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Two models of the human infant's caretaking requirements—the continuous care and contact model and the caretaker-child strategy model—are discussed in terms of the caretaking practices observed among the Efe (Pygmies) of northeastern Zaire. The Efe¹ engage in a system of multiple care which begins at birth and continues through at least the first 18 weeks of life. An important aspect of this care includes being suckled by lactating and nonlactating women. The data suggest that the continuous care and contact model is too rigid a formulation of the infant's caretaking environment, and lend support to the strategic model. Efe caretaking practices are discussed in terms of the cultural, ecological, and physiological constraints acting on these people.

MANY OF THE MODELS CONCERNING THE REQUIREMENTS of the human infant's caretaking environment share certain fundamental features. For example, most models state that the human infant is unable to satisfy its needs and, as a result, is dependent on the care of adult conspecifics for survival. Furthermore, there is agreement that the type of care an infant receives is influenced by cultural, socioecological, and phylogenetic factors. There is, however, disagreement among proponents of the various models over the relative influence of specific factors in tempering caretaking practices. Some argue that caretaking practices are shaped predominantly by phylogenetic factors and conform to a species prototypical form. Others argue that phylogenetic constraints are but one of many factors that shape caretaking practices and that a variety of caretaking practices exist. Two models illustrate these different positions.

The first model, coined the continuous care and contact model (CCC; Tronick, Winn, and Morelli 1985) maintains that human caretaking practices are biologically based and conform to a species prototypical form. According to this model, one individual, typically the mother, should be primarily responsible for providing the infant with relatively continuous care and constant contact, and frequent nursing bouts of short duration. The observed differences in the way people care for their young are commonly attributed to either normal biological variation around the modal form, or to modifications (sometimes considered distortions) produced by factors such as culture (Oakley 1982). The CCC model is widely accepted by psychiatrists (Bowlby 1980; Spitz 1965), pediatricians (Klaus and Kennell 1976), and some human ethologists (Blurton-Jones 1972).

A major source of support for the CCC model is based on the work of Konner (1976) who studied the !Kung bushmen, a group of hunters and gatherers living in Botswana. Konner observed that during the first year of life !Kung infants were in physical contact with their mothers 70% to 80% of the time and were nursed by them 4 to 5 times per

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hour for short bouts. These findings were a particularly important confirmation of the CCC model because its proponents claimed that the form of caretaking observed among contemporary people evolved when our ancestors subsisted by hunting and gathering. Therefore, the !Kung's caretaking practices were considered by many to be similar to those of our early ancestors (Konner 1977).

A strong version of the CCC model, the bonding model, is influential in the field of pediatrics. This model focuses on the events surrounding the postpartum period and argues that there is a critical period immediately following birth during which physical contact between mother and infant is crucial for the infant's optimal development. Much of the evidence used to support the bonding model comes from empirical studies which manipulate the amount of postpartum contact between mother and infant (deChateau and Wiberg 1977; Hales, Trause, and Kennell 1976; Klaus and Kennell 1976).

The second model, referred to by us as the caretaker-child strategy model, conceptualizes human development as a process shaped by behavioral exchanges occurring between children and their caregivers. These exchanges are constrained by a multiplicity of factors including evolved capacities and motivations, cultural beliefs and practices, residence patterns, and situational factors. According to this model, caretaking is an investment of material and psychological resources in infants aimed at accomplishing three universal goals: child survival and eventual reproduction, economic self-sufficiency, and enculturation (LeVine 1980). To guide their caretaking investment strategies and fit them to relatively stable social and environmental conditions, caretakers draw on knowledge that is culturally based. These strategies are extremely valuable. They dramatically reduce the cost and effort required to (re)create appropriate caretaking patterns which protect the infant from major environmental hazards and result in appropriate development in each generation. Therefore, there is no universally optimum caretaking investment strategy, only ones that better deal with the factors to which caretaking must adapt (Hinde 1983). One factor is the infant.

