

EARLY DEVELOPMENT OF THREE WILD INFANT *Cebus apella* AT LA MACARENA, COLOMBIA.

Nicole Valenzuela
Universidad de los Andes

Little is known about developmental changes of neonate *Cebus apella* in the wild. Some studies have been made in captivity by Nolte and Dücker (1959), Welker et al. (1987) and Fragaszy (1989). Because social groupings have been established artificially to conduct studies in captivity, and because the conditions that individuals face differ markedly from natural conditions, behavior and development of captive individuals might differ from those of wild animals. The purpose of this study is to contribute to the establishment of a more realistic model of behavioral development in *Cebus apella*. A comparison between the results obtained in this study and those obtained in captivity will help to elucidate the model. Here I report the weekly changes in the infant's behavior patterns and in its relations with carriers, mostly during the first two months of life, though data from the third to the sixth months are also available. The development of social relations between the infants and the other group members are described elsewhere (Valenzuela, in press).

METHODS

Study site

The study was conducted from January to July 1989 at La Macarena Primates Research Center, La Macarena, Colombia. The study site is located on the southern bank of the Rio Duda, midway between its mouth and source, within Tinigua National Park, in the departamento of Meta. For a description of the study area see the note "The study site: a brief description", elsewhere in this volume. The dry season lasts for four months (December to March), and the rainy season extends for the rest of the year. Temperatures ranged from 17°C to 35°C during the study period. The registered rainfall during those six months totaled 1728 mm.

Study group

The group observed (MC-1, see Table 1), has been provisioned with food (at a feeding platform located within the camp site) since 1986 (Izawa, 1988), and individuals are thus used to human presence. In addition, because this group has been studied for four years, kinship and hierarchy relationships are known. At the beginning of the study period there were 22 individuals; on June 16th, Kenio, a subadult male, joined the group.

Observations:

This study was focussed on the behavioral patterns of three new born individuals (Liber, Colon and Dante) and their interactions with carriers. The study group was observed (almost) daily, from 0600-0800 hours until 1500-1700 hours depending on weather and

Table 1: Composition of MC-1 group

AGE AND SEX GROUP	NAME, KINSHIP AND DATE OF BIRTH
Alpha male	Chamusa
Adult males	Lleris
	Uribe
	Martin
	Oregon
Subadult male	Kenio (joined the group on june 16, 1989)
Adult Female	Losada
	Yaruma
	Duda
	Guaya
	Cabra
Juvenile males	Jose (Cabra's son)
	Lopez (Losada's son)
Juvenile females	Peneya (Guaya's daughter)
	Villa (Duda's daughter)
	Cauca (Guaya's adopted daughter)
	Caqueta (Cabra's daughter)
	Dagua (Duda's daughter)
Older infant males	Guavio (Guaya's son) (june 26/88)
(3-6 months of age)	Yoan (Yaruma's son) (nov. 10/88)
New born males	Liber (Losada's son) (feb. 5/89)
	Colon (Cauca's son) (feb. 22/89)
	Dante (Duda's son) (late may/89)

visibility. Liber and Colon were observed from the day of birth. Dante was first seen during his second week of age (deduced from his size and developmental stage), but systematic observations only began when he was four weeks old. Observation time was distributed among the infants; after observations on Dante were initiated, most of the observation time was dedicated to him. By this time Liber and Colon were 18 and 16 weeks old, respectively. Of the 90.5 hs of observation time, 9.7 hs occurred at the feeding platform and 80.8 hs in the forest.

The carrier's name, sex, age and state of activity (see below) were recorded besides its kinship relation to the infant. The infant's state of activity (and the time it changed) were noted.

States of activity of the carriers were grouped into three classes: (1) Foraging or Feeding: The carrier searches for and consumes food, either insects, fruits or leaves; (2) Displacement: The carrier moves, changing its location; and (3) Resting: The carrier remains motionless or reclined on a branch.

Four zones on the carrier's body and three orientations on the carrier's back were used to classify the infant's positions (Table 2). Every possible combination of zones and orientations was taken into account. Observation times for each of the three infants were weighted and then averaged to avoid a bias, since the observation time for the three infants were different.

Several states of activity were distinguished and grouped into three major categories (Active, Inactive and Not Clear). A description of these activity states appears in Table 3.

Table 2: Carrying zones and orientation of the infant on the carrier's body

ZONES

- High back: over carrier's neck and shoulders.
- Middle back: between carrier's arms and legs.
- Low back: across carrier's hip.
- Ventrum: over carrier's belly.

