

# The Effects of Caretaker–Primate Relationships on Primates in the Laboratory

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As contact with caretakers is likely to make up the majority of human–primate interactions in laboratories, caretakers represent an important influence in the lives of captive primates. The aim of this study was to determine how caretaker–primate relationships affected the behavior of primates in the laboratory. We examined whether stump-tailed macaques (*Macaca arctoides*) who were evaluated by caretakers as being either friendly or unfriendly differed in the quality and quantity of interactions with their caretakers during husbandry procedures and in their behavior at times of high and low levels of caretaker activity. Results revealed that animals who had friendly relationships with caretakers were less disturbed by routine husbandry procedures, approached caretakers more often, and were willing to accept food offered by caretakers compared with animals considered unfriendly toward their caretakers. The study concluded that the quality of the primate–caretaker relationship may have an important impact on behavior and may have implications for the well-being of animals and caretakers, as both can benefit from positive feedback from one another.

Over the past decade, there has been a growing recognition of the potential influence that humans may exert on primates in captive settings. Although relationships between primates and humans have not been the subject of extensive

research, the potential influence is often acknowledged in animal welfare literature and animal care guidelines (European Union, 1986; Home Office, 1989; Reinhardt, 1992, 1996). The American National Research Council Institute for Laboratory Animal Research (1998) report lists "interactions with personnel that are generally positive and not a source of stress" (p. 2) among its four major criteria for ensuring the welfare of nonhuman primates.

There is some evidence that having a positive relationship with caretakers may be extremely beneficial to the well-being of primates in the laboratory. These studies have generally focused on utilizing positive interactions (treat provisioning, grooming, positive reinforcement training) with caretakers as a form of enrichment. Such interactions have been reported to promote higher levels of activity and positive interactions with conspecifics as well as to reduce abnormal and agonistic behaviors (Baker, 1997; Bayne, Dexter, & Strange, 1993; Bloomsmith, Lambeth, Stone, & Laule, 1997; Choi, 1993). In addition, by developing a trusting relationship between primates and their caretakers, cooperation rather than coercion may be utilized during common procedures (e.g., blood removal, health examinations), which helps to avoid data-confounding distress responses (Reinhardt, 1996, 1997).

Conversely, interactions with caretakers can have a potential negative influence. Studies involving domesticated animals in modern farming systems have provided a considerable amount of evidence on the impact of interactions between animals and their caretakers. These studies have found a positive correlation between fear of humans and depressed growth, reproductive performance, and basal cortisol concentrations in livestock and poultry (Barnett, Hemsworth, Hennessy, & McCallum, 1994; Hemsworth & Barnett, 1989, 1991; Hemsworth, Barnett, Beveridge, & Matthews, 1995; Hemsworth, Barnett, & Hansen, 1986; Hemsworth, Brand, & Willems, 1981). The situation may be similar for laboratory primates. As primates may instinctively perceive humans as predators or intruders and often react fearfully or aggressively (O'Neill, 1989), routine exposure to caretakers for extended durations during husbandry procedures may act as a considerable source of stress. Such activity has been associated with higher wounding rates (Lambeth, Bloomsmith, & Alford, 1997), altered time of parturition (Alford, Nash, Fritz, & Bowen, 1992; McGrew & McLuckie, 1984), and elevated heart rates (Line, Markowitz, Morgan, & Strong, 1991; Manilow, Hill, & Ochsner, 1974) in some laboratory primates. Although a variety of factors such as increased noise levels or the timing and predictability of routines may be responsible for stress-related responses in relation to routine husbandry procedures, the type of relationship that animals have with their caretakers may be an important factor in determining the animals' responses.

As laboratory primates' relationships with their caretakers may be of critical importance to their well-being, the aim of this study was to determine how caretaker-primate relationships affected the behavior of laboratory primates (in this

case stump-tailed macaques [*Macaca arctoides*]) and the types of interactions these animals had with their caretakers. We examined whether animals who were evaluated by their caretakers as being either friendly or unfriendly toward staff members differed in (a) the quality and quantity of interactions with their caretakers during routine husbandry procedures, and (b) their behavior at times during high and low levels of caretaker activity.

