

# A Biocultural Approach to Breastfeeding Interactions in Central Africa

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**ABSTRACT** Anthropologists have long recognized that breastfeeding involves much more than feeding; it entails intimate social interactions between infants or children and their mothers. However, breastfeeding has predominantly been studied with respect to structural features (frequency, timing) as well as nutritional and health aspects of infant feeding. Thus, in this study we complement previous anthropological studies by examining social interactions that occur during breastfeeding among the Aka and Bofi foragers and Ngandu and Bofi farmers at various ages (three to four months, nine to ten months, toddlers). Further, we use an integrated biocultural perspective to explore how patterns of breastfeeding and social interactions can be shaped by economic constraints, cultural values, and children's development. Overall, our findings illustrate how biological and cultural factors interact and provide useful explanations of variations in breastfeeding structure and social interactions more so than either perspective alone. *[breastfeeding, Central African foragers and farmers, biocultural, infants and toddlers, social interactions]*

Breastfeeding involves much more than feeding; it entails intimate social interactions that reflect cultural ideas and practices about social relationships, childcare, and child development. Nonetheless, breastfeeding has predominantly been studied with respect to nutritional and health issues (for reviews, see Dettwyler and Fishman 1992; Van Esterik 2002). With the exception of Relindis Yovsi and Heidi Keller's (2003) study of mother–child interactions, breastfeeding has typically been studied as a discrete behavior predicted by biological (e.g., Konner and Worthman 1980; Sellen and Smay 2001) or social-cultural factors (e.g., Mabilia 2005; Maher 1992; Raphael and Davis 1985) rather than as a locus of social interactions. Like Yovsi and Keller, many ethnographers have acknowledged that breastfeeding undoubtedly encompasses more than nutrition and is a socially rich context that varies cross-culturally and developmentally. Accordingly, they have called for a relational view of breastfeeding that moves beyond the emphasis on health issues to include considerations of the associated social interactions (Bird-David 2008; Dettwyler and Fishman 1992; Gottlieb 2004; McKenna et al. 2007; Maher 1992; Raphael and Davis 1985) as well as recognizes breastfeeding in childhood, not only in infancy (for review, see Van Esterik 2002).

Drawing on cultural and biological perspectives of breastfeeding, our main objectives in this study are as follows: (1) to extend our cross-cultural understanding of the

nutritional, health, and structural aspects of breastfeeding, especially in infancy, by examining social interactions that occur during breastfeeding at various ages; (2) to consider breastfeeding as both a discrete behavior and a locus for social interactions; (3) to articulate a biocultural view of breastfeeding by exploring biological and cultural factors affecting the structure and social components of breastfeeding; and (4) to apply this biocultural approach in analyses exploring how patterns of breastfeeding and social interaction can be shaped by economic constraints, cultural values, and child development.

In this study, we provide exploratory analyses, examining infants' and young children's social experiences when being breastfed by Aka and Bofi forager and Ngandu and Bofi farmer mothers in Central Africa. In a previous study of attachment processes, we described general patterns (timing and frequency) of Aka, Ngandu, and Euro-American early infant (three- to four-month-olds) breastfeeding (Hewlett et al. 2000a). In a later study of weaning among Bofi forager and farmer children (one- to four-year-olds), we presented limited data on structural patterns (timing and frequency) of breastfeeding in relation to the cessation of breastfeeding (Fouts et al. 2005). The present study is distinct from our previous studies because we explicitly focus on understanding breastfeeding, examine breastfeeding across several ages in both forager and farmer groups, and present quantitative data on mother–child interactions occurring

during breastfeeding. In our examination of breastfeeding across three ages (three to four months, nine to ten months, and early childhood) and considering two subsistence groups (foragers and farmers), we acknowledge that neither the forager groups (Aka and Bofi) nor the farmer groups (Bofi and Ngandu) are single cultural groups. Instead, the Aka, Ngandu, Bofi foragers, and Bofi farmers are each distinct cultural communities (described more fully in the ethnographic results section), even though there is more similarity in terms of cultural values, social organization, and childcare patterns within each subsistence group than there is between the subsistence groups. Because we did not observe similar number of infants and children in the different cultural groups, we focus on variation related to age and subsistence groups rather than cultural groups.