ORIENTATIONS

- Transversal: perpendicular to the carrier's body axis.
- Diagonal: oblique to the carrier's body axis.
- Longitudinal: parallel to the carrier's body axis.

NOT CLEAR

- Any non discernible zone or orientation because the
 - infant constantly moved or because of low visibility.
-

Table 3: Infants' states of activity.

ACTIVE:

- Displacement (D): Infant goes over a distance. Not being carried.
- Moving (M): Infant moves without displacement. Not being carried.
- Resting (R): Infant remains still on a branch. Not carried.
- Foraging (F): Infant moves in a foraging-like play; touching, manipulating and biting leaves and branches, green or dry as well.
- Playing (P): Infant interacts with other individuals in a social play (chasing, wrestling, pulling).
- Jumping (J): Infant is alone and jumps during displacement or non-social play. Sometimes includes a leap of several meters by the infant usually over a mass of branches.
- Touching (T): Infant has hand or mouth contact with another individual.

INACTIVE:

- Sleep (S): Infant is carried and has closed eyes.
- Awake (A): Infant is carried and has open eyes.

NOT CLEAR:

- Any non-discernible state because of lack of visibility.
-

RESULTS**CARRIERS**

During the first three or four weeks of life, each infant was carried exclusively by its mother. After the fourth or fifth week, the infant began to move independently. Its first independent movements were initiated by the mother, who left him alone or with another individual. When the mother left her infant alone for the first time, she made it on a tangle of twigs of small diameter. The tangle allowed the infant attach himself safely in spite of his lack of strength and low motor coordination. After this time, other members of the group also acted as carriers.

Juveniles acted as carriers more often than adults during the whole study period (Fig.1). The first individuals to carry an infant other than his mother, were Yaruma (an adult female), who first carried Liber, and Lopez (a juvenile male), who first carried Colon and Dante. The most frequent carriers were infant's siblings during week 4 and juvenile males (weeks 4 to 6) and later juvenile females (from the 6th week on) and non-relatives after the seventh week (Figs. 1 and 2).

INFANT CARRYING POSITION:

Zones:

The upper-back was the most used carrying zone during the first month of life (73 to 51% of the total carrying time) and then decreased during the 4th or 5th week of life (31%), when the infant was first left alone and appeared to be self-mobile. The middle-zone was first used on the second week of life and became more common (57%) in the 5th week, when carrying in the upper-back zone became rarer. When self mobility developed, the time the infant was carried diminished. Thus, the middle-zone carrying became less common with respect to the observation time but the middle-back remained as the prevailing carrying zone (57 to 79%) until the end of the study. Low-back carrying was always rather unusual (<10%). The ventral position did not occur very frequently, being only used during lactation or grooming of the infant by its carrier (mother or allomother). It was also present sometimes when the carrier made a short displacement after lactation or grooming sessions.

Orientation

The transversal position prevailed during the first two weeks of life (85% and 55% of carrying time, respectively) and even during the third week was used 30% of the carrying time. Afterwards, the use of this position decreased in frequency (<11%). Although diagonal position was present during the first week (12%), its use increased (>34%) during the second and third weeks. Afterwards its frequency diminished (<21%). The longitudinal position became the prevailing one (>54%) during the fourth week, when the frequency of the other positions decreased, and remained the dominant position until the end of the study. In almost all cases infants faced forwards while being carried. At least one observation was made of each infant facing backwards. In those latter cases, when the infant was facing backwards, it was being carried on the hip.

INFANTS' STATES OF ACTIVITY:

Most observations sampled as Not Clear during the first month belong probably to the Inactive category, because the infants were almost always carried during this period (Fig.3). After week 8, activity levels increased. There was a gradual development of the infants' coordination, strength and self mobility. If the infant was not being carried, it was almost always in an active state. Infants only slept when they were being carried, while juveniles slept by themselves on a branch. Liber showed an increase in his self locomotion after his 7th week of life (>20%). There were no data on Colon's 7th to 9th weeks of life, and the observation time on Dante during those weeks was scant. Moving and Displacement were the only behavioral states present at the time infants were first left alone, Table 4. Displacement (D), Moving (M), Resting (R), Foraging (F), Playing (P), Jumping (J), and Touching (T), first appeared after the infant was left alone by its mother for the first time. Foraging and Touching activities were present whether the infant was being carried or not, while the other activities exclusively occurred when the infant was not being carried.

