

## RESEARCH ARTICLE

Preliminary Assessment of Natal Attraction and Infant Handling in Wild *Colobus vellerosus*LAUREN J. N. BRENT<sup>1,2\*</sup>, JULIE A. TEICHROEB<sup>1</sup>, AND PASCALE SICOTTE<sup>1</sup><sup>1</sup>Department of Anthropology, University of Calgary, Calgary, Alberta<sup>2</sup>Centre for Research in Evolutionary Anthropology, Roehampton University, London, United Kingdom

This study describes natal attraction and infant handling in wild ursine colobus (*Colobus vellerosus*). Focal animal samples were collected from five infants of 1–16 weeks of age (mean: 14.5 focal hours per infant). Group members may be attracted to an infant, but unable to handle it because of resistance from the mother. We thus measured natal attraction independently from infant handling by the number of interactive approaches received. The youngest infants were most attractive. Immature females were attracted to and handled infants more than other group members. Mothers were tolerant of most handling attempts and infant-directed aggression was rare. A sixth infant was attacked by members of an all-male band, which allowed us to record the expression of natal attraction and infant handling in the context of an acute threat of infanticide. This infant was carried by non-mothers less frequently than the other infants, and its mother resisted handling attempts more often. *Am. J. Primatol.* 70:101–105, 2008. © 2007 Wiley-Liss, Inc.

**Key words:** *Colobus vellerosus*; natal attraction; infant handling; infanticidal threat

## INTRODUCTION

In primates individuals other than the mother often exhibit an interest in infants or “natal attraction” [Silk, 1999; Silk et al., 2003; Small, 1991]. This attraction leads to physical contact (“infant handling”) with infants in approximately 1/3 of the species studied [Ross, 2003]. At least 15 hypotheses have been generated to explain the adaptive significance of primate infant handling [Maestripieri, 1994]. If the ultimate goal is to understand the function of this behavior, we need a detailed description in as many species as possible.

Infant handling has been described in Asian colobines [Bennett, 1988; Hrdy, 1977; Jay, 1963; Poirier, 1968; Scollay & DeBold, 1980; Stanford, 1992; Vogel, 1984] and to a lesser extent in African colobines [Emerson, 1973; Horwich & Manski, 1975]. Here we offer a preliminary description of natal attraction and infant handling in wild ursine colobus (*Colobus vellerosus*), and examine the effect of an acute threat of infanticide on the expression of these behaviors. Although our sample size is small and relatedness is not known between adults in our study groups, this study provides the type of fine-grained data necessary to assess the function of natal attraction and infant handling.

## MATERIAL AND METHODS

## Study Site and Subjects

This study took place at the Boabeng-Fiema Monkey Sanctuary in Ghana. Five infants belonging

to 4 groups were followed. Coat color was used to estimate infant age (Table I). Group compositions remained identical after the birth of infants for all groups except B2, in which a male takeover occurred (Table I). We use the term “non-mother” to refer to individuals other than the focal infant’s mother.

## Data Collection

Data were collected between June and December 2004. Groups were followed from 6:00 to 18:00. We used focal animal sampling [10-min sampling; Altmann, 1974] to record all behaviors directed toward infants by non-mothers and all behaviors performed by infants. A mean of 14.5 hr of focal data were collected per infant (Table I).

The amount of infant handling performed is often used as a measure of the amount of interest in infants [Caine & Mitchell, 1980; Silk, 1999]. Maestripieri [1994] argued that the number of successful attempts to handle infants is more a measure of

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\*Correspondence to: Lauren J. N. Brent, Centre for Research in Evolutionary Anthropology, Roehampton University, Holybourne Avenue, London, England SW15 4JD. E-mail: L.Brent@roehampton.ac.uk

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**TABLE I. Focal Infants and Composition of Study Groups**

Infant (sex/group)	Date of birth <sup>a</sup>	Hours of focal data per age category <sup>b</sup>				Group composition (no. of individuals)					
		W	G	BW	Tot	AF	iF	AM	iM	fBWI	Total
No acute threat of infanticide											
CK (M/AK)	August 28– September 15	2.5	8.7	0.0	11.2	6	3	1	0	5	16
SM (F/B2)	July 19–21	5.3	7.8	10.2	23.3	4	3	3/1 <sup>c</sup>	6/5 <sup>c</sup>	0	17/14 <sup>c</sup>
SV (M/OD)	April 26–May 8	0.0	5.0	4.2	9.2	4	3	1	5	0	14
TH (M/OD)	July 27–August 4	8.3	6.5	3.7	18.5	8	4	1	0	3	18
TL (M/RT)	June 5–16	3.8	4.8	1.7	10.3	5	1	1	1	4	13
Acute threat of infanticide											
PG (M/DA)	October 17–19	19.3	0.0	0.0	19.3	10	2	1	12	4	30

<sup>a</sup>Birth dates were estimated using the date of last contact with an infant's group before their birth, and the dates of natal coat transition.