Because having a positive relationship with caretakers may help to prevent stress-related responses during husbandry routines, it was predicted that animals who had positive relationships with their caretakers would exhibit lower levels of vigilance, aggression, and other stress-related behaviors in times of increased exposure to caretakers compared with those animals who were aggressive toward staff. In addition, it was predicted that frequency of interactions would vary between caretakers and animals based on the quality of the primate-caretaker relationship. Such interactions may be an important determinant in mediating both primate and caretaker reactions toward one another.

## METHODS

### Study Animals and Housing

Twenty-one adult laboratory-housed stump-tailed macaques were selected as subjects for this study. There were six groups in total, ranging in size from 3 to 5 individuals. Two of the groups consisted entirely of females and the other four each contained a single adult male. All individuals were known to be negative for B-virus (*Herpesvirus simiae*). Animals lived in indoor enclosures, measuring  $2.7 \times 2.8 \times 4.8$  m, containing both wooden perching and metal climbing structures. Floors were covered with wood shavings. Large viewing windows ( $1 \times 0.88$  m) at the front of the enclosures allowed the monkeys visual access to human activity in the external laboratory environment. In addition, the monkeys had free access to two tiers of cages in an adjoining room, allowing them direct visual and auditory access to a neighboring group.

Caretakers were encouraged by the facility to engage in positive interactions with the animals if they so wished. The majority of animals interacted in a positive, relaxed manner with caretakers, although there were some individuals who remained aggressive and unpredictable in their responses toward staff. These animals had been seen frequently threatening their caretakers when husbandry routines were being carried out (including open mouth threats with brow retraction, lunging, and grabbing at caretakers). Animals were classified as caretaker friendly or unfriendly based on independent interviews with caretakers, during which caretakers were questioned separately about their perceptions of the animals' personalities. There was a consensus among caretakers, who all labeled 6 in-

dividuals (5 females and 1 male) of the 21 study animals as unfriendly. Three of the unfriendly females were from two different all-female groups, whereas the other 2 were housed in groups with an adult male.

## Apparatus

Both a video camera and check sheets were used for data collection. The video camera was used to tape caretaker–primate interactions during afternoon feeding routines to facilitate data collection.

## Procedure and Analyses

A total of 105 hours of data were collected over a 14-week period. To investigate how the types of relationships that animals have with their caretakers affect both their behavior and the types of interactions they have with their caretakers, two types of data collection procedures were utilized.

First, groups were monitored by instantaneous scan sampling at 15-sec intervals for 10-min durations (Martin & Bateson, 1993) to compare relative frequencies of behaviors across individuals during periods of high and low contact with caretakers. The order of observation for each group was rotated on a set schedule to equalize the number of observations during each observation period. Ordering of subjects observed during scan sampling, however, was randomized. The behaviors recorded by this method included feeding and foraging, traveling, inactive alert, self-directed, affiliative, agonistic, destructive, and abnormal behaviors (see Table 1 for behavioral definitions). Data were collected during two time intervals, between 9:00 a.m. and 10:30 a.m. and 11:30 a.m. to 1:30 p.m. In the morning period (9:00 a.m. to 10:30 a.m.), animals spent a greater amount of time in proximity to caretakers, who spent most of the morning moving in and out of enclosures to feed and clean. During midday (11:30 a.m. to 1:30 p.m.), no husbandry procedures were carried out; therefore, this time served as a baseline for comparison. Data from these two periods of time were compared to assess behavioral differences between the times surrounding husbandry routines and the times when routines were not being carried out. As these periods consisted of unequal amounts of time, relative frequencies for all behaviors during each period were constructed to allow for comparison. Comparisons between two subgroups of monkeys that could be clearly labeled friendly or unfriendly toward caretakers were performed using Student's *t* test.

