

SHORT COMMUNICATION**Threats to Observers, Keepers, Visitors, and Others by
Zoo Mangabeys (*Cercocebus galeritus chrysogaster*)**

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ABSTRACT. The facial threats of ten captive golden-bellied mangabeys (*Cercocebus galeritus chrysogaster*) were categorized by object threatened. Adult males threatened more than did females except when the object was a nonhuman primate in a neighboring cage. Juvenile mangabeys threatened mainly in play within their own enclosures. Keepers and observers did not differ in frequency of being threatened by the mangabeys. Adult female mangabeys seemed more concerned with neighboring cages of nonhuman primates than were the juveniles and the males. Human visitors to the enclosures received by far the most threats of any targets, certainly far more than the observers and keepers. They were treated like interlopers. Keepers were treated like familiar conspecifics, observers like familiar neighbors. The implications of these findings for captive management of primates and for observational methods in behavioral primatology are discussed.

Key Words: Threats; Mangabeys; Keepers; Visitors; Observers.

INTRODUCTION

The zoo is an environment filled with stimulation, with some enclosures getting more stimulation than others (MITCHELL et al., 1990b). While a monkey may not have the space and the variety of foliage and organisms available to it that a wild animal has, that monkey does respond to people, animals, airplanes, and other urban noises to say nothing of its more intense relationships with conspecifics in its own enclosure.

One of the most salient stimuli in a monkey's zoo environment is the zoo visitor. Monkeys often threaten zoo visitors (CHAMOVE et al., 1988; HOSEY & DRUCK, 1987; MITCHELL et al., submit.). They also threaten other objects, animate and inanimate, on a daily and, in the case of mangabeys, on a minute-by-minute basis. Threatening with open-mouth threats and brow threats (among other displays) is exceedingly common in cercopithecids in captivity. What do these animals threaten? Which objects do they threaten the most? Are there age and sex differences in the frequencies of threats and in the objects threatened? Are keepers and observers treated differently than visitors by the monkeys? Are keepers and observers treated like conspecifics or like monkeys in neighboring cages? All of these questions are addressed in the present paper. A beginning is made here toward the development of a socioecology of aggressive behavior in a zoo primate.

METHOD**SUBJECTS**

The subjects were the three groups of golden-bellied mangabeys (*Cercocebus galeritus*

chrysogaster) listed in Table 1. There were two adult males, four adult females, and four juveniles. None of the three groups were in cages proximate to one another.

ENCLOSURES

Figure 1 presents the relative positions and configurations of the three enclosures containing the mangabeys. The three enclosures were identical wings in two four-wing monkey complexes also described and illustrated in MITCHELL et al. (1990a). Two of the cages were

Table 1. Group, age, and sex of golden-bellied mangabeys at the Sacramento Zoo between February and September 1988.

Group	Subject	Age (years)	Sex
1	<i>Pino</i>	ca. 9	Male
1	<i>Wendy</i>	ca. 9	Female
1	<i>Chuck</i>	3	Male
1	<i>Howard</i>	1.5	Male
.....			
2	<i>June</i>	ca. 18	Female
2/3	<i>Leslie</i>	4	Female
2	<i>Murray</i>	2.5	Male
2	<i>Rafiki</i>	1	Female
.....			
3	<i>Dutch</i>	7	Male
3	<i>Julie</i>	7.5	Female
2/3	<i>Leslie</i>	4	Female

