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## Social relations in groups of Black-capped capuchin monkeys, (*Cebus apella*) in captivity: mother-juvenile relations from the second to the fifth year of life

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### Abstract

For juvenile black-capped capuchin monkeys the mother is the most attractive social partner in the social group. They approach their mother more frequently than any other group member, prefer to sit in close bodily contact with her and both groom and are groomed by her more frequently than any other group member. With respect to grooming-relations sex-differences become apparent with age. In contrast the mother is of no noticeable importance as a partner in social play.

### Introduction

Long-term studies on some primate species living in large social groups reveal that the mother is the most important social partner for her juvenile offspring, continuing even after they reach adulthood. These results are limited to few species of Old World monkeys where long-term studies on individually known animals have been conducted – *Presbytis*, *Macaca*, *Papio* – and where many informations are available on Old World monkeys and Great Apes regarding maternal-juvenile interactions (for a review WELKER 1985). There are no comparable studies of New World monkeys. In previous reports, on our long-term study of the black-capped capuchin, we reported that the mother is the most attractive animal for the infant (WELKER et al. 1987; WELKER et al. 1990). This, of course, is true for most mammals and, particularly for primates, the close and prolonged mother-infant bond satisfies both the nutritional and protective needs of a relatively helpless infant. However, to what extent this bond is maintained, after the infant matures and becomes independent, is not known.

Breeding success and a high survival rate in the primate station of Kassel University have yielded quantitative data on mother-juvenile relations in a large sample of black-capped capuchin monkeys, *Cebus apella*, providing us, for the first time, with information on long-term mother-infant relations in a South American primate species living in large social groups. Although these results, obtained under artificial laboratory conditions, do not allow us to extrapolate directly to the wild, we have no reason to believe that the same individual preferences will not be found under natural conditions.

### Materials and methods

All 21 *Cebus apella* juveniles, which constituted our sample (see Table), were born into a single social group, the Don group, named after the group's dominant male, at the primate station of Kassel University. The patterns of social behaviour, which occurred regularly and which were scored by trained observers in terms of frequency of occurrence, were: active approach (approaching another individual), passive approach (being approached by another individual), contact sitting, active

**List of capuchin monkeys the authors report on in this paper, observed by group observations (G) of focal-animal samplings (F)**

The years of life where data were used are marked (X)

No	Name	Type of observ.	Sex	Date of	Mother	Year of life			
						2.	3.	4.	5.
25	Pan	G	f	08. 02. 1978	Sylvia			X	X
26	Claudia	F	f	17. 04. 1978	Erna			X	X
27	Daniel	F	m	18. 09. 1978	Dunka			X	X
29	Sarah	G	f	25. 05. 1979	Sylvia		X	X	X
30	Isabelle	F	f	20. 06. 1979	Teufel		X	X	X
31	Christian	F	m	12. 07. 1979	Page		X	X	X
32	Agnes	G	f	17. 07. 1979	Sanga		X	X	X
35	Jonaine	G	f	18. 08. 1980	Teufel	X	X	X	
36	Petra	F	f	19. 09. 1980	Sylvia	X	X	X	X
37	Dennis	F	m	28. 09. 1980	Dunka	X	X	X	X
38	Carlos	G	m	17. 11. 1980	Erna	X	X	X	
40	Lisa <sup>1</sup>	F	f	28. 07. 1981	Sanga	X	X		
41	Justus	F	m	25. 09. 1981	Teufel	X	X	X	X
42	Samuel	F	m	28. 05. 1982	Sylvia	X	X	X	
45	Cesar	F	m	02. 08. 1982	Erna	X	X	X	
46	David	F	m	03. 08. 1982	Dunka	X	X	X	
48	Thomas <sup>2</sup>	F	m	25. 07. 1983	Kim	X			
49	Philipp	F	m	24. 09. 1983	Sylvia	X	X		
53	Jesca	G	f	12. 06. 1984	Teufel	X			
55	Stephanie	G	f	22. 07. 1984	Sarah	X			
56	Karin	G	f	10. 09. 1984	Kim	X			