Second, monkey–caretaker interactions were observed during afternoon feeding routines. Three caretakers took turns carrying out the afternoon feeding routines on different days. During these routines, one of the caretakers would enter the mon-

TABLE 1  
Behavioral Categories and Definitions Recorded During Scan Sampling

<i>Behavior Category</i>	<i>Definition</i>
Feed/forage	Searching for or ingesting food or water
Affiliative	Social grooming, touching, embracing, huddling, presenting, make play face toward or play with another
Inactive alert	Remaining in one location without engaging in any other activity, eyes looking around at surroundings or other individuals
Travel	Any locomotor activity about the enclosure, including walking, running, and climbing
Self-directed	Auto-grooming, scratching, licking self, masturbation
Agonistic	Aggressive and submissive behaviors, such as visual and vocal threats, chases, lunges, slaps, bites, avoiding gaze, teeth chattering, and displacements
Destructive	Biting, pulling, or picking apart enclosure or furnishings
Abnormal	Includes pulling or repetitively picking at skin or fur, eye poking, pacing, ingesting fecal matter, self-aggression, self-clasping, rocking, wall licking, and so on

keys' enclosures to scatter the food; therefore, direct interactions between monkeys and caretakers were possible. Feeding sessions were brief, with the mean for all recorded sessions of 1.04 min ( $SD = \pm 0.36$  min,  $n = 12$  per group). All interactions with caretakers during feeding routines were videotaped in the main enclosure. Utilizing continuous behavior sampling (Martin & Bateson, 1993), each behavioral interaction between caretakers and monkeys was recorded. Durations of behaviors were not measured, as behaviors recorded were events rather than states. Caretaker behaviors recorded during routines included approaching or avoiding contact with the animals and hand-feeding. Primate behaviors recorded included approaching and avoiding caretakers, accepting and refusing food offered by caretakers, and threatening caretakers. These behaviors made up the majority of direct contact between the staff and animals. Again, comparisons between the two subgroups of monkeys were carried out using Student's *t* test.

## RESULTS

The results revealed some significant differences in the way unfriendly and friendly animals behaved (see Table 2). Compared with unfriendly individuals, friendly animals displayed significantly higher levels of feeding and foraging and affiliation during mornings, when animals were exposed to a high degree of caretaker activity these differences disappeared during midday, when caretaker activity was low. Unfriendly animals exhibited higher levels of traveling,

TABLE 2  
 Mean Relative Frequencies per 10 Min and *t*-Test Results for All Behavioral Categories in Friendly<sup>a</sup> and Unfriendly<sup>b</sup> Monkeys During Mornings, When Husbandry Routines Were Carried Out, and Midday, When No Routines Took Place

		<i>Morning</i>			<i>Midday</i>		
		<i>M</i>	<i>SD</i>	<i>t</i>	<i>M</i>	<i>SD</i>	<i>t</i>
Feed/forage	Friendly	5.06	± 1.62	2.29*	6.42	± 2.72	-1.33
	Unfriendly	3.37	± 1.87		7.27	± 3.29	
Affiliative	Friendly	10.26	± 5.07	2.25*	12.95	± 5.72	1.52
	Unfriendly	7.62	± 2.62		11.97	± 4.53	
Travel	Friendly	3.62	± 2.82	-2.68*	3.07	± 1.93	-0.86
	Unfriendly	5.17	± 1.67		3.90	± 2.14	
Inactive alert	Friendly	10.39	± 3.48	-2.02	7.67	± 3.09	-2.22*
	Unfriendly	13.24	± 2.14		10.65	± 1.56	
Self-directed	Friendly	5.51	± 2.22	-2.92**	4.99	± 2.06	-1.21
	Unfriendly	7.10	± 1.26		3.87	± 1.43	
Destructive	Friendly	0.88	± 1.07	-0.01	0.68	± 0.75	0.92
	Unfriendly	0.88	± 0.73		0.38	± 0.34	
Agonistic	Friendly	1.27	± 0.37	-2.29*	0.72	± 0.42	1.27
	Unfriendly	1.83	± 0.60		0.97	± 0.40	
Abnormal	Friendly	2.01	± 1.80	0.91	1.63	± 2.10	1.11
	Unfriendly	1.30	± 0.81		0.66	± 0.49	

Note. *df* = 19.

<sup>a</sup>*n* = 15. <sup>b</sup>*n* = 6.

\**p* < .05. \*\**p* < .01.

self-directed, and agonistic behavior in mornings and engaged in more inactive alert behavior during both mornings and midday, although differences were significant only for midday. However, relative frequencies of most behavioral categories during midday were quite similar, with no other significant differences between friendly and unfriendly monkeys. Furthermore, interactions between animals and their caretakers differed significantly between friendly and unfriendly animals (Figure 1).