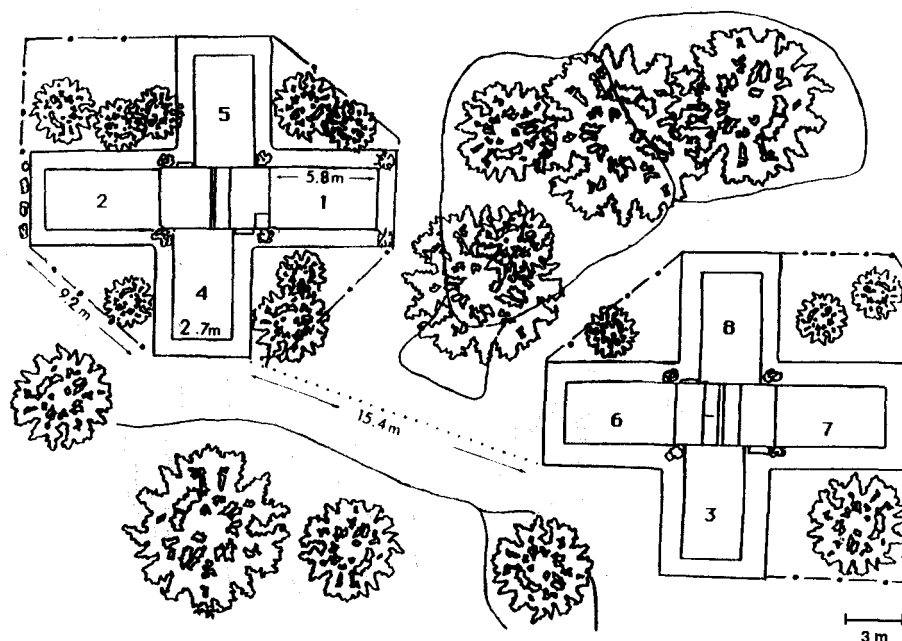


Fig. 1. Physical layout of the Sacramento Zoo's non-ape primate area. 1–3: *Cercocebus galeritus*; 4: *Cercopithecus ascanius*; 5: *Varecia variegatus*; 6: *Colobus polykomos*; 7: *Cercopithecus neglectus*; 8: *Presbytis francoisi*.

in one four-wing complex (on opposite sides of the complex) and one of the cages was a wing in another identical complex about 18 m nearer the zoo entrance. In each four-cage complex, the four wings (enclosures) were at 90° angles to one another, each wing being 5.8 m long, 2.69 m wide, and 3.1 m high. At their farthest extensions from the hub of the complex, the wings were 9.2 m apart. Floors were cement, ceilings and walls were chain link fence except for the brick wall of the indoor hub. The brick wall had an animal entry door. Each cage contained three large branches, a plastic ball, and occasionally, a small tub of water.

PROCEDURES

Data sheets for each 15-min session contained 5 columns and 25 rows for threats because most 15-min sessions involved 25 or fewer threats. The five columns employed were for the following targets of mangabey threats: (1) keeper; (2) observer; (3) mangabeys in same cage; (4) other nonhuman primates in neighboring cages; and (5) visitors. Each of the 25 rows represented a possible threat by a mangabey directed toward one or more of these five targets. If there were more than 25 threats in a session, a second page of the data sheet was used for that session. A threat could be either an open-mouth threat (T) or a brow threat (B). An open-mouth threat was defined as follows: A slightly to fully-open mouth with the corners brought forward with tensed lips forming a more or less circular aperture. The teeth are not completely visible except when the mouth is opened widely. In cercopithecidae, especially males, both lower teeth and the tips of the upper canines may be visible. This threat has been said to have been ritualized from an intention to bite. It is often accompanied by ear retraction or flattening and by harsh vocalizations. The brow threat involves a raising and lowering of the brows which, in the case of the golden-bellied mangabey, results in covering and uncovering of the white markings above the eyes. Thus, in a brow threat, a mangabey "flashes" these eye markings at the target of the threat (see HINDE & ROWELL, 1962; VAN HOOFF, 1969; REDICAN, 1975). Open-mouth and brow threats can occur independently or simultaneously. Both components were scored if both components occurred.

Each observation session lasted 15 min. Observations were not made at the three enclosures simultaneously. As noted, a few sessions produced more than 25 threats so that a second data sheet had to be used before the 15 min had elapsed. A total of 453 15-min sessions was accumulated. These 453 sessions extended across all weekends between February and September 1988. Weekend attendance at the zoo is greater than attendance on weekdays.

There was a mean of 45.33 visitors to a mangabey cage per 15-min session. The behavior of the visitors ranged from very passive to harassing. Most visitors commented on the animals.

The sum of all B and T threats was used as the dependent variable compared in the analyses. The B and T categories were reliably measured by seven different observers. A lone observer recorded behavior at each enclosure in turn, except when measures of observer agreement were made. There were only these two behaviors recorded, so it is not surprising that measures of agreement ($\kappa > .75$) and measures of reliability ($r > .95$) showed exceptional values. The observers stood in the same area as did the visitors, approximately 3 to 4 m in front of each enclosure. Keepers got much closer to the animals, sometimes within 1 m, but they were often not present during observations.

The data (B and T threats) were entered onto an SPSS-PC⁺ program for ease in getting totals and making comparisons. Chi-square analyses were used with frequencies corrected for unequal numbers of males and females (the obtained values for females were halved rather than doubling the obtained values for males).

RESULTS

SEX AND AGE DIFFERENCES

Male mangabeys threatened every target (object), except for observers and neighbors, significantly more often than did females (see Table 2). Non-human primate neighbors in other cages were threatened significantly more by females than by males. There was no mangabey sex difference in overall frequencies of observer-directed threats.