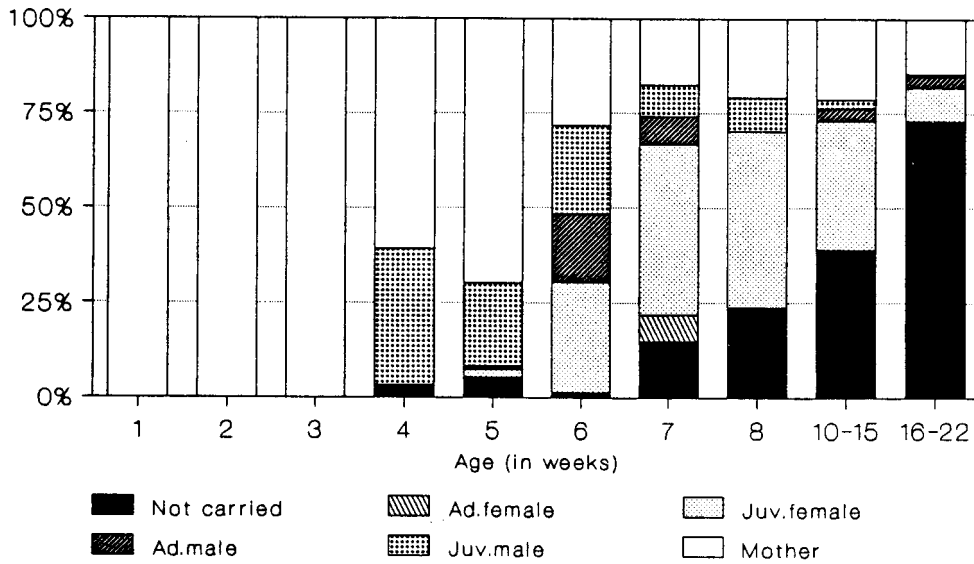


Fig. 1. Variation in the composition of the carrier's group in a *Cebus apella* troop followed at La Macarena from January to July, 1989. The relative importance as carriers of adults and juveniles of both sexes changes as the infant grows older.

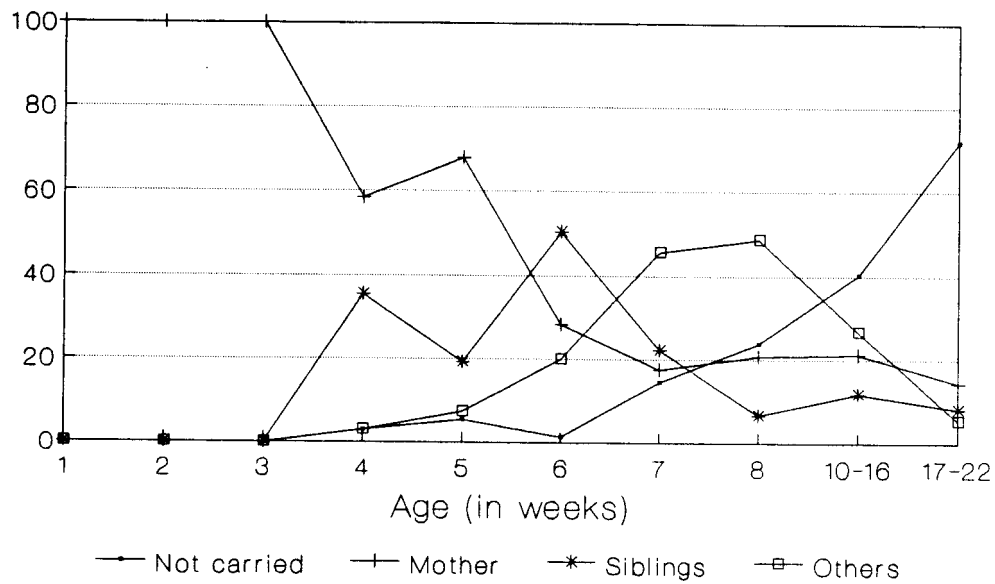


Fig. 2. Percentage of time the infants move independently (.), or are carried by the mother (+), siblings (*) or other, not kin related individuals.