<sup>b</sup>The categorization of infant age by coat color is perhaps more biologically significant than an arbitrary division by days or weeks. The function of the natal coats has been linked to a number of social behaviors, including infant handling [Treves, 1997].

<sup>c</sup>Pre- and post-takeover values.

Age categories: W = white (0–7 weeks of age); G = grey (7–11 weeks of age); BW = black-and-white (12 weeks of age). Age-sex classes: AF = adult females; iF = immature females; AM = adult males; iM = immature males; fBWI = fully black-and-white infants (aged 4–12 months, were not focal infants).

maternal tolerance to infant handling than it is a measure of interest toward infants. We thus measure interest (“natal attraction”) by the number of interactive approaches received (Table II).

### Data Analysis

Because the number of individuals that could potentially interact with each infant varied, we treat each infant within the context of its group. Difference scores [Sanchez et al., 2002] were calculated for the number of interactive approaches and infant handling bouts by infant age and by handler age–sex class. These scores incorporate observed and expected values, similar to a  $\chi^2$  analysis.  $\chi^2$  analyses could not be performed as they could not deal with our sample sizes. Difference scores  $>0$  indicate more interactions were observed than expected,  $<0$  indicate less interactions than expected. Difference scores by non-mother age–sex class were calculated as follows:

$$\frac{\text{Observed \# of infant handling bouts (or interactive approaches) performed by non-mothers of age-sex class in question}}{\text{Total \# of bouts performed by all non-mothers}}$$

$$\frac{\text{Expected \# of bouts performed by non-mothers of the age-sex class in question (see description below)}}{\text{Total \# of bouts performed by all non-mothers}}$$

Expected values were calculated by dividing the total observed number of bouts by all non-mothers by the total number of non-mothers in the group (to give the number of bouts we would expect per individual

non-mother if all non-mothers were to handle infants the same amount). This value was then multiplied by the number of non-mothers in the age–sex class in question. B2 group's pre- and post-takeover compositions are analyzed individually when necessary.

Observed values for difference scores by infant age were adjusted to account for different numbers of focal periods collected for each individual infant at different ages. The number of interactions received at the age in question was divided by the number of focal periods collected at that age. This gave the mean frequency of interactions per focal session. We then determined the number of focal periods we would have had if we had collected the same number of focal periods for each infant age category. This number was multiplied by the mean frequency of interactions per focal session to give an “adjusted” observed value. Expected values were simply the total observed number of interactions received by all infants (adjusted) divided by the number of age categories.

This study received clearance from the animal care certification committee of the University of Calgary (Protocol BI 2003-028), and was authorized by the Ghana Wildlife Division and by the BFMS Management Committee.

## RESULTS

### Natal Attraction

The mean frequency individual infants received interactive approaches was  $0.15 \pm 0.02$  events per hour per number of available non-mothers (range = 0.14–0.18). Infants received more interactive approaches than expected when their coats were white (3/4 infants; Table III). All females interactively approached infants. In the 2 groups in which

all members were recognized (RT and B2, 1 infant each), six of 21 individuals did not approach infants interactively. These were all males (2/3 adult males, 4/7 immature males). Immature females interactively approached infants more than expected,

whereas difference scores for adult females were both above and below the expected values (Table III). Difference scores for interactive approaches by adult and immature males were less than zero in almost all cases. Compared with females, males interactively

