult F	10	8	10
C	Mature adult F	3	12	0
D	Young adult F	66	1	54
E	Mature adult F	18	5	14
G	Old adult F	9	9	6
H	Mature adult M	2	13	9
K	Young adult M	23	3	24
N	Subadult M	5	11	5
Q	Young adult M	38	2	46
T	Young adult F	15	6	17
X	Adolescent F	14	7	8
Y	Young adult F	20	4	18

\* Spearman's correlation coefficient ( $r_s$ ) = 0.892 between approach withdrawal and other submissive scores; F-female; M-male.

Table 2. Matrix of approach interactions between subjects.

Approach to														
Approached by	A	B	C	D	E	G	H	K	N	Q	T	X	Y	
A	—	10	8	12	6	17	47	9	5	13	78	10	26	
B	2	—	9	4	9	16	14	30	5	1	4	16	4	
C	6	7	—	7	6	6	17	4	40	0	9	3	9	
D	24	10	24	—	20	22	60	14	29	41	39	22	21	
E	4	24	17	14	—	8	27	14	11	7	6	13	6	
G	13	32	8	2	21	—	15	30	3	5	23	18	18	
H	14	4	11	2	10	10	—	9	0	2	33	4	15	
K	3	39	17	2	12	38	20	—	9	7	16	27	13	
N	6	4	30	9	8	1	8	4	—	11	4	13	7	
Q	15	12	16	36	18	38	25	22	10	—	11	20	25	
T	28	14	21	3	10	22	38	7	8	6	—	8	21	
X	5	24	13	5	16	5	13	9	21	45	6	—	2	
Y	15	17	20	6	12	11	33	9	9	8	32	4	—	

A total of 2308 initial diadic social interactions were observed.

### 3.1 Analysis

Polyadic interactions, redirected and intervened approaches, as well as observations during artificial feeding and intragroup strives were not scored. Dyadic interactions, when other monkeys were not in proximity have been scored/analyzed. The approach frequencies which occurred during the observation period were scored in a two way matrix, *i.e.*, who approached whom and who was approached by whom. Since, there were 13 subjects, the matrix contains 156 cells  $N(N - 1)$ .

The obtained matrix of approach frequencies was converted into bivariate contingency tables for chi-square analysis. Total chi-square and degrees of freedom was partitioned into two main effects and the interaction between two variables, *e.g.*, sex of the approacher  $\times$  sex of the approached (Winer 1971). Separate analyses were done for sex and dominance variables. Random interaction model (each animal approaches other with equal likelihood) was used to derive expected cell frequencies. The confidence level of probability was 0.005.

## 4. Results and discussion

A total of 2308 initial dyadic social interactions among 13 subjects were observed during 10700 observation intervals of 20 sec each. A  $2 \times 2$  contingency table for sex of the approacher and the approached was prepared and analyzed (table 3). It revealed that sex of either animal was non-significant, but significant association was obtained

**Table 3.**  $2 \times 2$  contingency table of dyadic approach frequencies summed across sex of interacting animals and summary of Chi-square analysis.

Approach to Sex \ Approach by		Sex		Total
		Female ( $n = 9$ )	Male ( $n = 4$ )	
Female ( $n = 9$ )	EF	1065.23	532.62	1597.85
	OF	1030	607	1637
Male ( $n = 4$ )	EF	532.62	177.53	710.15
	OF	544.00	127	671
Total	EF	1597.85	710.15	2308
	OF	1574	734	2308

#### Summary of Chi-square

Source	Chi-square	df	P
Sex of Approacher (A)	1.71	1	Non-significant
Sex of Approached (B)	3.12	1	Non-significant
$A \times B$	24.06	1	0.005
Total	28.35	3	0.005

EF = expected frequency; OF = observed frequency.

**Table 4.** A 3 × 3 contingency table of dyadic approach frequencies summed over levels of dominance of interacting animals and summary of Chi-square analysis.

Approach By Dominance level	Approach To			Total	
	High (n = 4)	Middle (n = 5)	Low (n = 4)		
High	EF	177.54	295.90	236.71	710.15
	OF	219	420	314	953
Middle	EF	295.90	295.90	295.90	887.70
	OF	210	295	275	780
Low	EF	236.71	295.90	177.54	710.15
	OF	131	243	201	575
Total	EF	710.15	887.70	710.15	2308
	OF	560	958	790	2308

  

Summary of Chi-square			
Source	Chi-square	df	p
Rank of approacher (A)	121.83	2	0.005
Rank of approached (B)	46.29	2	0.005
A × B	5.03	4	Non-significant
Total	173.15	8	0.005

EF = expected frequency; OF = observed frequency.

for international effect ( $X^2 = 24.06$ ,  $df = 1$ ,  $p = 0.005$ ). Female subjects approached more often males than females. Males too initiated more social interactions with females. Thus, a preference for the opposite sex was indicated even in non-mating season.

This seeming preference for the opposite sex in nonmating season should not be considered as sexual receptivity. As in the present study the content of interactions was not analyzed, it is true for the initiation of a social interaction. Soumi *et al* (1970) also reported such a preference as a development trend in their experimental studies.

Table 4 presents frequencies of initial dyadic social interactions between varying levels of dominance. The hierarchy of 13 subjects was divided into three levels, *viz.*, upper four animals, middle five animals, and lower four animals. Chi-square analysis showed that high ranked animals made more approaches, whereas middle and low ranked animals initiated less social interactions than was expected on the basis of random interaction model. Strayer *et al* (1975) analyzed the frequencies of initiated interactions of captive squirrel monkeys and found social power as a primary factor in such interactions.

It is clear that apart from the seasonal and group factors, individual correlates also contribute in determining the likelihood as to which animals are inclined to initiate social behavior and with whom. However, the pattern of such frequencies in group situations is a result of individual, social and environmental factors.

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