Infants have the same goals as their parents, and infants too have strategies, resource acquisition strategies, for acquiring the necessary energetic and informational resources from caretakers to achieve these goals. These acquisition strategies are made up of signalling and other manipulative behaviors. Infants' initial strategies are under strong genetic control, but as infants mature their strategies are modified by experience and increasingly conform to culturally prescribed forms.

Support for our strategic perspective comes from cross-cultural research documenting the variable nature of caretaking practices (Chisholm 1983; Spiro 1979; Whiting and Whiting 1975), and from studies on alloparental care in nonhuman primates (Hrdy 1976; McKenna 1979). Our research on the Efe and their caretaking practices contributes to this body of work. The Efe engage in a system of multiple caretaking which appears to be a strategic solution to the circumstances they encounter, rather than an example of biological variation around a prototypical form. Examination of this system of care is useful in helping to understand the range of variation of human caretaking practices.

Efe Social Ecology

The group of Efe we studied inhabits the northeast section of the Ituri Forest of Zaire and is closely associated with a group of horticulturalists, the Balese. The Efe are a short-statured people and are often referred to as hunters and gatherers. Although they utilize wild forest foods, the majority of their caloric intake comes from cultivated foods acquired from the Balese (Bailey and Peacock 1987). The Efe are seminomadic. They move camp every four to six weeks to exploit seasonally available foods and for health (e.g., flea infestation) or personal reasons. The new campsite is often located at or near previous campsites. Camp location and hunting usually occur within a home range which appears to be associated with a given Efe band from generation to generation.

The Efe live in small virilocal camps of 6 to 50 residents. Camp size and composition are very flexible, with camp divisions occurring mainly at the household level. Potential

disturbances caused by fluctuations in group membership are minimized because newcomers are usually familiar individuals.

The life of the Efe is that of continuous social interaction and exposure. They clear a small area in the forest to build their camp and this area is virtually free of physical barriers. This, coupled with the fact that hut use is limited to food storage, sleeping, and protection from the rain means that most of an individual's camp activities (e.g., eating, cooking, childcare) and an individual's moods are public information. Efe men and women also share many of their out-of-camp activities with other individuals. It is very unusual, therefore, to find an Efe in a solitary setting or engaged in a solitary task.

Efe values and daily routines require an individual to be socially skilled in avoiding disruptive conflict, minimally aggressive within the group, cooperative, and in general committed to the group's overall successful functioning. This includes a strong group identification and attachment. At the same time, the individual's functioning must not be too disrupted by membership changes resulting from the fission and fusion of camps.

One of the goals of our two-year research project was to understand how Efe caretaking practices, beginning at birth, prepare their infants to meet these and other sociocultural demands, as well as meet their infants' physiological and psychological needs. We accomplished this goal by collecting information on Efe perinatal and child-rearing practices using three different procedures: interviews, participant-observations, and naturalistic observations.

Interviews with adult men and women were structured to obtain information on Efe beliefs and values concerning children and their development, and Efe practices related to childbirth and child rearing. Data collected from participant-observation were based on our experiences while living with the Efe and attending various events, functions, and ceremonies. Naturalistic observation involved the systematic study of ten Efe infants, six females and four males. Infants, selected from seven different camps, were observed for 2 hours at 3 weeks of age ($N = 7$, mean age = 23 days, range 13–31); 2 hours at 7 weeks ($N = 8$, mean age = 51 days, range 43–57); and 4 hours at 18 weeks ($N = 9$, mean age = 137 days, range 120–152).

Naturalistic observations were recorded by noting the incidence of selected behaviors in each one-minute interval that were initiated by, or directed to, the infant being watched (see Table 1 for a description of the behaviors included in this paper). This type of behavioral coding system is referred to as one-zero or Hansen frequency and the type of sampling as focal subject (Altmann 1974). Each observation session lasted 60 minutes. Approximately 70 hours of data were collected.