In addition to data describing observed social interactions associated with breastfeeding, we also present Aka, Ngandu, and Bofi foragers' and farmers' ideas about childcare and breastfeeding. We refer to these ideas as "cultural models of childcare" because they encompass beliefs about many aspects of childcare, including, for example, child development, styles of care, children's health, breastfeeding, and weaning. In addition to cultural models of childcare, we also consider broader core or foundational values encompassed by these cultural models and refer to these as "core cultural values." For example, a cultural model about childcare might relate to core values about social relationships (e.g., Demuth et al. in press).

Before reviewing biological and cultural perspectives of breastfeeding, it is necessary to clearly define what we mean by *cultural*, *breastfeeding*, and *biological*. We view *culture* as any socially transmitted and learned knowledge (which includes cultural values) or behaviors shared to some degree by a social group. We thus consider a cultural perspective to be one centered on how individuals think and feel about a particular phenomenon: in this case, breastfeeding. We consider *breastfeeding* to be the physical and social act of infants or children suckling the nipple of a caregiver. The focus of our study is on maternal breastfeeding rather than breastfeeding by other caregivers, because nonmaternal breastfeeding occurs predominantly among young Aka infants and this study examines breastfeeding in several groups across three ages (three- to four-month-olds, nine- to ten-month-olds, and toddlers). We briefly discuss nonmaternal breastfeeding, but a forthcoming paper will provide more detailed analyses of allomaternal breastfeeding among foragers (Hewlett and Winn n.d.). Finally, for our purposes, *biological* aspects of breastfeeding include maternal and child health, nutritional impacts of breastfeeding, and evolutionary approaches to breastfeeding. Despite these designations of perspectives, all of the studies reviewed acknowledge that breastfeeding is both a biological and cultural process.

### CULTURAL PERSPECTIVES ON BREASTFEEDING

It is well recognized that eating is as much a social activity as it is a biological necessity (Jones 2007; Mintz and Du Bois 2002). In a recent ethnographic study of mealtimes,

Elinor Ochs and Merav Shohet demonstrated how meals are "cultural sites" for the socialization of children that "are laden with symbolic meanings and mediated by material artifacts" (2006:35). Breastfeeding can also be conceptualized as a site for social interaction and cultural learning. For example, Alma Gottlieb explained that for Beng (Côte d'Ivoire) babies "learning the value of sociability begins . . . at the breast" (2004:206).

Many other ethnographers have suggested that breastfeeding should be viewed not only as a health-relevant activity but also as a sociocultural activity (Ball 2003; Dettwyler and Fishman 1992; Gettler and McKenna 2011; Gottlieb 2004; Mabilia 2005; Maher 1992; Raphael and Davis 1985; Van Esterik 2002; Yovsi and Keller 2003). For example, Mara Mabilia (2005) identified connections between breastfeeding behaviors and postpartum sex taboos, exploring ideas about the quality of milk being contaminated by sexual activity in research among the Wagogo in Tanzania. Indeed, maternal decisions about breastfeeding and its termination have been a major focus of both sociocultural and nutritional studies of breastfeeding (e.g., Cosminsky et al. 1993; Fouts 2004; Fouts et al. 2005; Gray 1995; Harrison et al. 1993; Mabilia 2005; Maher 1992; Marquis et al. 1998; Raphael and Davis 1985; Sellen 2001). Many of these studies have shown how weaning practices are influenced by cultural beliefs about children's development, maternal conditions, and beliefs about pregnancy and breastfeeding. For example, ethnographic studies have illustrated how culturally defined developmental "milestones" (e.g., walking, teeth eruption, height) relate to mothers' decisions to wean; likewise, subsequent pregnancies often precipitate weaning where it is believed that pregnancy affects the quality of breast milk (e.g., Fouts 2004; Fouts et al. 2005; Harrison et al. 1993; Marquis et al. 1998; Sellen 2001). Furthermore, emotional states are often associated conceptually with the health consequences of breastfeeding in some communities. Gail Harrison and colleagues (1993) described how mothers in poor urban communities of Cairo explained that grief or sadness caused the quality of their breast milk to worsen and decreased supply. Similarly, we have previously described how Aka and Bofi foragers view infant and child emotions as instigators of illness, thus encouraging immediate responding to fussing and crying (e.g., Fouts 2010; Hewlett et al. 2000a). In sum, there is ample evidence that breastfeeding and weaning practices are guided by cultural beliefs about children's development and maternal states.