<sup>1</sup> Lisa died 24. 05. 1984, the data on the third year of life are based on ten months of life, only. –

<sup>2</sup> Thomas was separated 27. 06. 1985, the data on the second year of life are based on eleven months of life, only.

grooming, passive grooming, social play. The data were collected by focal-animal observations (F) or group observations (G). As in a previous paper (WELKER et al. 1987) both data sets were combined since both methods revealed no differences between the different age/sex groups when frequency scores were converted to percentages. In the figures the mean of the absolute frequency of the different behaviour patterns protocolled within one year is added (mainly, to give sample sizes for the data sets).

Three of the capuchin juveniles were observed from year 2 to year 5, i.e., for a total of 4 years. The others were observed for from one to three years. The total number of juvenile years covered was 53, 36 of which were by the focal-animal-sampling method and 17 of which were by the group-observation method.

The focal-animal sampling method (in sensu ALTMANN 1974) was used on 13 animals while "all occurrences of some behaviors" were scored for the remaining 8 animals. The focal-animal sampling method provides a complete record not only of the focal animal's actions, but also of behaviours directed to it by others. Each focal animal was observed daily for 15 minutes each minute being a separate entity such that if one behaviour pattern lasted 10 minutes it was scored 10 times. Group observations were conducted daily for 60 minutes each two minutes being regarded as a separate unit such that if one behaviour pattern lasted for 10 minutes it was scored 5 times. All observation sessions were conducted randomly during the period from 3.00 p.m. to 7.00 p.m., according to an established schedule.

The frequency with which juveniles made contact with the mother, in terms of the various categories of behaviour scored, converted to a percentage, was compared statistically with an expected percentage based on the assumption that all members of the group are equally attractive as social partners. Subject to minor fluctuations in group size, over the period of time during which this research was conducted, this value would be about the same for all mother-juvenile dyads observed.

All statistical tests were performed using the Mann-Whitney test with the level of statistical significance set at  $p < 0.05$ . The data of one individual collected over one year was taken as one independent sample for statistical purposes.

## Results

Figure 1 indicates that both male juveniles (Year 2,  $p < 0.001$ ; Year 3,  $p < 0.001$ ; Year 4,  $p < 0.005$ ; Year 5,  $p < 0.05$ ) and female juveniles (Year 2,  $p < 0.005$ ; Year 3,  $p < 0.025$ ; Year 4,  $p < 0.001$ ; Year 5,  $p < 0.005$ ) approach their mothers significantly more often than expected, females significantly more often than males of the same age (Year 3,  $p < 0.025$  and Year 4,  $p < 0.005$  respectively). Even at five years the same trend is still apparent ( $p < 0.1$ ). These differences hold whether we compare absolute or percentage frequencies from the third year of life on. The higher percentage frequency of approaches to the mother by juvenile daughters in the second year of life is due to the fact that they approach group members less frequently than do males.

Figure 2 reveals that sons and daughters were approached by their mothers significantly more often than expected (sons – Year 2,  $p < 0.001$ ; Year 3,  $p < 0.001$ ; Year 4,  $p < 0.005$ ; Year 5,  $p < 0.05$ ; daughters – Year 2,  $p < 0.005$ ; Year 3,  $p < 0.025$ ; Year 4,  $p < 0.005$ ; Year 5,  $p < 0.005$ ). From four years daughters were approached by their mothers significantly more frequently than were sons ( $p < 0.05$ ). This difference between the sexes is not upheld statistically, however, if absolute frequencies are compared instead of percentage frequencies. With the exception of the fifth year of life, when males were approached less often than were females by their mothers, there was no difference between the sexes in this regard.