Table 1
Definitions of behaviors.

Behavior	Definition
Time in contact with individuals other than mother	The percent of time, calculated to the nearest minute, that the infant is in physical contact with individuals other than the mother. This measure includes being carried by, or lying with, these individuals
Transfer rate	The number of times per hour an infant is passed from one person to another
Number of caretakers	The number of different individuals with whom the infant is in physical contact. This measure does not include the people who interact with, but do not hold or care for, the infant
Latency of response to an infant fuss or cry	The elapsed time between the onset of an infant's fuss or cry, and the first response by the caretaker to the fuss or cry. Latency of response is measured as occurring within 10, 30, or 60 seconds of the fuss or cry

Observations took place in Efe camps and were evenly divided between the early morning and late afternoon. We limited our observations to the camp setting for several reasons. The effect of setting on development is well documented by the Whittings (1975) and their colleagues (Edwards and Whiting 1980; Wenger 1983). In order to minimize the amount of variability that would result from collapsing observations across settings we selected only one setting in which to code behaviors. The camp was chosen because Efe adults (Bailey 1985) and young children (Morelli 1987) spend a major percentage of their time in this setting.

Interobserver reliability sessions were conducted in the field. Reliability coefficients were determined by calculating a percent agreement score (no. of agreements/no. of agreements + no. of disagreements) and exceeded 90% for each of the behaviors included in this study. Data collected during these sessions are excluded from our analyses.

Efe Caretaking Practices

Interview and Participant-Observation

Efe mothers do not hold their newborns immediately after birth because of the belief that harm will come to the infant if she is first held by the mother. This belief precludes women from giving birth on their own (cf. Konner 1976 on the !Kung). The perinatal practice observed is for one or a few women to serve as midwife, and for most female camp members to attend the birth. Following birth, the newborn is passed among the group of women and is likely to be suckled by them whether or not they are lactating. During this time the mother assumes a passive role and is attended to by only one or a few women. The first contact between mother and newborn usually occurs several hours postpartum.

A lactating woman, preferably from the camp, nurses the newborn at least two to three times a day until the mother's milk comes in. The importance of this practice is indicated by the fact that if no lactating women reside in the camp, a woman from another camp or village is recruited to suckle the newborn. Even though the Efe believe that a mother's colostrum lacks nutritional value, the mother also suckles her newborn during this time (see Morelli et al. 1984 for a more detailed description of Efe perinatal practices).

For the first few days of life the newborn is kept in or around the hut and is almost always in physical contact with the mother or another person. A mother does not resume her normal work schedule until four to five days postpartum. When regular tasks are resumed, the infant may accompany her mother on long out-of-camp trips. If this occurs, child-care responsibilities are generally shared by individuals at the work site. When the mother's work requires a short out-of-camp trip, she often leaves the infant in the care of another. Almost all females attempt to comfort a distressed or fussy infant. Comforting includes allowing the infant to suckle and often occurs in the mother's presence. But if unsuccessful the infant is returned to her mother.

Naturalistic Observation

Our naturalistic observations of Efe caretaking practices show that their system of multiple caretaking extends well beyond the first few days of life. The percentage of time infants spend in physical contact with individuals other than their mothers increases from 39% at 3 weeks to 60% at 18 weeks. The mother may or may not be in proximity to the infant during these times.

The rate of infant transfer is also high during the first 18 weeks of life. At 3 weeks infants are transferred on average 3.7 times per hour, at 7 weeks 5.6 times and at 18 weeks 8.3 times per hour.

During our observations each infant was cared for by an average of 14.2 different people, with the number of caretakers ranging from 5 to 24. An important aspect of this care included being nursed by individuals other than the mother. Five of 7 infants observed at 3 weeks, 2 of 8 at 7 weeks, and 6 of 9 at 18 weeks were nursed by women other than their mothers. In over 60 hours of observations 8 of 10 infants were recorded as experi-

encing this culturally sanctioned practice of being nursed by women other than the mother.