Although many researchers have examined breastfeeding in relation to social, cultural, economic, political, ecological, and nutritional contexts, they have often treated breastfeeding as a discrete behavior, examining how those contexts predicted breastfeeding practices rather than how breastfeeding is a context for other behaviors (for reviews, see Dettwyler and Fishman 1992; Ellison 2001; Maher 1992; Sellen 2001, 2007; Van Esterik 2002). It is important to recognize that contexts affect breastfeeding (as a discrete behavior) and that breastfeeding is a locus for interactions in

order to understand the dynamic nature of this biocultural process.

Yovsi and Keller (2003) specifically focused on breastfeeding as a locus for behavior by examining maternal behavior during breastfeeding among Nso farmers and nomadic Fulani pastoralists. Yovsi and Keller proposed that breastfeeding practices and attitudes toward breastfeeding are deeply embedded in parental ideologies about mother–infant bonding and that breastfeeding involves a parenting system that varies depending on cultural and ecological settings. They reported that Nso farmers and Fulani pastoralists breastfed infants in predictably different ways. Nso mothers had closer physical contact with, appeared more focused on, and provided more tactile stimulation to infants while breastfeeding than Fulani mothers did. Such differences underscored the extent to which breastfeeding provided a context for interactions that represent cultural values. Yovsi and Keller proposed that the Nso interactional style of breastfeeding reflected a cultural value related to cultivating an “interdependent self-construct that is essential for communalism” (2003:155). By contrast, they suggested that the Fulani breastfeeding interactional style reflected the cultural value of “economic self-sufficiency and self-reliance” and “the development of an independent self-construct” (Yovsi and Keller 2003:156). In contrast, our previous findings have exemplified that the dichotomy between interdependent and independent does not adequately explain Aka infant-care patterns, as Aka parents place high value on autonomy but are also markedly indulgent and responsive to infants and display extensive cooperation and sharing in childcare and production (Hewlett et al. 1998, 2000a).

In a critique of Western-biased conceptions of breastfeeding that emphasize mother-directed feeding, Nurit Bird-David (2008) argued that parent–child interactions, such as breastfeeding, should be viewed in relation to child agency. For example, in her analysis of Nayaka (hunter-gatherer) breastfeeding, she noted how mothers did not “feed” infants but rather gave Nayaka infants free access to nursing while being carried. Further, Bird-David described how infants “could actively suckle their mother’s breast *because of* their constant bodily closeness to her. Babies and mothers, in this respect, lived together, while doing their own separate things” (Bird-David 2008:538). Moreover, Bird-David proposed that breastfeeding patterns “appear to be the most powerful reflection” (2008:529) of notions about child agency— notions demonstrated, for example, by maternal beliefs in schedule-, demand-, or infant-led breastfeeding. The Nayaka portray babies as feeding themselves using their mother’s breast rather than as being fed. Bird-David emphasized the importance of a relational view when studying breastfeeding and other aspects of infancy and childhood because such a perspective prevents essentialistic Western assumptions about maternal primacy and the lack of child agency.

