

Ontogeny of play behavior in free-ranging rhesus macaques (*Macaca mulatta*)

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Abstract. Self and social play of 29 rhesus monkeys were observed in a free-ranging group situation for 6 months. Subjects of various age-sex classes were observed by focal animal and one-zero sampling: Frequencies for 5 categories of play were analyzed in a 3 way factorial analysis of variance. Age and frequencies of play were found to be inversely related. Analysis also revealed that except during infancy, females played more than male subjects. Among categories, self play and non-contact mutual play were dominant forms than those involving physical contact of either or both partners. However, it was also influenced by age, as the preference shifts from self play to non-contact mutual play in a developmental perspective. Among adult monkeys, the occurrence of play was least. Obtained results have been interpreted in terms of ontogenetic and situational variables. Rhesus monkeys preferred peers in social play than youngers and elders. However, adolescent/subadult and adult animals played with younger animals.

Keywords. Ontogeny; self-play; social play; free-ranging rhesus monkey.

1. Introduction

Play behavior among mammals has been identified as an activity with substantial evolutionary, biological and ethological significance (Wiesler and McCall 1976; Vandenberg 1978; Fagen 1981). Research on primate play has advanced many functional propositions relating to dominance, group and role behaviors (Loizos 1967; Poirier and Smith 1974). Symons (1978) has presented a detailed dynamics of the development of aggressive behavior through play among rhesus monkeys. In experimental situations, play has been found indispensable for adequate social development in rhesus monkeys (Mitchell 1970; Suomi 1974). In nature, rhesus monkeys start play in early weeks of life and continue even in adulthood with less frequencies (Southwick *et al* 1965; Lindburg 1971; Bhan *et al* 1984). Mitchell (1979) has reviewed sex-differences in rhesus play patterns.

Despite the proliferation of studies on rhesus play, a detailed ontogenetic description of play behavior from naturalistic settings is really lacking. Therefore, the present study was planned to account for the occurrence of self and social play in a free-ranging rhesus group. It attempts to describe the play behavior of subjects varying in sex and age from birth to old age.

2. Methods

2.1 *The study area and group*

A population of about 350 rhesus monkeys inhabits in Galta hillock, eastward to Jaipur (Rajasthan). It is distributed in 4 groups of varying sizes with frequent

intergroup interactions. Among the 4 groups, two groups were bigger than 100 and often intermixed, which made observations very difficult. The third group was smaller than 40 and could not provide the sample as required. Therefore, the fourth group of moderate size and big home range was selected. The size of the study group in the last week of October 1980 was 73. It ranges in an area of about 4 km². Being an arid rocky zone, there are few big trees in the area and for their safety the group used the same as sleeping site during the study period. The site is also important for devotees of Hindu religion and, therefore, the group is abundantly offered food with varied human interaction.

2.2 Subjects

A total of 29 rhesus monkeys served as subjects. The subjects were selected on the basis of age, sex, spatial position in the group, identification marks and kinship group. For example, when juvenile 1 (J_1) was selected its sibling was not selected from juvenile 2 (J_2) category or infant category. Such criteria ensured full representation of group interactions. Table 1 describes their particulars. As the group was under observation since 1977 only, age estimations for mature animals and those born earlier were approximate on the basis of physical/behavioral characteristics and birth seasonality. Therefore, adults were categorized as young, mature and old. Nulliparous, primiparous and diparous females were categorized as young; multiparous as mature, and non-reproductive with twisted tail and broken teeth as old. Among males, peripheral, low ranked with smaller but red testes as young; heavy with developed canines and testes as mature; and with twisted tail and rubbed extermitics as old. One juvenile female (JF_1) died in August 1980 because of some

Table 1. Particulars of subjects (N=29).