Efe infants do not seem overly stressed by this pattern of multiple care. Most interactions with infants appear positive and playful. But if infants do fuss or cry, they are responded to quickly by their caretakers. Data on latency of response to fussing show that individuals, including the mother, attempt to comfort an infant within ten seconds of a fuss. This is true for over 85% of observed fussing during the first 7 weeks of life and over 75% at 18 weeks. This finding suggests that the Efe are sensitive to their infants and respond quickly to their needs.

There is variability among Efe infants on each of these caretaking measures. Figures 1 and 2 show the range of care Efe infants receive on the measures (1) percent of time infants spend in contact with individuals other than mother and (2) rate of infant transfer. Factors that account for the range in caregiving practices include infant birthweight, infant behavior, and group size. For example, in the first two months of life caretaking is strongly influenced by the infant's birthweight. Compared to lower birthweight infants, higher birthweight infants spend more time in contact with individuals other than mother. At four to five months caretaking is more strongly influenced by infant behavior and group size. Fussy infants spend more time with their mother at this age than less fussy infants, and infants living in larger groups are passed more frequently and spend less time with their mother than infants living in smaller groups (Winn, Morelli, and Tronick 1987).

Efe Caretaking Practices and the CCC Model

The Efe engage in a distinctive pattern of childcare. Efe infants spend a large percentage of time away from their mothers. They are passed often among many individuals, suckled by women other than their mothers, and quickly comforted following a fuss. At the same time, infants vary in their caretaking experiences (see Figures 1 and 2). Therefore, while an Efe pattern of multiple caretaking can be identified, within this pattern individual variability in parenting style exists. This childcare strategy appears to fit to situational variables and cultural values. Moreover, it fulfills the physiological and psychological requirements of the infant outlined by the CCC and bonding models, but in ways not specified by them.

The physiological needs of the infant are many. They include fluid and temperature regulation, immunization against pathogens, and proper nutrition. Proponents of the CCC model argue that these needs are best met by a single, lactating caretaker. But clearly the Efe do not follow this form of caretaking. How, then, do Efe caretaking practices meet these and other important needs?

Efe infants average 2.4 kg ($N = 15$; $SD = .4$) at birth. This birthweight, although small by Western standards, is normal for the Efe. Efe infants are neither premature nor small-for-dates and should not be thought of in terms similar to those applied to equivalent-weight infants born in populations of larger-statured adults. But this absolute small size does exacerbate the normal vulnerability of the human infant to fluid imbalance and temperature instability (Schaffer and Avery 1971). Both of these risks are further exacerbated by the cool temperatures of the forest with its mean daytime temperature of 22°C and mean nighttime temperature of 17°C. But the nursing and caretaking patterns observed among the Efe during the newborn period may function to reduce these risks.

During the first few days of life an Efe infant receives a greater fluid load because the infant is nursed by a woman with a mature milk supply as well as by the infant's mother, whose milk supply is not fully established. We hypothesize that this fluid load mitigates against fluid imbalance and provides the infant with the calories necessary for increased heat production.

We also hypothesize that other aspects of Efe caretaking practices improve the infant's thermoregulatory stability. The high rate of infant transfer increases the infant's activity