The behaviour pattern most frequently observed among mothers and juvenile offspring is contact sitting. Figure 3 shows that, for all four age categories under consideration, mothers sit in close contact with both sons and daughters significantly more frequently than with other group members (sons – Year 2,  $p < 0.001$ ; Year 3,  $p < 0.001$ ; Year 4,  $p < 0.005$ ; Year 5,  $p < 0.025$ ; daughters – Year 2,  $p < 0.001$ ; Year 3,  $p < 0.005$ ; Year 4,  $p < 0.001$ ; Year 5,  $p < 0.005$ ).

Grooming is a particularly important social behaviour and figure 4 reveals that both daughters and sons, irrespective of age, groom their mothers significantly more frequently than they groom other group members (sons – Year 2,  $p < 0.025$ ; Year 3,  $p < 0.05$ ; Year 4,  $p < 0.005$ ; Year 5,  $p < 0.05$ ; daughters – Year 2,  $p < 0.001$ ; Year 3,  $p < 0.005$ ; Year 4,  $p < 0.001$ ; Year 5,  $p < 0.005$ ). At each age level, and in terms of both absolute frequency and percentage frequency, daughters groom their mothers more frequently than do sons these differences being significant from year 3 (Year 3,  $p < 0.025$ ; Year 4,  $p < 0.005$ ; Year 5,  $p < 0.05$ ). The tendency to groom the mother increases with age.

Figure 5 shows that mothers groom both their male and female juvenile offspring significantly more frequently than they groom other members of the social group (sons – Year 2,  $p < 0.001$ ; Year 3,  $p < 0.001$ ; Year 4,  $p < 0.005$ ; Year 5,  $p < 0.05$ ; daughters – Year 2,  $p < 0.001$ ; Year 3,  $p < 0.005$ ; Year 4,  $p < 0.001$ ; Year 5,  $p < 0.005$ ). Male juveniles are relatively more attractive to their mothers than are female juvenile offspring. Interest on the part of the mother in grooming her infants of either sex declines with age.

When one considers both active and passive grooming together (Figs. 4 and 5, absolute frequencies) it is clear that, as they become older, daughters become the more active partners in the mother-infant dyad.

In contrast to the affiliative behaviour patterns mentioned thus far, figure 6 reveals that the mother is of no more importance as a partner in social play to her juvenile offspring of either sex than are other group members and, in fact, is of significantly less importance as a partner in social place to her juvenile sons than are other members of the social group (Year 2,  $p < 0.001$ ; Year 3,  $p < 0.001$ ; Year 4,  $p < 0.005$ ; Year 5,  $p < 0.025$ ).