Class	Sex	Age (May–October, 1980) (Months)	Codes	n
Infant	Female	Birth-5	I_1, I_3	2
	Male	Birth-6	I_2, I_4	2
Juvenile ₁	Female	13–18	FI_1, FI_2	2
	Male	13–18	MI_1, MI_2	2
Juvenile ₂	Female	25–30	JF_1, JF_2	2
	Male	25–30	J_1, J_2	2
Adolescent	Female	37–42	AF_1, AF_2	2
	Male	37–42	J_3, J_4	2
Adult	Female	Young, 49–54	YF	5
		Multiparous Mature	MF_1, MF_2	
		Non-reproductive old	OF_1, OF_2	
	Male	Young transitional	MJ_1, MJ_2	8
		49–54		
		Young peripheral	SA_1, SA_2	
		61–66		
Young central	YM	8		
Mature-full sized	MM_1, MM_2			
Old	OM			

unspecified disease. One young male (SA₁) left the group in August 1980 and joined another group in the Jaipur city. One old female (OF₁) died in the first week of July 1980 as it slipped from a high cliff. Female infants were born during May 1980, i.e., after the beginning of actual observations (I₁-31st May; I₃-13th May)

3. Procedure

3.1 *Observation schedule*

Observations were taken by focal animal and one-zero sampling technique (Altmann 1974) on a checklist with 20 s intervals. Each animal was observed for 10 min (30 intervals) twice a week for 6 months, viz from 1st week of May to last week of October, 1980. Thus, actual observations covered a duration of 13,920 min (session × week × months × N subjects). However, 48 sessions could not be materialized due to deaths of two subjects and migration of one male during the study.

3.2 *Definitions of play categories*

On going behaviors were recorded by codes on checklist with specification of the interacting animal(s) with the focal animal. Sex of infants and J₁ during interactions was not specified for the low reliability. The social interactions involving more than 4 animals were not analyzed and recorded as subgroup activity. Play behaviors analyzed in the present study were classified into 5 broad categories and defined as following:

- (i) Self play—any rolling, repetitive climbing, jumping, running and playing with inanimate object and animate other than conspecifics.
- (ii) Non-contact mutual play—visually oriented charges approaches, and withdrawals with another animal(s).
- (iii) Mutual contact play—rough and tumble nature, wrestling and shambiting etc.
- (iv) Non-mutual contact play with others—any rough handling, play instigation by focal animal while the interacting animal remained passive.
- (v) Non-mutual contact play by others—elements as in (iv) by interacting animal, while the focal animal remained passive.

3.3 *Scoring and analysis*

Frequencies of occurrence for 5 categories were summed up for each age-sex class. Among adults, the occurrence was so low that scores of sub classes, viz young, mature, and old had to be mixed. Since, the number of animals in age-sex classes was unequal, for the equal limits mean scores were obtained. Thus, the maximum possible occurrence for self play was 1440 (48 sessions × 30 intervals per session). For the categories of social play, focal animal could interact with 7 age sex classes and upto 3 animals from each class. Thus, theoretically the maximum possible occurrence for social play categories could be 31240 (21 social interactions × 48 sessions × 30 intervals/session).

The observed frequencies were arranged in a $2 \times 5 \times 5$ trivariate table, viz male-female, 5 age classes (infant, J_1 , J_2 , adolescence/subadult and adult); and the 5 play categories. It was analyzed for variance by Tukey's non-additivity test (Winer 1971). The F value was considered significant having associated probability equal to or less than 0.01. The second order interaction served as error term because non additive F was non significant and residual could not be error term.

In another analysis, only the social play was analyzed to see the effect of the age of the partner at 3 levels, viz youngers, peers and elders. Thus, $2 \times 5 \times 3$ factorial analysis of variance with Tukey's test was done. It involved 3 variables, as the sex, age class and the age of interacting animal.

4. Results

The sex of animal as an independent source of variance was not found to be significant. Mean play frequencies for females (26.53) were nonsignificantly higher than for males (23.68).

Significant differences emerged among age classes (table 2). Play behavior frequencies decreased with increasing age. Infants was the most playful class, whereas the adults played with the least frequencies (figure 1). Various play categories were emitted with significantly different frequencies ($F = 19.50$, $df. = 4/16$, $P < 0.001$). Non-contact mutual play was the most preferred category with its mean occurrence as 38.52, followed by self play with mean as 35.98 (figure 2).