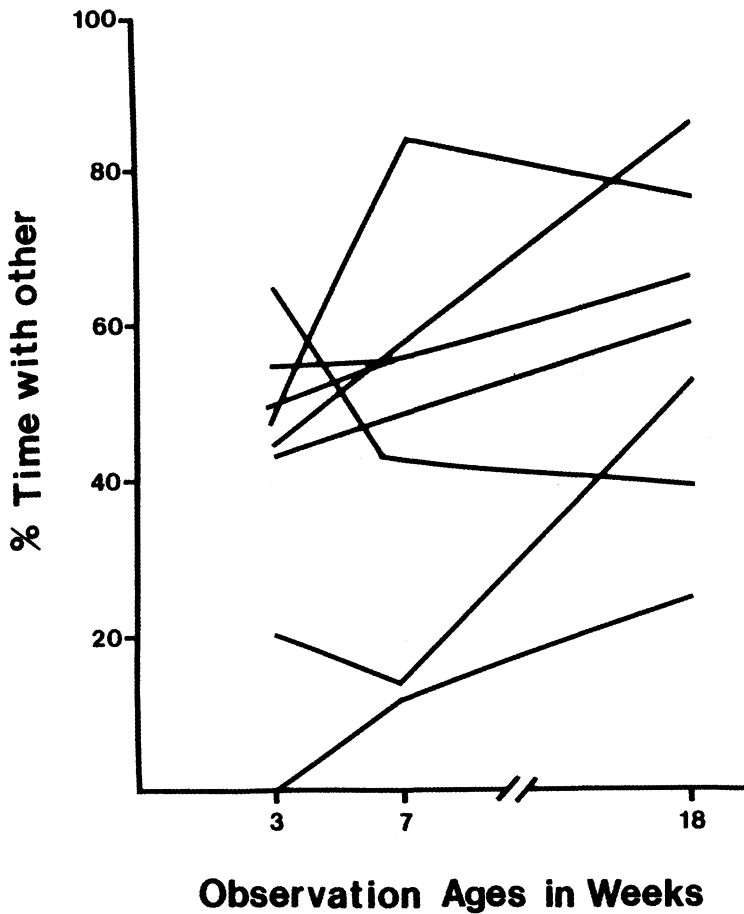


Figure 1

Mean percent of time that each infant spends in contact with individuals other than mother.

level which, in turn, increases heat production. Furthermore, the practice of keeping an infant in physical contact with people, mother or other, means that the infant is always incorporated into another's temperature regulatory system.

One cost to the infant that might result from these handling practices is exposure to foreign pathogens. But the risk of epidemic infection is reduced among the Efe. This is due to a combination of low population density (Armelagos and McArdle 1975; Dunn 1968), high incidence of physical contact among group members, and utensil sharing. Furthermore, it is established that the infant is colonized by the mother's pathogens and that the mother, by nursing her infant, provides the infant with the specific antigens needed for protection against these pathogens. A similar process takes place in the Efe, but it is enacted differently.

An Efe infant is initially exposed to and colonized by the pathogens of her mother and other female group members. This exposure probably places the infant at no greater risk because the women to whom the infant is exposed are relatively homogeneous in their pathogen types. But to the extent that these women may be heterogeneous, they each provide the infant with specific antipathogens that increase the infant's passive immunity. This analysis suggests that the strategy of exposure to and protection from pathogens of the infant is related to the homogeneity of the pathogens of the mother and other individuals to whom the infant is exposed. A single caretaker, therefore, may play a more

