Figure 2. Anaesthetized immature red titi monkey over the "*Saguinus* trap".

and body length and 365 mm tail length. Testicles of this individual were very small and were not measured. Following capture, the group spent eight days without returning to the Feeding Station where it was captured. However, the monkeys returned to feed on 4 June and revisited the platforms on a daily basis until the end of the study (8 August).

In conclusion, the Peruvian Method proved useful in capturing titi monkeys. Its efficacy, however, is low and seems to depend strongly on the animals' habituation. We believe that widening the individual compartments of the trap, putting the traps in a shady place, for example, close to lianas, and having a detailed knowledge of the group's range would greatly increase the facility with which titi monkeys can be captured using this trapping method.

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PROXIMITY AND GROOMING INTERACTIONS AS INDICATORS OF THE SOCIAL ORGANIZATION OF BROWN HOWLING MONKEYS (*ALOUATTA FUSCA CLAMITANS*)

Dilmar A. G. de Oliveira
César Ades

The frequency of social behaviors is much lower in howling monkeys (genus *Alouatta*) than in other primate species (Neville *et al.*, 1988); a feature believed to be related to a strategy of reduced energy expenditure (Crockett and Eisenberg, 1987; Neville *et al.*, 1988; Milton, 1980, 1981). Our own field data indicate that brown howling monkeys (*Alouatta fusca clamitans*), observed at the Cantareira State Park, São Paulo, spend less than 5% of their day in explicit social activities (Oliveira and Ades, 1993; Oliveira, 1997). The scarcity of social interactions makes the assessment of aspects of group structure and organization time-consuming and difficult.

Besides displays and ostensible interactive behaviors, howlers communicate and organize their behavior as members of a group through *indirect* signals, such as approaches, retreats, following bouts, and huddling (Jones, 1980, 1983). Spatial relationships among howlers may constitute, as in other primates (Rowell and Olson, 1983), an important indication of how they relate to each other in the group and of the prevailing social organization (Jones, 1980).

The main aim of this research, which was part of a study of vocal communication (Oliveira, 1997), was to evaluate aspects of the social organization of brown howlers using records of inter-individual distances and, as supplementary information, data on grooming episodes (Mendes, 1989; Chiarelli, 1995). The observation method adopted is simple, reliable and relatively economic in terms of the time spent in the field.

Our research site, the Cantareira State Park, is a large urban reserve (7,900 ha) in the middle of the metropolitan region of São Paulo. It is comprised predominantly of secondary forest and, besides *A. fusca clamitans*, the primate community there includes capuchins (*Cebus apella nigritus*), marmosets (*Callithrix aurita*) and masked titi monkeys (*Callicebus personatus nigrifrons*).

Howlers at Cantareira spend about 60% of the day resting, about 18% and 15% foraging and travelling, respectively, and the remaining, short time in social and other activities (Oliveira, 1997). These figures do not differ markedly from previous assessments of time allocation in the same species (Mendes, 1989; Chiarello, 1993, 1994; Oliveira and Ades, 1993; Marques, 1996). At Cantareira, mature leaves predominate in the howler's diet, probably as a result of the low supply of other preferred food items, such as immature leaves and fruits (Oliveira and Ades, 1993; Oliveira, 1997).

Several groups of howlers were included in the study. They were studied opportunely. Behavioral quantificaion was by scan sampling (Altmann, 1974), with scans of three minutes at intervals of 10 minutes. The duration of the scan established a limit on the number of focal group members sampled at each opportunity.

The following data were recorded for every sampled individual: (a) identity - adult male (AM), adult female (AF), juvenile (JU), infant (IN); (b) social behavior - social play, grooming; (c) distance to nearest individual - in contact, from 0 to 1 m, from 1 to 2 m; from 2 to 3 m, more than 3 m, and 'isolated'; (d) identity of nearest individual - sex and age category of nearest individual. Indeterminate (IND) was recorded whenever the identity of the nearest individual could not be ascertained. When sex and age categories of a sampled individual could not be determined with certainty, it was necessary to use compound categories - adult (AD), adult or juvenile (AJ), male or juvenile (MJ), female or juvenile (FJ) and juvenile or infant (JI). With the exception of the FJ category, such cases are, however, responsible for a very small number of the records and were not taken into account.

The distance to the nearest individual (Fig. 1) depended significantly upon sex and age categories ($\chi^2 = 246.2$; df = 12; p <0.001). All binary comparisons between sex and age categories were significant (AM x AF, $\chi^2 = 15.7$; AM x JU, $\chi^2 = 71.2$; AM x IN, $\chi^2 = 23.8$; AF x IN, $\chi^2 = 59.9$; JU x IN, $\chi^2 = 76.8$; in all cases, df = 4; p <0.001). Adult males were most distant from other members of the group (high levels of ISOLATED), infants predictably were nearest to other members of the group. Juveniles and adult females occupied intermediary spatial positions (Fig. 1). The identity of the nearest individual also depended significantly on sex and age category of the sampled animals ($\chi^2 = 516.1$; df = 12; p < 0.001). Differences remained significant when FJ records were discarded ($\chi^2 = 423.8$. df = 9, p < 0.001).

Table 1: Number of grooming episodes. Left column indicates the identity of the groomer, top row indicates the groomee.