**TABLE II. Definitions of Behaviors**

Behavior	Definition <sup>a</sup>
1. Interest/ attraction	Attraction to another individual is expressed by approaching interactively that individual. An interactively approaching [Altmann, 1980] is an approach to a distance of $\leq 2$ m (i.e. establishment of proximity) by one individual to another that is followed (within 30 sec) by a social interaction other than simply remaining in proximity. For infants, interactive approaches are initiated by non-mothers and may involve a combination of peering, non-agonistic mouth-opening, threats, grooming the mother, or attempts to handle the infant. Because infants are often in contact with their mothers, we consider both interactive approaches to the infant (when alone) and to the mother–infant dyad as expressions of interest in the infant.
2. Infant handling	A behavior comprised of contacts of infants by non-mothers. These contacts include touches, transfers, and aggression (defined below). Handling was classified as either “gentle” or “rough”. Gentle handling included holding an infant in a secure position, and grooming an infant. Rough handling included quickly grabbing an infant, and holding an infant insecurely (e.g. dangling between the legs).
3. Touch attempt	An individual reaches toward the infant to touch it. The attempt may be successful or not.
4. Transfer attempt	An individual other than the mother attempts to bring an infant into contact with its body. Following successful transfer attempts, infants are held and/or carried by the individual.
5. Aggression	An individual hits, bites, or chases an infant, or chases the mother–infant dyad.

<sup>a</sup>Unless specified otherwise, these definitions were adapted from Maestripietri [1994] and Kleindorfer and Wasser [2004]. Bouts of infant handling were considered distinct if the identity of more than one individual involved changed, or when a break in contact was  $\geq 30$  sec. Interactive approaches were considered distinct if the individual left proximity to the infant for  $\geq 30$  sec before approaching again. Interactions that were initiated by infants and those that involved play were excluded from our definition of infant handling. Interactions between fully black-and-white infants and focal infants mostly involved play and were not considered infant handling.

**TABLE III. Difference Scores for the Number of Interactive Approaches and Bouts of Infant Handling Received**

Infant	Infant age			Handler age-sex				Handler sex	
	W	G	BW	AF	iF	AM	iM	F	M
CK									
App	0.05	-0.05	No data	-0.24	0.30	-0.06	—	0.06	-0.06
IH	-0.04	0.04	No data	-0.16	0.20	-0.04	—	—	—
SM <sup>a</sup>									
App	0.05	0.1	-0.15	—	—	—	—	—	—
IH	-0.12	0.23	-0.01	—	—	—	—	—	—
SM <sup>b</sup>									
App	—	—	—	0.13	0.20	-0.07	-0.27	0.34	-0.34
IH	—	—	—	0.24	0.24	-0.20	-0.27	—	—
SM <sup>c</sup>									
App	—	—	—	0.10	0.30	-0.08	-0.32	0.40	-0.40
IH	—	—	—	-0.06	0.28	-0.08	-0.14	—	—
SV									
App	—	-0.02	0.02	-0.15	0.24	-0.08	—	0.08	-0.08
IH	—	-0.15	0.15	-0.02	0.10	-0.08	—	—	—
TH									
App	0.11	-0.12	0.01	0.07	0.01	-0.08	—	0.08	-0.08
IH	-0.01	-0.01	0.03	0.14	-0.06	-0.08	—	—	—
TL									
App	0.27	0.06	-0.33	-0.24	0.30	-0.14	0.08	0.06	-0.06
IH	-0.09	0.05	0.04	-0.07	0.26	-0.14	-0.04	—	—

<sup>a</sup>Pre- and post-takeover group compositions combined.

<sup>b</sup>Pre-takeover.

<sup>c</sup>Post-takeover.

App = approaches; IH = infant handling. Ages: W = white; G = grey; BW = black-and-white. Age-sex classes: AF = adult female; iF = immature female; AM = adult male; iM = immature male.

approached infants less than was expected in all cases (Table III).

### Infant Handling

We observed 176 bouts of infant handling (106 touches, 70 transfers). All infants received infant handling (mean:  $0.20 \pm 0.02$  bouts per hour per number of available non-mother, range = 0.15–0.30). White infants were handled less than expected (4/4), whereas some gray (3/5) and black-and-white (2/4) infants were handled more than expected (Table III). Immature females handled infants more than expected in all but one case (Table III). The mean frequency of infant handling by adult females was  $0.17 \pm 0.02$  bouts per hour per number of available adult females, although difference scores for adult females were often below the expected amount (Table III). Only 1 adult male handled an infant (2 touches of infant CK). Handling by immature males was more common ( $n = 16$ , or 9.1% of all bouts), but difference scores for immature and adult males were always below zero. We recorded a single case of infant-directed aggression (a hit by an adult female). Rough handling, such as awkward carrying (Table II), comprised 15.1% of all attempts to handle infants ( $n = 186$  attempts). The mean percentage ( $\pm$ SE) of handling attempts that were rough for infants of different ages were as follows:  $W = 7.1 \pm 7.1$ ,  $G = 19.0 \pm 5.5$ , and  $BW = 4.3 \pm 2.5$ . The mean percentage of handling attempts that were rough did not appear to differ between adult and immature females (adult =  $15.2 \pm 13.1$ , immature =  $10.6 \pm 10.2$ ). No wounds were observed as a result of rough infant handling. Only 6.0% of attempts to handle infants were resisted (1.9% of touch attempts, 10.0% of transfer attempts), mostly by the mothers (72.7%).