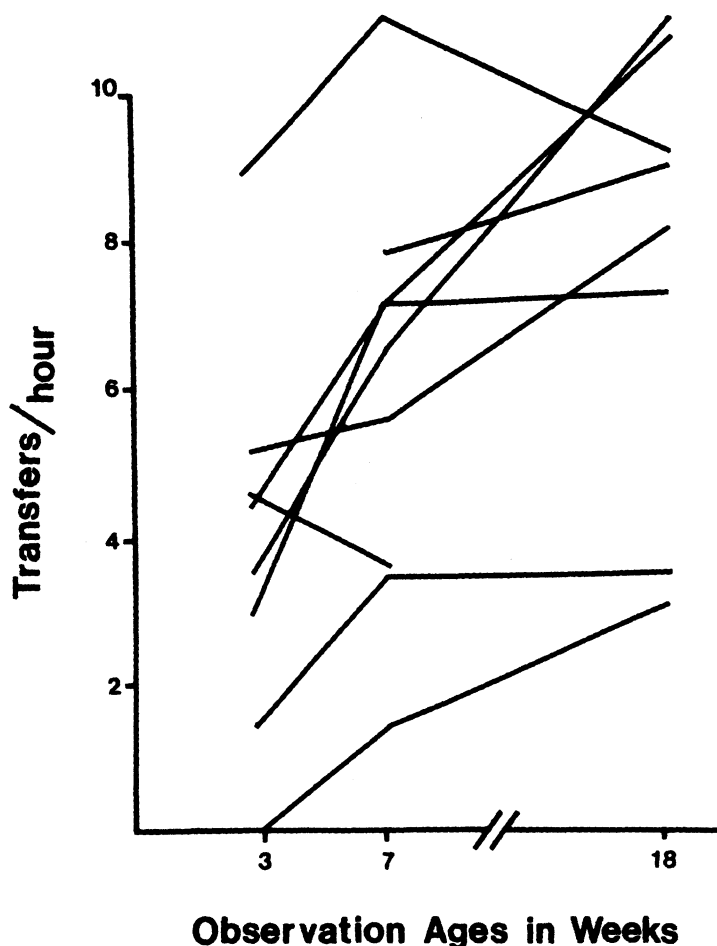


Figure 2
Mean rate of transfer for each infant.

central role in providing antipathogen protection for an infant in cultures where subsistence forms and other factors result in larger and more dense populations.

The multiple caretaking pattern that begins at birth also raises concerns by proponents of the CCC and bonding models about the psychological well being of the infant. Many of these concerns center around the issue of bonding. According to Klaus and Kennell (1976), bonding is a tightly constrained behavioral system that evolved during the period of time when the human pattern of subsistence was hunting and gathering. Bonding functions to increase the likelihood that a mother will care for her infant and occurs only if the mother is exposed to the infant immediately after birth. However, in many technologically simple societies mothers and infants are separated during the immediate postpartum period (Lozoff 1983). This finding clearly refutes some of the basic principles on which these models were established. Yet Lozoff argues that bonding still occurs between mothers and infants because there is a compensatory period of extended mother-infant exposure that lasts days, weeks, or months following the initial period of separation. It is difficult, however, to evaluate Lozoff's argument because the criteria she used to assess postpartum contact between mother and infant were not reported. Nonetheless, it is obvious that in light of contradictory evidence, Lozoff chose to modify the bonding model rather than reject it.

Although certain aspects of Efe care (e.g., separation between mother and infant for several hours after birth, followed by several days of prolonged mother-infant exposure) conform to the modified bonding model suggested by Lozoff, other aspects of their care contradict this model as well as the more comprehensive CCC model. Efe newborns are nursed several times daily by women other than mother during the immediate postpartum period, and spend much of their first weeks, and months, in the care of other group members. Such practices exceed the limits of these models and, as a result, make it difficult to accept the view that bonding is a universal process, or that infants require a single caregiver.

Efe Caretaking Practices: A Psychosocial Perspective

The Efe pattern of caretaking has many psychosocial benefits. Efe infants receive increased exposure to and stimulation from their environment because they are carried by and interact with a variety of people. Konner (1976) argues that !Kung infants also receive increased exposure to and stimulation from their environment, but this results from being carried in an upright vertical position by their mothers. Thus, different caretaking strategies can result in similar benefits to the infant.

The multiple caretaking system contributes to the development of the Efe infant's behavioral capacities for maximizing culturally appropriate behaviors. These include the skills needed to interact with many individuals on a fairly regular basis. Stern (1977) and Tronick (1980) argue that infants' social skills develop by adjusting to the normally occurring mismatches and miscoordinations that occur in their daily interactions with other individuals. Efe infants are likely to experience more of these mismatches than infants raised by single caretakers because of the number of different caregivers with whom they interact and because of the stylistic differences among the caregivers. These interactive experiences should facilitate the development of "precocious" social skills that allow Efe infants to negotiate the daily social demands placed on them. A similar development of "precocious" social skills is found among children attending quality daycare centers in the United States (Kagan, Kearsley, and Zelazo 1975), Russia (Bronfenbrenner 1970) and China (Kessen 1975).