Adult mangabeys threatened every target, human or nonhuman primate, significantly more frequently than did the juvenile mangabeys with the notable exception of threats toward cagemates (see Table 2). Juveniles threatened their cagemates much more frequently than adults threatened their cagemates. The great majority of these juvenile threats were directed toward other juveniles in vigorous play.

KEEPERS VS. OBSERVERS (see Table 3)

Overall, there was no significant difference in numbers of threats directed toward observers and those directed toward keepers, but adult female mangabeys tended to threaten observers more and juveniles, the keepers. Adult male mangabeys showed no difference between keeper-directed and observer-directed threats (see Table 3).

CAGEMATES VS. OTHER NON-HUMAN PRIMATES IN NEIGHBORING CAGES (see Table 4)

Significantly more threats were directed toward cagemates than toward neighbors except for the adult female mangabeys for which the significant difference was reversed (see Table 4). The difference was particularly marked for the juvenile mangabeys who threatened each other in play much more than they threatened animals in other cages.

Table 2. Sex and age differences in adjusted frequencies* of threats by mangabeys toward keepers, observers, cagemates, and non-human primate neighbors.

	By male mangabeys	By female mangabeys	χ^2	<i>p</i>
To keepers	135 (85.5)	36 (85.5)	57.32	.001
To cagemates	180 (118)	56 (118)	65.15	.001
To neighbors	54 (80)	106 (80)	16.90	.001
To observers	105 (98.5)	92 (98.5)	0.86	n.s.
To visitors	714 (645.5)	577 (645.5)	14.53	.001
	By adult mangabeys	By juvenile mangabeys		
To keepers	86 (48)	10 (48)	60.17	.001
To cagemates	118 (185)	252 (185) (in play)	48.53	.001
To neighbors	80 (63)	46 (63)	9.17	.005
To observers	99 (50.5)	2 (50.5)	93.16	.001
To visitors	646 (338.5)	31 (338.5)	558.68	.001

*These frequencies have been adjusted so that numbers of males, females, and juveniles have been equated. Keeper presence or absence has also been accounted for. Expected values in parentheses.

KEEPERS AND OBSERVERS VS. VISITORS (see Table 5)

The visitors were much more often the object of mangabey threats than were the keepers and observers. This was true even for the juvenile mangabeys who threatened people only rarely (see Table 5).

Table 3. Target-of-threat differences in adjusted frequencies* of threats by mangabeys toward keepers and observers.

Group examined	Threats to keepers ¹⁾		Threats to observers	χ^2	<i>p</i>
Adult male mangabeys	135 (120)		105 (102)	3.75	n.s.
Adult female mangabeys	36 (64)	<	92 (64)	24.50	.001
Juvenile mangabeys	10 (9)	>	2 (9)	5.56	.025
All mangabeys	181 (190)		199 (190)	0.85	n.s.

*These frequencies have been adjusted so that keeper presence and numbers of males, females, and juveniles have been equated. 1) Occurring during normal cleaning and feeding and do not include threats occurring under unusual husbandry procedures (e.g. as in trying to get something dangerous that visitors have thrown into the cage away from an animal). Expected frequencies in parentheses.

Table 4. Target-of-threat differences in adjusted frequencies* of threats by mangabeys toward cagemates (mangabeys) vs. other non-human primates in neighboring cages.

Group compared	To cagemates		To neighbors	χ^2	<i>p</i>
Adult male mangabeys	180 (117)	>	54 (117)	67.85	.001
Adult female mangabeys	56 (81)	<	106 (81)	15.43	.001
Juvenile mangabeys	252 (149)	>	46 (149)	142.40	.001
All mangabeys	488 (347)	>	206 (347)	114.59	.001

*These frequencies have been adjusted so as to equate numbers of males, females, and juveniles. Expected frequencies in parentheses.

Table 5. Target-of-threat differences in adjusted frequencies* of threats by mangabeys toward keepers and observers vs. visitors.

Group compared	Toward keepers and observers		Toward visitors	χ^2	<i>p</i>
Adult male mangabeys	240 (477)		714 (477)	235.51	.001
Adult female mangabeys	128 (325.5)		577 (325.5)	285.96	.001
Juvenile mangabeys	12 (21.5)		31 (21.5)	8.40	.005
All mangabeys	380 (851)		1,322 (851)	521.37	.001

*These frequencies have been adjusted so as to equate numbers of males, females, and juveniles. Expected frequencies in parentheses.