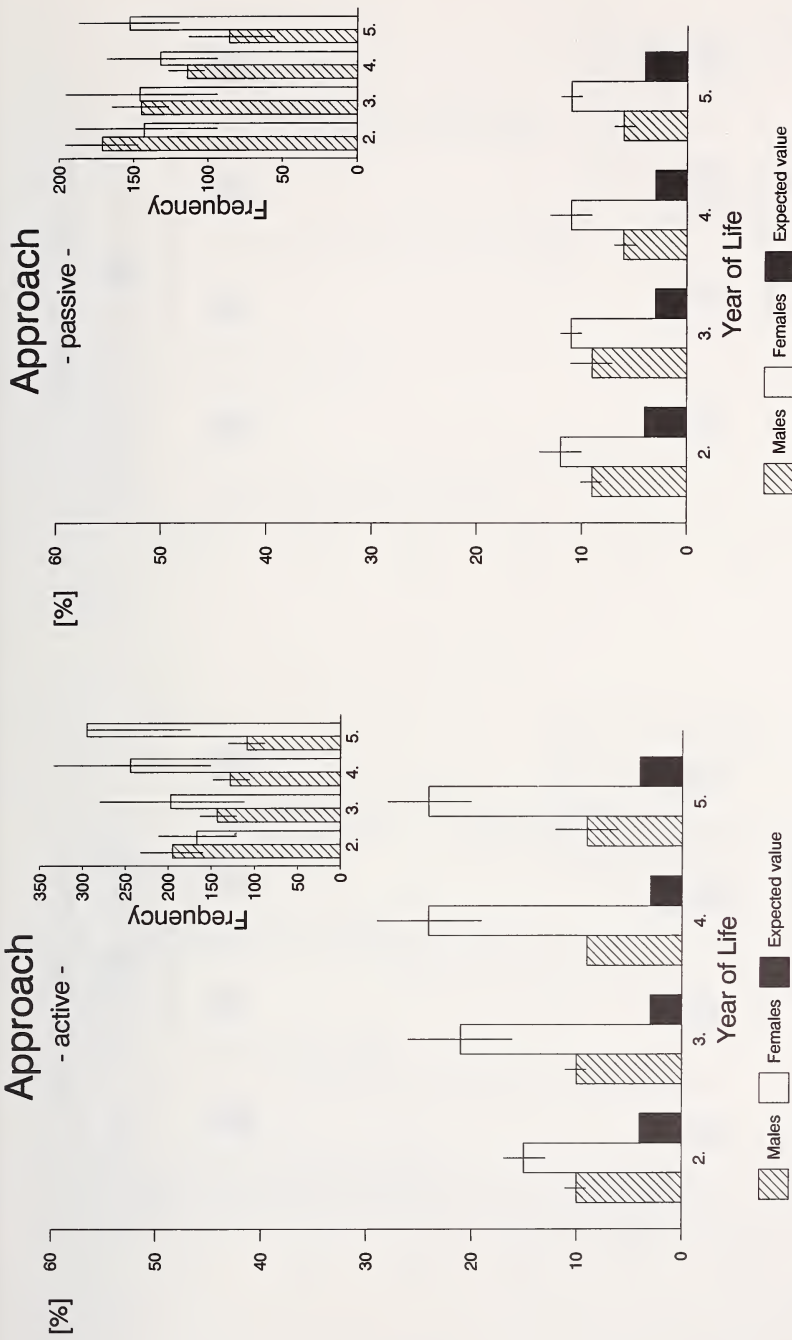


Fig. 1 (left). Active approach – Mean percentage of the frequency of occurrence, together with the standard error of the mean of male and female offspring towards their mother from year 2 to year 5, compared to an expected mean frequency based on the assumption that all members of the group are equally preferable as social partners. In addition the mean absolute frequency (with standard error) is given above on the right hand side. – Fig. 2 (right). Passive approach. (As for figure 1)