In addition, early social experiences may serve to teach infants a style of interaction which embeds cultural values. For example, Tronick and colleagues (Dixon, Tronick, Keefer, and Brazelton 1981) showed that interactions between Gusii mothers and their infants reflect the rules of gaze contact and aversion that govern interactions among adults. These rules are shaped by cultural values related to the expression of emotions. Similar relationships between mother-infant interactive style and cultural values are found among the Japanese (Caudill and Weinstein 1969) and Americans (LeVine 1977). Multiple caretaking in the Efe, then, may function to teach infants about culturally appropriate styles of interactions as well as to expose infants to the culture's valuation of cooperation, mutual support, and gregariousness. And as C. P. Edwards (personal communication, 1984) points out, the multiple caretaking an infant receives is observed by older children. As a result, infants and children alike constantly receive the cultural messages that are communicated by this pattern of shared care.

Efe caretaking practices have implications for personality development. Efe infants are likely to be less sharply attached to any single caregiver and more diffusely attached to many caregivers because of the pattern of care they receive. Similar arguments are made about Israeli children raised in the kibbutz (Bettelheim 1969) and American children attending daycare centers (Clarke-Stewart 1979). Even Lancaster, in her writings on alloparental care in Langurs, advances essentially the same argument: "certain behavior patterns can alter the sharpness of focus of the mother-infant bond so that the developing infant seeks social partners among [other] members of the social group" (1976:15). Lancaster considers the amount of contact between mother and infant important in determining the nature of an infant's attachment to mother and others. Equally important,

however, may be the amount of time an infant spends with individuals other than mother. We believe that one of the features that distinguishes Efe caretaking from other cultures' caretaking practices is the amount of time Efe infants spend with individuals other than mother, rather than simply the reduction in the amount of time they spend with their mothers.

The effect of multiple caretaking on the Efe infants' social experience and personality development contrasts strongly with that of infants who are reared by a single caregiver and receive limited exposure to other interactants. Mono-cared-for infants are expected to be less "precocious" socially because their interactions are limited to one other person. This minimizes variations in interactive styles and reduces the number of adjustments that are made to social miscoordinations. As a result, the infant and caretaker rapidly develop a shared history that strongly shapes their current social exchanges. LeVine (1980) argues that such a pattern of caretaking makes for a demanding and attention-seeking child, hardly a pattern in line with Efe goals.

Conclusion

The caretaker-child strategy model rather than the CCC model puts the Efe pattern of childcare into better psychological and physiological perspective. The Efe, children and caretakers alike, can be viewed as employing strategies that are molded by ecological factors such as the low temperature of the forest, the small size of the infants, cultural values including the importance of group identification, and their unique cultural history. Many of the Efe practices function to fulfill a number of the goals simultaneously. For example, multiple nursing fulfills the small infant's biological demands for fluids and energy supplies as well as the cultural demands for cooperation, sharing, and group identification. But at the same time, the Efe pattern is not rigid, and variability is observed in caretaking practices and infant behavior. Individuals in other settings, and cultures with other demands, would generate other caretaker investment and child acquisition strategies.

The caretaker-child strategy model argues that there is no prototypical form for caretaker or child strategies. There are only patterns that allow individuals to better deal with situational variables. This model emphasizes the complexity of variables that affect our behavior. It moves us away from a somewhat narrow and inflexible view of human behavior and makes us skeptical of easy generalizations. Further evaluation of the strategic model and the CCC model will depend on obtaining detailed observations of individual practices in different settings and examining how the practices best exploit these settings. We hope our data on the Efe contribute to that evaluative task.

Notes

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¹Efe is pronounced EF-fay.

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