In sum, cultural perspectives emphasize the relational nature of breastfeeding, the influence of cultural models on breastfeeding, and the recognition of breastfeeding (like

other practices) as a locus for cultural learning and social interaction. A limitation of this perspective is that it has focused on infants and omitted young children. Child development scholars have long recognized that, as infants and children develop socially, cognitively, and physically, their range of social interactions with diverse individuals expands (Lamb et al. 2002). Breastfeeding interactions should change as children grow older and develop different social competencies.

### BIOLOGICAL PERSPECTIVES ON BREASTFEEDING

Nutritional and health aspects of breastfeeding have been the focus of anthropological research, in part because of the vast benefits of breastfeeding for mothers and children (American Academy of Pediatrics 2005; Field 2005). Breastfeeding is also widely recognized as an evolved behavior, and evolutionary anthropologists have published extensively on the adaptive nature of breastfeeding. Melvin Konner (2005, 2010), Nicholas Blurton Jones (1993), and Daniel Sellen (2007) have emphasized the phylogenetic history of breastfeeding, proposing that infant proximity and frequent sucking are life history characteristics shared by all Old World monkeys and apes, including humans. From this point of view, frequent sucking is part of human nature, evident in most contemporary hunter-gatherers (Konner 2005). Furthermore, James McKenna and colleagues’ extensive research on cosleeping and breastfeeding (for review, see McKenna et al. 2007) has informed the argument that mother–infant cosleeping is an evolved behavior that supports breastfeeding. Further, Lee Gettler and McKenna (2011) have encouraged a biocultural perspective through their recent study that demonstrates how breastfeeding frequency is affected by culturally guided decisions about where infants sleep.

Structural patterns (frequency and timing) of breastfeeding are associated with the energetic costs of lactation, the composition of breast milk, and children’s energy requirements and physiological development. Sellen (2007) has described optimal evolved feeding patterns for infants and young children, noting how, after birth, daily breast milk intake increases, stabilizes after special “transitional” foods are introduced, and then gradually decreases once children are eating normal family foods. Thus, the energetic needs of infants and children and the introduction of complementary foods are related to the frequency of breastfeeding.

Compared to other mammals, the energetic cost of lactation is relatively low for human and nonhuman primate females who typically have single births and slow-growing offspring; thus, the energetic needs of lactating women are typically 20–25 percent higher than that of nonlactating women (Prentice et al. 1996). This lower cost relates to remarkably flexible behavioral strategies concerning dietary intake and physical activity that contrast with those of mammals that have multiple births and fast-growing offspring (Prentice et al. 1996). Primate breast milk is also more dilute than that of other mammals. Indeed, human breast milk composition is similar among women throughout the

world despite differences in nutritional status and dietary intake. Breast milk production (i.e., volume produced) is predominantly affected by infant feeding practices rather than nutritional status (Dewey 1997). Breast milk production contributes to the energetic needs of lactating women, with higher production associated with higher energetic needs, so that changes in the structure of breastfeeding (i.e., frequency and timing) are related to variations in the energetic costs of lactation (Dufour and Sauter 2002).

Anthropologists focusing on biological aspects of breastfeeding often acknowledge and sometimes incorporate cultural factors into their analyses. For example, evolutionary-informed studies of breastfeeding consider modes of production, maternal work, marriage patterns, and social support in relation to evolutionary dimensions of breastfeeding (Cosminsky et al. 1993; Fouts et al. 2005; Gray 1995; Nerlove 1974; Piperata and Dufour 2007; Sellen and Smay 2001), but they seldom consider cultural beliefs and models in their analyses.