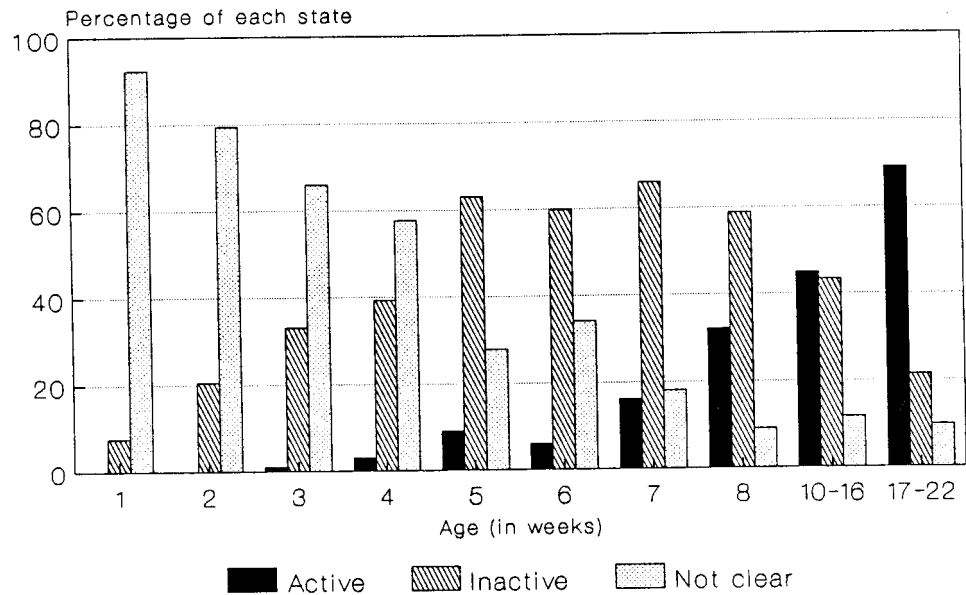


Fig 3. Combined states of activity of three infants, during a 22 weeks' study period (January to July, 1989) at La Macarena.

DISCUSSION

Wild *Cebus apella* must respond to a more complex and stressful environment than groups kept in captivity. Moreover, the pressures imposed by natural conditions may cause a more rapid development of infants. These factors may help to explain differences in observations between this study and studies of captive individuals. While the infants' carrying positions observed during this study were similar to those reported in studies made in captivity, data on infants' mobility independence and alloparental care were different.

CARRIERS:

In a study made by Robinson and Janson (1987) they described alloparenting as common for the Subfamily Cebinae, to which *C. apella* belongs. Welker et al. (1987) rarely observed alloparental care during a study on *C. apella*. On the contrary, alloparental care was commonly observed during this study and carrying by allomothers was virtually restricted to juveniles (males and females) who showed a greater interest to act as carriers of the new born infants than adult males and females. The infants spent 20-70% of the observation time with allomothers after week four. Individuals of every age, sex and kinship group acted as carriers, which shows the cohesion of the group.

Escobar (1989) stated that juveniles benefit when they carry an infant, thus explaining the motivation of the carrying activity. The benefit is supposed to be related to the hierarchy of the carried infant's mother. Carrying the infant of a higher ranked mother would represent a greater benefit than carrying those of a lower ranked female. However, I found that juveniles born of high and low ranked females carry infants of low and high ranked females without preference. Carrying behavior can be better interpreted as a sign of group cohesion, and perhaps a way in which juveniles obtain experience in infant care. Such experience would very likely improve survivorship of their own offspring. However, given the low frequency of allomaternal carrying performed by adult males and females during this study, it seems that such an experience will be used almost exclusively by the future mothers. Then, the motivation of the allopaternal care often shown by juvenile males remain an open question. May be it is just a non gender-determined juveniles' activity.

CARRYING POSITION:

Changes of the carrying position recorded by the author were similar than those reported by Welker et al. (1987) in a study of captive *C. apella*.

Changes of the carrying position from transversal to longitudinal and from high-back to middle-back zones seem to be related to the size of the infant. When born, the infant is too small to reach around the mother's back; thus, it is located on the mother's neck. As the infant grows it moves to a longitudinal position which provides a larger area in which to attach, and the infant attains a "jockey like position" (Welker et al., 1987). In this position, the infant's body does not interfere with the carrier's movements. The diagonal position is a transitory position from transversal to longitudinal. In the same way high-back zone (which includes mostly the mother's neck during the first weeks) is replaced by the middle-back as the infant becomes larger. After week 5, the infant's length makes it cover the high and middle zones simultaneously.

ACTIVITY STATES:

During the first month the infants rely upon the mother for transportation and during the first two months, when the infants are lactating, they are dependent on their mother for food. Foraging behavior was first observed during the fifth week, but it appeared to be more like play or training than actual foraging.