Overall, animals initiated or avoided proximity to caretakers more frequently than did their caretakers. Those animals who were friendly toward caretakers approached caretakers significantly more,  $t(19) = -2.09$ ,  $p < .05$ , and were also approached more frequently by caretakers, although not significantly so,  $t(19) = -1.47$ ,  $p > .05$ . In contrast, those animals who were unfriendly both significantly avoided caretakers more,  $t(19) = 4.74$ ,  $p < .01$ , and were avoided by caretakers,  $t(19) = 2.24$ ,  $p < .05$ . Caretakers hand-fed friendly individuals more frequently,  $t(19) = -1.10$ ,  $p > .05$ , although this difference was not significant. When caretakers were attempting to hand-feed, the proportion of food accepted by friendly ani-

mals was significantly greater than by unfriendly individuals,  $t(19) = -2.31, p < .05$ . Although there were no significant differences in relative refusal frequencies in terms of the overall proportion of attempts to hand-feed, unfriendly individuals refused to accept food in 80% of all attempts ( $n = 10$ ), whereas friendly individuals refused just 42% of such attempts ( $n = 50$ ). Unsurprisingly, friendly animals threatened caretakers significantly less than did unfriendly individuals,  $t(19) = 2.24, p < .05$ ; however, there also was a difference in the type of aggression exhibited. Although infrequent, when friendly individuals threatened caretakers, all threats were visual, consisting primarily of eyebrow raises and some open mouth threats. However, for unfriendly individuals, 32% of threats involved lunging and grabbing at caretakers, although actual physical contact was extremely rare, observed only on one occasion.

## DISCUSSION

The individual relationships that primates form with their caretakers appear to have a significant impact on behavior. At times of greater caretaker activity, individuals who were friendly toward staff seemed to be less disturbed by routine husbandry procedures. These animals exhibited higher levels of feeding and foraging and affiliation, whereas unfriendly individuals displayed higher levels of self-directed and agonistic behaviors. Both aggressive and self-directed behav-

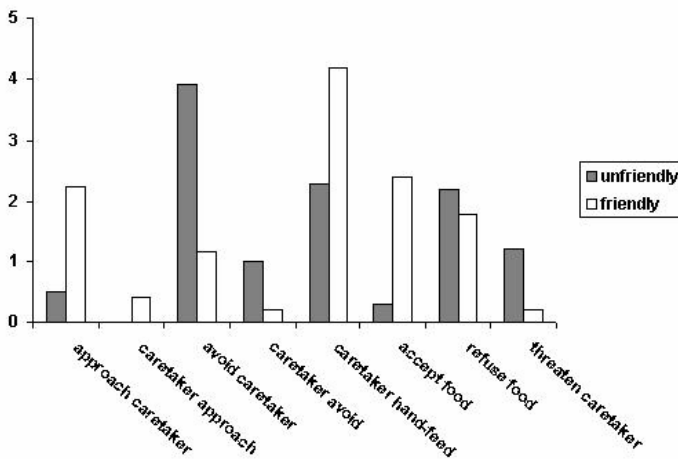


FIGURE 1 Mean number of occurrences per feeding session for all caretaker-primate interactions recorded during afternoon feeding routines.

iors have been reported as increasing in captive animals during tense or frustrating situations (Arnone & Dantzer, 1980; Castles & Whiten, 1998).

Relative frequencies for most behavioral categories were quite similar in friendly and unfriendly individuals around midday, when caretakers were not entering animal areas. However, animals who were unfriendly toward their caretakers displayed higher levels of vigilance (based on their higher relative frequencies of inactive alert behavior and traveling) not only in the times surrounding routines, but also during midday when staff members were not entering enclosures. Although caretakers were not entering the animal enclosures, they occasionally could be seen by the animals through the viewing windows carrying out other duties. Therefore, unfriendly animals may have been more sensitive and alert to external staff activity.

During feeding routines, unfriendly and friendly individuals reacted quite differently. Friendly animals tended to approach caretakers or appeared indifferent to their presence. In contrast, unfriendly animals tended to retreat or react aggressively. Unfriendly animals also were less willing to accept food from caretakers when it was offered. This could be an important issue to some facility managers and caregivers. If animals who avoid human contact become sick or injured and are unwilling to approach or accept food from caretakers, it could be difficult to inspect or treat wounds or to dispense medication, as hand-feeding medication mixed with food is a common and often the easiest method of administration.