Sara Nerlove (1974) examined 83 societies in the Standard Cross-Cultural Sample and showed not only how maternal work is affected by childcare responsibilities but also that childcare (and breastfeeding in particular) is often modified to support mothers' subsistence activities. Nerlove concluded that adjustments to patterns of breastfeeding can, in turn, have substantial effects on fertility and child morbidity. Further exemplifying the intertwined relationship between breastfeeding patterns and maternal work, Barbara Piperata and Darna Dufour (2007) found that, as a group, rural Amazonian women tended to spend less time in subsistence work during peak lactation periods and that this was affected by availability of social support, with women who had more social support not only able to reduce work more than women with less social support but also better protected from weight loss during peak lactation periods. By showing how biological (energetic) constraints interacted with cultural constraints (i.e., social support) in explaining intracultural variation in breastfeeding behavior, Piperata and Dufour also illustrated the usefulness of a biocultural model. Sellen and Diana Smay (2001) have also demonstrated how group-level subsistence strategies and related variations in social support predict children's age at weaning by showing how foragers, who typically exhibit high levels of social support, have later weaning ages than agriculturalists or pastoralists.

In sum, biological perspectives on breastfeeding have considered maternal and child health benefits of breastfeeding, concluding that high-frequency breastfeeding is an evolved characteristic. They have further proposed that breastfeeding may be viewed as an adaptive response to ecological and economic constraints.

#### **AN INTEGRATIVE BIOCULTURAL APPROACH TO BREASTFEEDING**

Assuming both cultural and biological perspectives to be complementary, we considered factors emphasized by both perspectives in our study. Cultural perspectives on breast-

feeding led us to consider general cultural values and parental expectations of children, take a relational view of breastfeeding by examining both child and maternal behaviors, and view breastfeeding both as a behavior and as a locus for other behaviors. Building on this perspective, our study is relatively unique because we use quantitative observations to examine breastfeeding as a locus for social interaction among foragers and farmers at three different ages. Biological perspectives on breastfeeding led us to consider factors related to maternal energetic constraints such as maternal work patterns and breastfeeding frequency and timing. Both perspectives informed our consideration of group-level modes of production (i.e., foragers and farmers) and the ages of infants and children. More specifically, this integrative biocultural approach led us to the following research questions: (1) How do core values and cultural models of childcare influence the structure and social composition of breastfeeding?; (2) do intra- and intersubsistence group variations in children's age and maternal work patterns predict structural and social patterns of breastfeeding?; and (3) is variation in mode of production associated with the structural and social aspects of breastfeeding?

Given our focus on these broad questions, we made general predictions based on existing cultural and biological research on breastfeeding. First, we expected that cultural values would be consistent with observed behavioral patterns related to breastfeeding, assuming that breastfeeding practices are guided by cultural values that relate to broader aspects of childcare and core cultural values (Bird-David 2008). Next, we anticipated that the age of children would predict variation in the structure and social patterns associated with breastfeeding, because the amount of breastfeeding generally decreases with age as complementary feeding increases (Sellen 2007). Likewise, it is well known that children's physical and social capabilities increase with age; thus we predicted that levels of social interaction during breastfeeding would be positively associated with age but that caregiving and holding would be negatively associated with age because older children need less physical care. We also suspected that intersubsistence group variation in maternal work levels would primarily predict breastfeeding patterns, having shown in previous studies that maternal work was central to farmers' cultural models of weaning but not to the foragers' models (Fouts 2004). Informed by studies showing the interconnections and tradeoffs between working and lactation (e.g., Nerlove 1974; Piperata and Dufour 2007), furthermore, we also predicted that maternal work would be negatively associated with breastfeeding frequency, especially among the farmers.

Finally, we expected that modes of production would predict breastfeeding patterns because previous studies have illustrated differences between foragers and farmers concerning weaning (Fouts et al. 2005; Sellen and Smay 2001) and broader styles of parenting and childcare (Draper and Harpending 1987; Hewlett et al. 2000b). Specifically, following Konner's (2005, 2010) model, we expected that

breastfeeding would be more frequent among the foragers than among the farmers and that it would decline more rapidly with age among farmers than foragers. Furthermore, previous studies showing higher levels of proximal care among foragers than farmers (Hewlett et al. 2000b) led us to predict that breastfeeding among the foragers would entail more holding than among the farmers. Previous studies of forager and farmer childcare patterns have shown that caregiver–child vocal interactions do not predominate, as they do in Western societies (Hewlett et al. 2000b). Thus, we expected that social interactions during breastfeeding would be similarly infrequent in both groups.