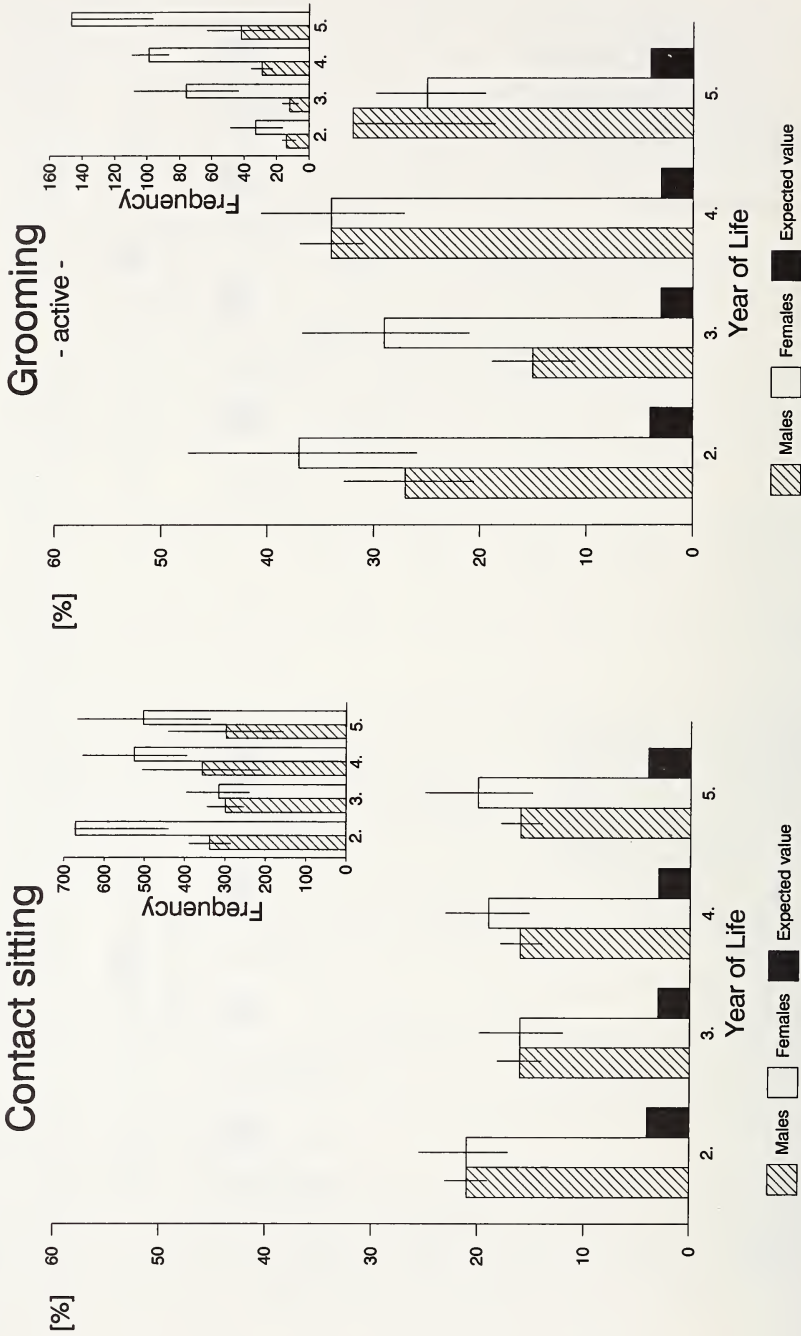


Fig. 4. Active grooming. (As for figure 1)

Fig. 3. Contact sitting. (As for figure 1)