The onset of self-mobility recorded in this study appeared earlier than in a study conducted by Fragaszy (1990), who described the first sight of the infant off its mother at the eighth week. Liber, Colon and Dante attained self-mobility during the fourth and fifth week of life. When infants reached the age of three months, they moved independently, except during rapid movements of the group. This was also reported by Escobar (1989), who studied the same *C. apella* group (MC-1). Even though self-mobility was rather unusual or brief at the beginning, its early onset and allomother carrying, help the infant to develop other abilities rapidly. Being off the mother or any carrier, the infant is forced to develop its coordination and motor skills. Contact with mother and allomother carriers give the infant an opportunity to learn behavior patterns that may be adaptive. There is an obvious, though gradual, increase in the infant's coordination and development of complex skills.

Moving and displacement were the only behavioral states present at the time infants were first left alone. They could only stand on their feet over the mass of branches or move wobbly with very short or no displacement at all, due to their lack of strength and incipient movement control. When moving coordination and strength increase, the infants perform novel activities such as foraging and playing. Jumping appears later than moving, displacing, foraging and resting (Table 4). Such activity indicates a high level of motor skill development and strength.

Table 4: Age in weeks of first occurrence of activities.

Individual	Behavior Pattern						
	M	D	F	R	J	T	P
Liber	4	5	5	4	9	9	12
Colon	5	5	5	7	7	16	10
Dante	5	6	5			7	

Blank spaces correspond to activities not recorded for that individual during the study period, although they could have been present.

M = Moving D = Displacement F = Feeding R = Resting
 J = Jumping T = Touching P = Playing

ACKNOWLEDGEMENTS:

I want to thank Dr. Kosey Izawa (Miyagi University) and Prof. Carlos Mejía (University of Los Andes), directors of La Macarena Primates Research Center (CIPM), for making this study possible. I also want to thank Z. Calle and A. Espinel for their help with the management of the data and to Mitch Aide and Bill Teska for their readings and suggestions about the manuscript and their help with the language. Also to Dr. A. Nishimura for his readings and corrections. Thanks to J. Ahumada for his ideas during the research and to Henry and Fredy Lozano at the Macarena Primates Research Center for their invaluable help.

REFERENCES

- Escobar-Páramo, P., 1989. The Development of the Wild Black Capped Capuchin (*Cebus apella*) in La Macarena, Colombia. *Field Studies of New World Monkeys at La Macarena, Colombia*, 2: 45-57.
- Escobar-Páramo, P., 1989. Social Relations Between Infants and Other Group Members in The Wild Black Capped Capuchin (*Cebus apella*). *Field Studies of New World Monkeys at La Macarena, Colombia*, 2: 57-63.
- Fragaszy, D.M., 1990. Early Behavioral Development in Capuchins (*Cebus*). *Folia Primatol.* 54: 119-128.
- Izawa, K., 1980. Social Behavior of The Wild Black Capped Capuchin (*Cebus apella*). *Primates*, 21(4): 443-467.
- Izawa, K. and Tokuda, K., 1988. General Aspects of Study Site. *Field Studies of New World Monkeys at La Macarena, Colombia*, 1: 1-3.
- Izawa, K. and Nishimura, A., 1988. Primate Fauna at the Study Site, La Macarena, Colombia. *Field Studies of New World Monkeys at La Macarena, Colombia*, 1: 511.

- Robinson, J.G and Janson, C.H., 1987. Capuchins, Squirrel Monkeys and Atelines: Socioecological Convergence With Old World Primates. In *Primates Societies*. Smuts, B.B., Cheney, D.L. Seyfarth, R.M, Wargham, R.W. and Struhsaker, T.T. (eds). University of Chicago Press: 69-82.
- Valenzuela, N., 1992. Social Contacts Between Infants and Other Group Members In The Wild (*Cebus apella*) in Colombia. *Field Studies of New World Monkeys at La Macarena, Colombia*, 5:
- Welker 1987. Social Relations in Groups of The Wild Black Capped Capuchin (*Cebus apella*) in Captivity. *Zoology and Comparative Anatomy, Primate Ethology*, University of Kassel. FRG.
- Yoneda, M., 1988. Habitat Utilization of Six Species of Monkeys in Rio Duda, Colombia. *Field Studies of New World Monkeys at La Macarena, Colombia*, 1: 39-
- Yoneda, M., 1988. Temperature and Precipitation Change at Camp Site in Rio Duda, Colombia. *Field Studies of New World Monkeys at La Macarena, Colombia*, 1: 47-
- Wright, E.M. Jr and Bush, D.E. 1977 The Reproductive Cycle of The Capuchin (*Cebus apella*). *Laboratory Animal Science*, vol 27 (5)

Author's Address: Calle 41 No. 25-34 Apto 202, Bogotá, Colombia, S.A.