An interaction between age and sex was found to be significant ($F = 15.83$, $df. 4/16$, $P < 0.001$). Figure 3 shows that males play more than females during infancy, but is vice versa in other age classes (table 3). Sex differences in relation to categories of play was non-significant, although, a significant interaction effect between age class and categories of play was obtained ($F = 5.04$, $df. 16/16$, $P < 0.01$). Infants and younger juveniles (J_1) exhibited the highest frequencies for self play, whereas elder juveniles (J_2) and subadults/adolescents revealed highest frequencies for non-contact mutual play (table 3).

The analysis of social play (table 4) revealed that the age of focal and interacting animals had a significant effect on play frequencies ($F = 6.10$, $df. 8/8$, $P < 0.01$). Immature animals preferred to play with peers than with youngers or elders, whereas subadult/adolescent and adult animals played more with younger animals than with peers (figure 4).

Table 2. Mean frequencies of play at different levels of main sources.

Levels	Source	Sex	Age-class		Type of play	
		$F = 1.41(1/16)$ ns	$F = 58.94(4/16)$	$P < .001$	$F = 19.50(4/16)$	$P < .001$
1	Male	23.68	Infant	53.60	Self play	35.98
2	Female	26.53	Juvenile ₁	37.95	Contact play with others	22.63
3			Juvenile ₁	17.50	Contact play by others	11.37
4			Subadult/ Adolescence	14.70	Non-contact mutual play.	38.52
5			Adult	1.76	Mutual contact play	17.02

ns, Non-significant.

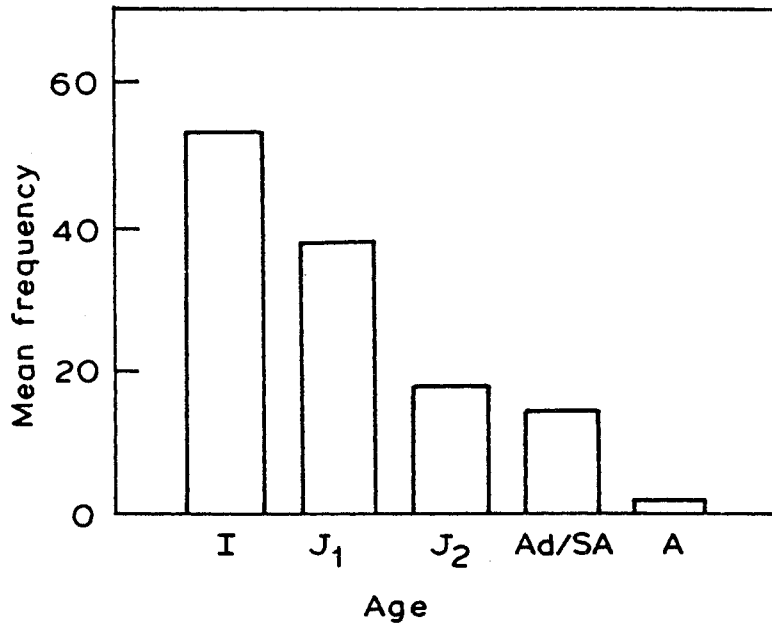


Figure 1. Mean frequency of play at different age levels. I, Infant; J₁, juvenile 1; J₂, juvenile 2; Ad/SA, adolescent/subadult; A, adult.