	AM	AF	FJ	JU	Total
AM	0	0	0	0	0
AF	10	4	1	8	23
FJ	9	2	2	1	14
JU	2	9	0	1	12
Total	21	15	3	10	**49**

AM = adult male, AF = adult female, FJ = female or juvenile, JU = juvenile. Infants were not included because they were never observed grooming and only once were groomed.

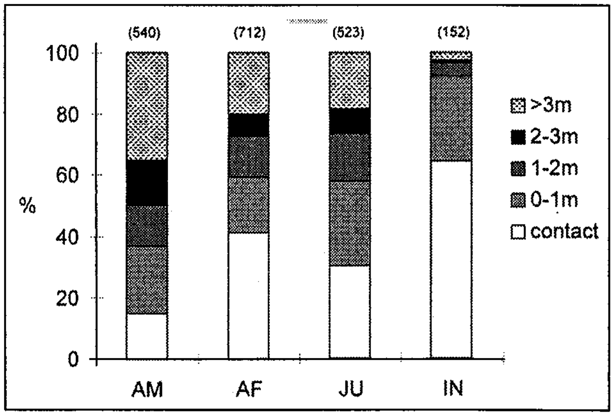

Figure 1. Distance to nearest individual (%). AM = adult male, AF = adult female, JU = juvenile, IN = infant. Total number of observations in parentheses.

The association patterns for adult females were less specific: they were seen with males, other females, juveniles and, predictably, infants. Juveniles and infants were most often associated with adult females. Adult males kept to themselves most of the time, but were otherwise in association with adult females (Fig. 2).

An analysis of 49 grooming episodes revealed a significant asysmmetry between groomers and groomed individuals ($\chi^2 = 29.98$, df = 3, p<0.0001). Males acted significantly more as groomees than as groomers (Fisher test, AM x AF, p<0.0001; AM x FJ, p<0.0001; AM x JU, p<0.0001). No other assymetries were significant (AF x FJ, p>0.05; AF x JU, p>0.05; FJ x JU, p>0.05). Adult females were responsible for most of the grooming. Infants were almost never groomed (see Neville [1972] who also noted very little grooming of infants in *A. seniculus*).

Play episodes were quite rare. We observed six (five dyadic and one triadic episode) involving eight juveniles, two infants, two females or juveniles, and an adult female. In all cases, at least one of the participants was immature (infant or juvenile).

Analyses of proximity and grooming reveal some relevant aspects of the social organization in *Alouatta fusca clamitans*. One interesting feature is the males' spatial relationship to the rest of the group. The adult males were habitually the most distant from all other members of the group; a feature which has also been observed for *Alouatta*

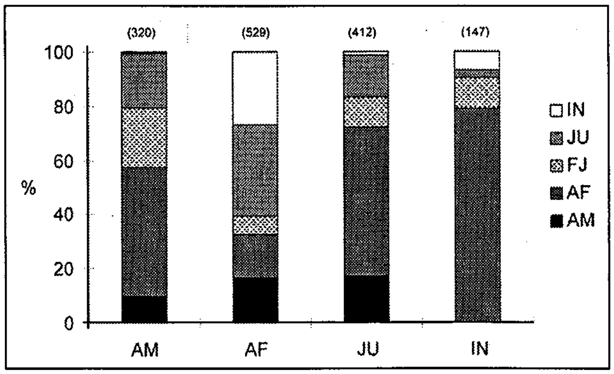

Figure 2. Identity of nearest individual (%). AM = adult male, AF = adult female, FJ = female or juvenile, IN = infant. Total number of observations in parentheses.

seniculus. Neville (1972) noted that males of this species were loosely attached to their groups, and Neville *et al.* (1988) also remarked that male howlers very rarely participated in the daily social interactions of other group members. The distancing of males in *A. f. clamitans* does not seem to us, however, to be a basis for inferring less influence on group organization. The groomer/groomee asymmetry, favoring adult males as recipients, would appear to be a clear indication of such an influence.

Adult females, on the other hand, also play an important role in the social dynamics of brown howler groups. By associating more equitably with other group members and by acting as the principal groomers (as was also related by Mendes [1989] and Chiarello [1995]), they can most effectively mediate social exchanges. Neville (1972) likewise noted the relevance of adult females in *A. seniculus* groups, giving emphasis to the grouping of females with their offspring.

It is usually assumed that subordinate primates groom dominants more than vice versa. This is indeed what occurs in black howler monkeys,*Alouatta caraya* (see Jones, 1983). In mantled howling monkeys, *Alouatta palliata*, however, Jones (1979) observed that the dominant individuals were the ones preferentially engaged in grooming. It seems to us that grooming interactions in brown howlers, at least those that occur among members of different gender/age classes, follow the usual primate pattern. The social structure of *A. f. clamitans* groups would appear to differ from that of *A. palliata*, while more similar to *Alouatta seniculus* and *A. caraya* (Neville *et al.*, 1988).

Inter-individual distances can be analysed with more precision using identified individuals as references (see Jones, 1982, for example). Using age and gender categories only, as in this study, however, can also provide important information for comparing *Alouatta* species, or the assessment of habitat and seasonal influences on group structure in a particular group or species.

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