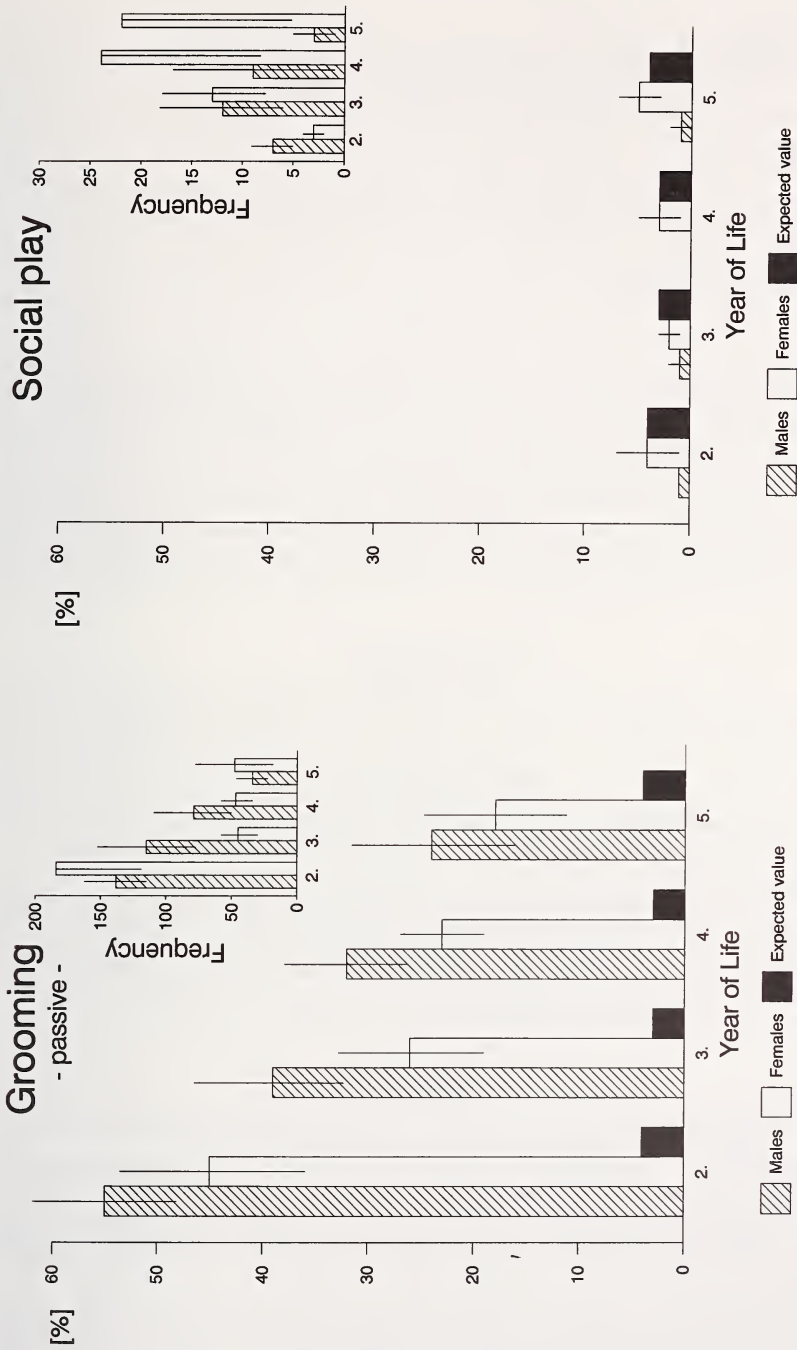


Fig. 6. Social play. (As for figure 1)

Fig. 5. Passive grooming. (As for figure 1)

## Discussion

In juvenile black-capped capuchins the mother remains the most important individual in the social group irrespective of the age of the juvenile. Contact established in the first year of life of the infant (WELKER et al. 1987, 1990) is important for the juvenile growing up within the social group, irrespective of the presence of younger siblings. With regard to the behaviour patterns contact sitting, approach and grooming, relations between mothers and juvenile offspring are especially close. These data may be compared with those from other primate species. The results suggest that in South American primates generally, and certainly in the black-capped capuchin, kin-relations are important for the development of the individual living in a social group. The data in respect of contact sitting suggest a particularly close relationship between mothers and daughters. While the reciprocal grooming relationship between mothers and offspring remains close throughout the juvenile period it is with respect of this category of social behaviour that differences between sons and daughters begin to emerge. In the mother-son dyad the mother remains the more active partner while, in the mother-daughter dyad, the daughter becomes the more active partner approaching her mother more frequently and grooming her more frequently than the mother approaches and grooms her daughter. In this way daughters appear both to establish and maintain close relations with their mothers thereby forming matri-clans and kin-based subgroups within the social group. Contact between mothers and sons, on the other hand, declines with age. This gradual weakening of kin relationships suggests a paving of the way, under natural conditions, for the male eventually to leave the social group into which he was born.

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## Zusammenfassung

*Soziale Beziehungen in Gruppen des Gehauften Kapuzineraffen (Cebus apella) in Gefangenschaft: Beziehungen zwischen Mutter und Jungtier vom zweiten bis zum fünften Lebensjahr*

Für Jungtiere des Gehauften Kapuzineraffen ist die Mutter der wichtigste Sozialpartner der Gruppe. Sie suchen ihre Mutter häufiger auf als irgendein anderes Gruppenmitglied, sitzen mit ihr in engem Körperkontakt, putzen sie häufiger als andere Kapuzineraffen und werden von ihr gleichfalls auffällig häufig geputzt. Als Spielpartner ist die Mutter jedoch für ihre heranwachsenden Kinder durchgängig unattraktiv. Geschlechtstypische Unterschiede im Verhalten sind vor allem bei der gegenseitigen sozialen Körperpflege aufzeigbar. Mit zunehmendem Alter werden hier Töchter die aktiveren Partner in der Mutter-Kind-Dyade, Söhne dagegen bleiben die passiveren.

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