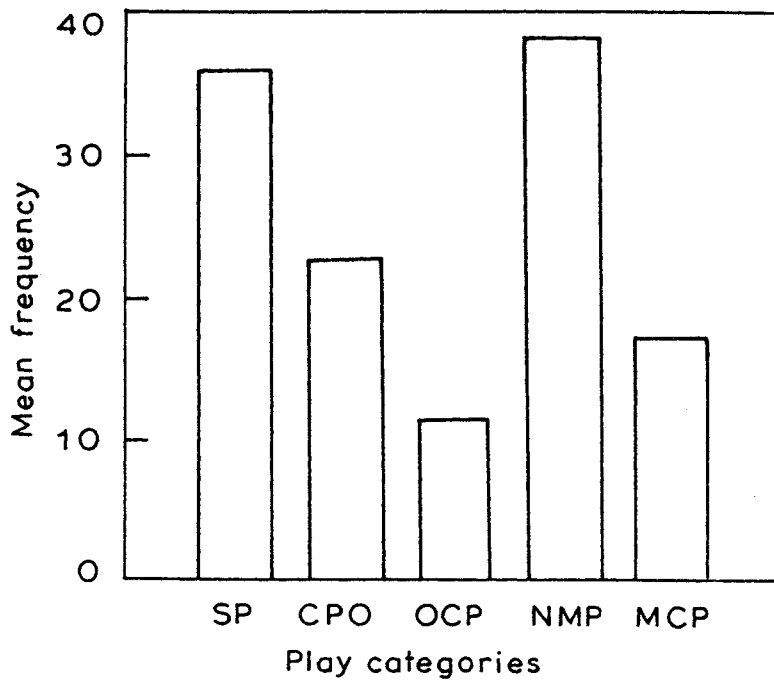


Figure 2. Mean frequencies of different categories of play. SP, self play; CPO, contact play with others; OCP, others contact play; NMP, non mutual contact play; MCP, mutual contact play.

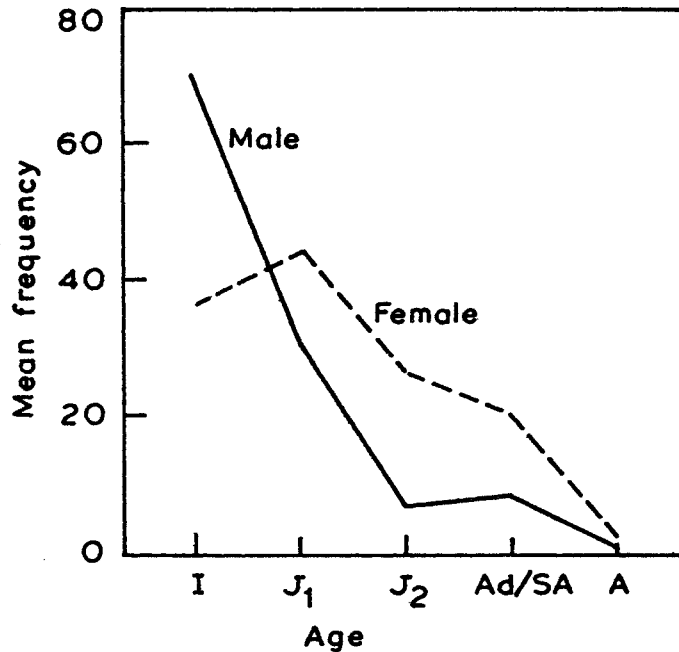


Figure 3. Mean play frequencies of both sexes at various age levels. I, Infant; J₁, juvenile 1; J₂, juvenile 2; Ad/SA, adolescent/subadult; A, adult.

Table 3. Significant interactive means of play frequencies.

	Infant	Juvenile ₁	Juvenile ₂	Subadult/ Adolescent	Adult
<i>Sex × age-class</i>					
Males	70.20	31.30	7.10	8.80	2.00
Females	37.00	44.60	27.90	20.60	2.53
<i>Type of play × age-class</i>					
Self play	98.25	53.00	17.00	11.25	0.39
Contact play with others	49.50	37.00	14.50	14.50	3.65
Contact play by others	22.50	19.00	5.25	9.25	0.84
Non-contact mutual play	70.00	52.75	38.00	29.25	2.60
Mutual contact play	27.75	34.00	12.75	9.25	1.34

Table 4. Interactive means of social play for age-class × age of interacting animal.

Age of Interacting animal	Youngers	Peers	Elders
<i>Age-Class</i>			
Infant	—*	76.75	45.00
Juvenile ₁	51.25	57.25	4.00
Juvenile ₂	10.75	47.75	6.75
Adolescent/subadult	51.00	1.50	0.50
Adult	4.33	0.17	—*

*Interaction not possible, since infant was the youngest and adult was the eldest class.