The exact origin of the unfriendly behavior could not be equivocally determined in this study, and it is highly possible that many other factors apart from primate-caretaker relationships have contributed to the development and maintenance of such behavior. Personal history and past experiences with staff could have a significant impact on responses. As the animals in this study originated from various facilities, their rearing and housing history, as well as past interactions with personnel, were largely unknown but may have played a considerable role in establishing unfriendly behavioral patterns. Group composition, gender, and rank also may influence responses. In this study, it seemed that females had a greater tendency to behave in an unfriendly manner, as 5 of the 6 unfriendly animals were female. Group dynamics and the presence of a male might influence behavior, although 3 of the unfriendly females were housed in all-female groups, and 2 were housed in single-male groups. Other factors such as caretaker gender, body size, and the speed and amount of noise created during routines could have an effect on behavior (Heymann & Holighaus, 1998). However, these factors often are hard to control and quantify and, as there were insufficient data, were not analyzed. In addition, because of differences in temperament, some animals may be predisposed toward greater emotional and fearful reactions toward humans. A certain percentage of nonhuman primates can be labeled as having highly reactive temperaments, demonstrating greater emotional and physiological responses to stressful events (Suomi, 1991). These animals might require additional effort to re-

assure and to habituate to human presence than their low-reactive peers. The degree to which any of these factors contributed to individual responses could be highly variable. Because these aspects could all be significant in affecting response, they provide important issues for future investigations into this area.

Although there is a somewhat circular aspect to this study (i.e., animals perceived as unfriendly behaved and were treated accordingly), we believe that the results still have implications for improving life in captivity for primates. Many facilities discourage any direct interactions between primates and caretakers because primates are viewed as being too aggressive and to avoid possible confounds in data collection (Boccia, Broussard, Scanlan, & Laudenslager, 1992). This may reinforce primates' fearful and aggressive reactions to humans, especially when they are forced into proximity to humans during husbandry routines or forced to engage in direct contact, such as during health examinations or when receiving experimental treatments. Once such fearful and aggressive reactions are instilled, they may be difficult to extinguish. Even if the primate-caretaker relationship is not the original source in the establishment of such unfriendly behaviors, it likely plays some role in the maintenance of these patterns, and working to establish positive relationships could help break the cycle. It should be noted that unfriendly animals did not appear to habituate to human presence despite daily exposure. In contrast, animals who had friendly relationships with their caretakers exhibited lower levels of stress-related behavior during times of high caretaker activity. Therefore, developing a positive relationship with caretakers may help mediate stress-related responses when animals are forced into contact with human personnel during daily animal care routines.

Having a positive, relaxed relationship with caretakers is considered by many as one of the most important components of captive primate well-being (Poole, 1997; Reinhardt, 1997). Some of the additional behavioral benefits associated with positive reinforcement training reported for captive primates (Bloomsmith et al., 1997; Heath, 1989; Laule, 1993) might result from improving primate-human relationships, which may prevent humans from being perceived as stressful stimuli. There is a possibility that aggressive reactions to caretakers could be reduced among the unfriendly individuals by utilizing positive reinforcement training to habituate them to human presence. Using positive communicative signals such as lip-smacking and affiliative vocalizations may also serve as an effective technique that personnel could employ to reduce animal stress (Bayne et al., 1993).

There are implications for the well-being of staff members as well as for the animals. Both animals and caretakers are likely to benefit from positive feedback from one another. Engaging in interactions that are pleasant for both caretakers and the animals are likely to create a better work environment for caretakers and to help instill positive attitudes regarding the animals they care for. Creating a positive attitude among caretakers is one of the most effective ways to enhance laboratory primate well-being, as caretakers are directly responsible for defining the

quality of the animals' daily lives (Petto, Russell, Watson, & Lareau-Alves, 1992). In addition, animals who behave aggressively toward staff also may pose a risk toward caretaker safety. Caretakers are much more likely to sustain scratches or bites from animals who are fearful and aggressive toward them. Although friendly interactions between animals and their caretakers do not in any way substitute for protective clothing and procedures in the prevention of zoonotic disease transmission, encouraging trusting relationships between animals and their caretakers could act as an additional preventative safety measure.

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