## **ETHNOGRAPHIC METHODS AND RESULTS**

### ***Ethnographic Fieldwork Methods***

Our descriptions of the Aka and Bofi foragers and Ngandu and Bofi farmers are based on ethnographic fieldwork among the Bofi foragers and farmers by Hillary Fouts in 1998, 1999, 2001, and 2006 and on extensive ethnographic fieldwork among the Aka and Ngandu by Barry Hewlett over the past 30 years. Behavioral observations of Aka and Ngandu infants used in this study took place between 1993 and 1997. Although the difference between the amounts of fieldwork is considerable, we used similar ethnographic methods, including participant-observation especially among families with infants and young children, frequently accompanying families during daily subsistence activities and involving ourselves in family and community social and spiritual gatherings (e.g., those related to births, deaths, community singing and dancing, and healing practices). In addition to participant-observation, we conducted structured and semistructured interviews related to group demographic patterns (fertility, mortality, marriage), parenting practices, nonparental caregiving patterns, weaning, fertility choices, birth practices, and breastfeeding initiation. We initiated this article to explore recent cultural perspectives on breastfeeding (e.g., Bird-David 2008; Yovsi and Keller 2003) using our existing data. Because we did not conduct the quantitative observations to specifically evaluate breastfeeding, we also did not conduct extensive interviews about breastfeeding practices for this article.

What follows is a brief ethnographic description of the Aka and Bofi foragers and Ngandu and Bofi farmers. More extensive ethnographic descriptions of these groups have been published previously (Fouts 2004; Hewlett 1991).

### ***Demography and Modes of Production***

The Aka, Ngandu, Bofi foragers, and Bofi farmers all live in the northwestern region of the Congo Basin tropical forest in the Central African Republic and are distinct cultural groups. The Aka and Ngandu live side by side and interact daily in many settings, as do the Bofi foragers and farmers. The Aka and Ngandu in this study are associated with one section or neighborhood (about 300 Aka and 400 Ngandu) of a larger village (about 1,000 Aka and 2,000 Ngandu), while the Bofi farmers and foragers are associated with two smaller villages

(fewer than 500 people in each village). In both settings, the foragers and farmers interact socially, spiritually, and economically, know each other quite well, and are aware of each other's caregiving and breastfeeding patterns, although the Aka, Ngandu, Bofi foragers, and Bofi farmers identify themselves as culturally distinct from one another. The Aka and Ngandu speak different Bantu languages, and the Bofi foragers and farmers speak the same Oubanguian language.

The Aka, Ngandu, and Bofi foragers and Bofi farmers have similar total fertility rates averaging nearly six live births per woman before menopause and high infant (birth to 12 months) mortality rates (10–20 percent). Mortality rates among the farmers tend to be slightly lower, perhaps because they have better access to Western medical clinics and vaccination programs (Fouts et al. 2005; Hewlett et al. 2000b).

The Ngandu and Bofi farmers share many subsistence patterns and technologies with one another and with other farmers in the region. The Ngandu and Bofi farmers subsist primarily through “slash-and-burn” horticulture. Although men hunt periodically in the forest using shotguns and snares, the farmers obtain most forest products by trading with nearby foragers. The farmers have a distinct sexual division of labor; women do most of the farming, and men spend most of their time engaged in intervillage trade or politicking within the village. Farmer men and women often spend their days apart, with men in the village and women in the fields.