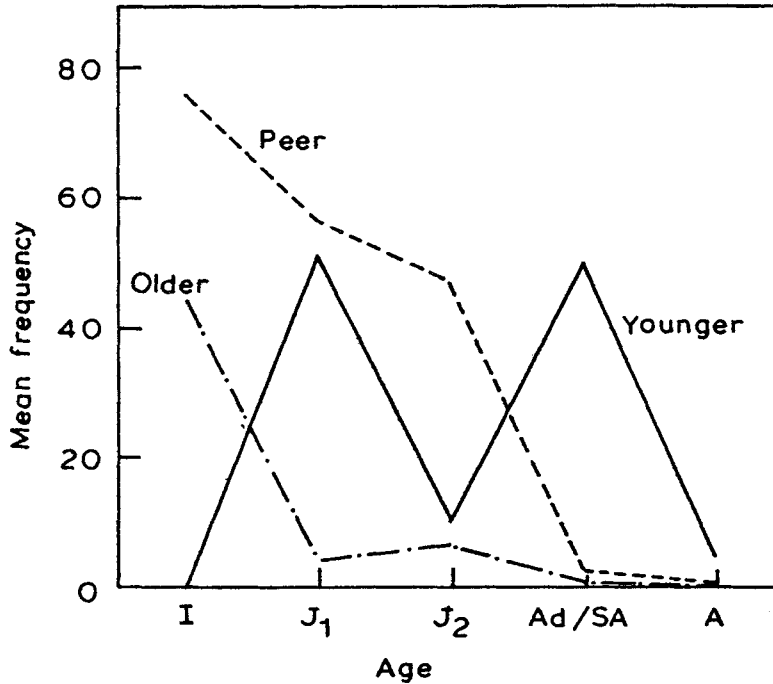


Figure 4. Mean frequencies of social play with age of interacting partner at different age levels. I, Infant; J₁, juvenile 1; J₂, juvenile 2; Ad/SA, adolescent/subadult; A, adult.

5. Discussion

It is generally understood that males among rhesus monkeys are more playful than females. Results of the present study did not conform to this notion. Although sex differences exist, but these concomitantly change with age. It is only during infancy that males play more than females. In rest of the ontogeny females play more than males. This change can be attributed to the shift in the spatial position of growing male in the group space. Juvenile and subadult male monkeys are propelled toward the periphery by group pressures. Consequently, the chances of play interactions are minimised. Whereas juvenile and adolescent female monkeys continue to stay with female assemblies and, thus, interact quite frequently with infants and peers. Moreover, the pattern of play of male and female young monkeys also contribute in age and sex interaction effect. Play bouts of juvenile and subadult males terminate soon, as these become rougher and aggressive. On the other hand, female play bouts last longer and rise to long term play sequences. Thus, sex differences in rhesus play are influenced by factors such as age, social structure, type of play, and spatial position in the group which operates characteristically in free-ranging situations.

Play frequencies decreased linearly with advancing age levels. Such a trend seems to be in congruence with learning theories (Fagen 1981). As by the end of adolescence age, monkeys, by and large, complete the socialization process and explore the major features of home range, less functional aspect of play is left beyond this age. Within adulthood, young adults were observed as playing several times and all forms of play

did occur. However, mature and old animals indulged in play rarely, i.e., only in 10 instances. Such occasional play by rhesus adults has also been reported by Lindburg (1971) in free ranging groups.

Different kinds of play patterns were exhibited by animals of different age-classes. During infancy, self play was most prominent and it was generally directed toward environment. It helps the infants in speedy exploration of the environmental features for which these animals are highly motivated (Harlow 1956). Among social play categories, non-contact mutual play was preferred most during other age levels. This is the safest category in the sense that contact play frequently terminate into aggression.

Peer play has received lot of attention in primate play studies and its importance has been evaluated (Harlow 1969). Analysis of the present study revealed that peers were most sought partner in the social play of infants and younger juveniles. Although infants play with elders quite frequently, juveniles do not do so. Elders often harrass youngsters in social play, but infants are continuously attended by their mothers and so they are saved by elders' harrassment. Adolescent/Subadult monkeys play more with youngsters, because their peer play becomes aggressive and elders seldom play.

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