### Infants With and Without an Acute Threat of Infanticide

Shortly after birth, infant “PG” received aggression from males who had recently entered DA Group. PG was born late in the study period, and data are confined to the period when his coat was white. We therefore compare him to the other infants using only data from this age. PG received interactive approaches at a mean frequency of  $0.17 \pm 0.04$  and infant handling at a mean frequency of  $0.15 \pm 0.04$ . These values were within the range received by other infants (approaches: CK,  $0.22 \pm 0.08$ ; SM,  $0.28 \pm 0.1$ ; TH,  $0.21 \pm 0.06$ ; TL,  $0.26 \pm 0.11$  and handling: CK,  $0.26 \pm 0.13$ ; SM,  $0.19 \pm 0.09$ ; TH,  $0.18 \pm 0.05$ ; TL,  $0.13 \pm 0.07$ ). However, the proportion of transfers relative to touches PG received was less than that received by the other infants (Table IV). Moreover, the frequency of transfers PG received ( $0.01 \pm 0.01$ ) was lower than all but one infant (CK,  $0.22 \pm 0.11$ ; SM,  $0.08 \pm 0.04$ ;

**TABLE IV. Ratio of Touches to Transfers and Resisted Infant Handling Attempts for Infants With and Without Acute Threats of Infanticide**

Infant	No. of touches	No. of transfers	Ratio of touches to transfers = no. of touch/no. of transfers	Percentage of all attempts resisted (total no. of attempts)
No acute threat of infanticide <sup>a</sup>				
CK	1	5	0.2 (trans > touch)	14.3 (7)
SM	6	4	1.5	0.0 (9)
TH	10	8	1.25	23.8 (21)
TL	2	1	2	0.0 (3)
Acute threat of infanticide				
PG	35	3	11.7 (touch > trans)	26.1 (46)

<sup>a</sup>Data for infants 0–8 weeks of age.

TH,  $0.08 \pm 0.03$ ; TL,  $0.04 \pm 0.04$ ). PG’s mother resisted attempts to handle her infant the most (Table IV).

### DISCUSSION

In this paper we present, to our knowledge, the first description of natal attraction and infant handling in *C. vellerosus*. Although these data are preliminary, some of our results are consistent with those of other colobine studies [e.g. females handled infants, males did not; McKenna, 1979], whereas others are not [e.g. youngest infants were not handled the most, and handling did not cease after infants obtained the adult pelage; *Colobus guereza*: Oates, 1977; *Semnopithecus entellus*: Hrdy, 1977; *Trachypithecus johnii*: Poirier, 1968; *Trachypithecus pileatus*: Stanford, 1992].

Thirty years of debate have produced at least 15 hypotheses to explain the adaptive significance of infant handling [Maestripieri, 1994]. Here we present for 1 species the type of data required in a broad range of primates to evaluate these hypotheses; information about age and sex effects is needed to test predictions regarding specific types of individual (e.g. the null hypothesis predicts adult females, but not males, will handle infants; Quiatt, 1979). Data that distinguish attraction to infants from infant handling are also required (e.g. the socioecological model of infant handling states adult females may be attracted to infants, but unable to handle them due to maternal resistance; Maestripieri, 1994).

We also compared natal attraction and infant handling for a *C. vellerosus* infant acutely threatened with infanticide to those with no or little threat. Although similarities between the overall frequencies of infant handling were apparent, the infant

with an acute threat appeared to be transferred to, and therefore held/carried by, non-mothers less often. This difference seemed in part due to greater resistance to handling attempts by the mother. Further study of this phenomenon with a larger sample size may reveal whether maternal permissiveness to infant handling typically decreases for infants threatened with infanticide.

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