The Aka and Bofi foragers are culturally very similar, and the two groups share a cultural history (Fouts 2004). As late as the 1980s, researchers have referred to the Bofi foragers as “Aka-Bofi pygmies” (Cavalli Sforza 1986). Related to this shared history, the Aka and Bofi foragers maintain similar material cultures, subsistence methods, and patterns of social organization. Both groups hunt with large nets. Men, women, and children participate in net hunting as well as gathering in the forest, although they procure many carbohydrates through trade with farmers. The Aka and Bofi foragers distinguish themselves from each other; for example, the Bofi foragers call the Aka “*yidi koola*,” meaning “forest pygmies.” The Bofi foragers note that Aka live much deeper in the forest and spend much more time in the forest than they do; the Aka average eight months of the year camped deep in the forest whereas the Bofi foragers spend only three to four months of the year there.

### ***Cultural Values and Beliefs about Childcare and Breastfeeding***

The Aka and Bofi foragers share the core cultural values of age and gender egalitarianism, personal autonomy, and high levels of cooperation and sharing. The core cultural value of cooperation and sharing is evident in their patterns and beliefs about childcare. The Aka and Bofi forager framework for sharing emphasizes that people should give everything they have. Both groups often tell stories about how hiding food (i.e., example of not giving everything you have) leads to misfortune and often death. Giving to others and providing

care to children are viewed similarly. In interviews, parents in both groups frequently listed many people who provided care to their children, often saying that “everyone” helped. The cooperative network of caregiving among the Aka and Bofi foragers appears to support the emphasis on close physical contact, holding, and sensitive, responsive involvement with infants and children by mothers, fathers, and alloparents (Fouts et al. 2005; Hewlett et al. 2000a, 2000b). The importance of keeping infants and children physically close and with attentive caregivers is highly emphasized among the foragers, as parents often expressed reluctance to leave infants or children with caregivers who were too young or distracted for fear that children might be left on the ground and cry too much.

The core value of personal autonomy is also reflected in Aka and Bofi forager beliefs and practices related to childcare and breastfeeding. Children are not punished and rarely scolded or verbally directed to behave in certain ways. For example, children commonly decide whether or not to help their families with subsistence tasks or where to live in the case of divorce. Furthermore, related to breastfeeding, most Aka and Bofi forager parents described a strong preference to let children decide when to stop breastfeeding rather than to wean actively (Fouts 2004). Interviews about weaning illustrated how both groups view breastfeeding as child directed and are even reluctant to explain particular breastfeeding or weaning patterns, often replying with “ask him [child], only he [child] knows why.” Aka and Bofi forager mothers rarely spoke of breastfeeding in relation to their own desires and constraints and generally believe that infants and children decide when, how, and for how long to breastfeed before deciding to stop. This respect for personal autonomy in breastfeeding is supported by the prevalent belief that denying the breast will result in deadly child illnesses.

The Bofi and Ngandu farmers also share core values and beliefs about childcare. The Bofi and Ngandu farmers’ core values include communalism (putting the interests of the clan before individual interests), gender and age hierarchies emphasizing deference and respect for elders (especially male elders), and the material basis of social relationships including resource defense (i.e., defending one’s property against thieves inside and outside the community). Related to age hierarchy, the farmer cultural model of childcare emphasizes child obedience. This value is also apparent in how both groups view breastfeeding, which is typified by maternal regulation. Bofi and Ngandu farmer mothers often expressed how difficult it was to work and breastfeed and how breastfeeding and carrying children to the fields caused great fatigue. These difficulties were often cited as reasons for weaning. Mothers also often described pain involved in nursing infants and toddlers who have teeth. One mother described how her son wanted to nurse all day long; that once he grew teeth, the nursing hurt; and that this had prompted her both to leave him at home with his siblings when she went to the fields and to wean him.