Table 6. Target-of-threat differences in adjusted frequencies* of threats by mangabeys toward keepers and observers vs. cagemates and non-human primate neighbors.

Group of mangabeys	Threats to observers and keepers		Threats to mangabeys and other primates	χ^2	<i>p</i>
Adult male mangabeys	240 (237)		234 (237)	0.08	n.s.
Adult female mangabeys	128 (145)		162 (145)	3.99	.05
Juvenile mangabeys	12 (155)		298 (155)	263.86	.001
All mangabeys	380 (537)		694 (537)	91.80	.001

*These frequencies have been adjusted so as to equate numbers of males, females, and juveniles. Expected frequencies in parentheses.

PEOPLE VS. NON-HUMAN PRIMATES

Ignoring visitors, who received far more threats than any other objects, the mangabeys threatened other familiar non-human primates (cagemates plus neighbors) significantly more often than they threatened familiar people (keepers and observers) (see Table 6). This was true for adult females and juveniles especially. There was no significant difference between familiar people and familiar monkeys in frequency of being threatened by mangabey adult males.

MISCELLANEOUS DIFFERENCES (see Tables 3 through 6)

Both keepers and observers were threatened by the adult males significantly more than were neighboring primates but significantly *less* than were cagemates [Observers vs. neighbors χ^2 (1, $N=159$)=16.36, $p<.001$; keepers vs. neighbors χ^2 (1, $N=189$)=34.71, $p<.001$; observers vs. cagemates χ^2 (1, $N=285$)=20.04, $p<.001$; keepers vs. cagemates χ^2 (1, $N=315$)=6.43, $p<.025$]

Adult females threatened observers *more* than they threatened cagemates [χ^2 (1, $N=148$)=8.76, $p<.005$]. Observers and neighbors did not differ in frequency of female mangabey threats directed towards them [χ^2 (1, $N=198$)=0.99, not significant] but neighbors were threatened by adult females more than were keepers [χ^2 (1, $N=142$)=34.51, $p<.001$].

Observers were treated more like neighbors by females but more like cagemates by males. Juvenile males threatened visitors no more frequently than they threatened neighbors [χ^2 (1, $N=77$)=2.75, not significant]. This was very different from the adult pattern. Both male and female adults threatened visitors more than they threatened neighbors [males χ^2 (1, $N=768$)=567.19, $p<.001$; females χ^2 (1, $N=683$)=324.80, $p<.001$].

DISCUSSION

Of some importance to behavioral research in the zoo is the finding that observers are not threatened as much as are visitors by the animals. Primates, even these irascible mangabeys, habituate to observers and threaten them only very rarely as compared to visitors. This result suggests that well-habituated but non-hidden observers are providing data which are relatively unaffected by the observing persons. Despite this relatively low aggressive response to observers, we are, nevertheless, engaged in a follow-up study on the possibility that a male observer (or mangabey) may provoke something very different from a mangabey (or observer) than a female observer (or mangabey).

The current emphasis on the sex of the visitor and/or observer/keeper and the sex of the mangabey stems from our current knowledge of several things: (1) mangabey males threaten more overall than do mangabey females; (2) there is the strong suggestion in the data presented here that other targets of threats differ with mangabey sex; (3) visitors receive more threats than do conspecifics; and (4) conspecifics in captivity and in the wild have been found to threaten interlopers of the same sex primarily (SOUTHWICK, 1967; ANGST, 1973; BERNSTEIN et al., 1974).

Clearly there is a need to determine whether we in behavioral primatology are underestimating the sex of the human observer as an influence on non-human primate behavior, whether in captivity or in the wild.

Furthermore, careful attention to all aspects of the socioecology of captive environments is essential to a better understanding of appropriate display and psychological well-being as well as being important to an understanding of more general conservation issues involving man-monkey interactions.

CONCLUSIONS

- (1) Golden-bellied mangabeys (*Cercocebus galeritus chrysogaster*) in the zoo threaten primarily other primates (human and non-human) and especially human visitors.
- (2) Adult males threaten more overall than do adult females, but females tend to threaten neighboring cages more than do males.
- (3) Juvenile mangabeys threaten mainly in play within their own groups. They rarely threaten people.
- (4) Keepers and observers are threatened much less frequently than are visitors but observers are treated very much like keepers unless the keeper is involved in non-routine activities (other than routine cleaning and feeding) with the animals, in which cases keepers are threatened more than observers.
- (5) Keepers are treated more like familiar conspecifics and observers more like familiar neighbors by the mangabeys. Visitors are treated like interlopers.

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