The emphasis on resource defense and protection of one’s property was also apparent in the Bofi and Ngandu farmers’ cultural values related to childcare. A pervasive theme in interviews concerned with childcare was the promotion of strength, particularly assertiveness with other children. Bofi and Ngandu farmers often remarked that nursing for too long (past two years of age) and carrying toddlers during the day caused children to be short, weak, and meek with other children.

## OBSERVATIONAL METHODS AND RESULTS

Quantitative behavioral observations were conducted using a focal-child (i.e., infant or child) sampling technique, which involved observing one child at a time and recording a specific set of child and caregiver behaviors and interactions. Behaviors were recorded on the mark at 30-second intervals. Observational sessions spanned 45 minutes and were followed by a 15-minute rest period. Each focal child was observed for a total of 9 hours, spanning 12 daylight hours with 1,080 30-second observational intervals made for each focal child. A total of 20 Aka and 21 Ngandu three- to four-month-old infants, 20 Aka and 20 Ngandu nine- to ten-month-old infants, and 22 Bofi forager and 21 Bofi farmer children between the ages of one-and-a-half and four years of age were observed in this way. Only children who were still nursing were included in analyses of the breastfeeding context; this included all of the infants, 14 Bofi forager children (5 one-and-a-half-year-olds, 5 two-year-olds, 3 three-year-olds, and 1 four-year-old), and 5 Bofi farmer children (5 one-and-a-half-year-olds). Because of the small samples and uneven representations of age among the Bofi, we are not able to more precisely address age as a factor.

### Coding and Analyses

We assessed the overall structure of breastfeeding from the average percentage of observational units during which infants and children were observed breastfeeding and by the length and frequency of bouts (defined as continuous sequences of breastfeeding).

Maternal activities that occurred while breastfeeding included “mother working” (i.e., mother was engaged in subsistence activities during child observations) and “mother talks to others” (i.e., mother talking to individuals other than the focal child).

We identified caretaking during breastfeeding by two behavioral codes: caregiving and holding. We coded “caregiving” when any caregivers provided direct physical care to the focal children by grooming, dressing, or cleaning them. We coded “holding” when a focal child was in a caregiver’s arms, lap, or sling.

We identified social and affectionate interactions during breastfeeding with three codes: affection, stimulation, and vocalization. “Affection” included caregiver displays of positive verbal or nonverbal affection to breastfeeding infants or children. “Stimulation” was coded when a caregiver focused

**TABLE 1.** *Structural Patterns of Breastfeeding*

	3–4 months		9–10 months		Children	
	Aka	Ngandu	Aka	Ngandu	Bofi forager	Bofi farmer
<i>N</i>	20	21	20	20	14	5
% of daylight hours spent breastfeeding	14.22 (5.99)	11.47 (5.02)	12.95 (4.48)	9.41 (4.10)	17.12 (9.18)	7.13 (4.79)
Mean number of bouts per hour	3.77 (1.48)	1.97 (.95)	4.14 (1.74)	2.51 (1.11)	4.74 (3.29)	2.29 (1.81)
Mean bout length (minutes)	2.34 (.77)	3.86 (2.09)	1.99 (.52)	2.43 (1.04)	2.26 (.91)	2.00 (.25)

Note: Standard deviations are in parentheses.

the focal child's attention on a specific activity—event or attempted to stimulate the child by poking, pulling on limbs, or shaking. “Vocalizing” to the breastfeeding focal children included any type of speech.

We identified focal-child social behavior with two codes: play and vocalize. “Play” was coded when the breastfeeding focal children distracted themselves with objects, their bodies, or by playing with others. “Vocalization” was coded when the breastfeeding focal children vocalized nonirritably (i.e., not fussing or crying).

These codes were adapted from those developed by Jay Belsky and colleagues (1984), and they have been used to observe infants in many different cultural contexts, including Central Africa, Central America, Germany, Canada, and the United States (e.g., Fouts et al. 2005, 2007; Hewlett et al. 1998; Leyendecker et al. 1997). This project involves an interdisciplinary collaboration with an overarching purpose of providing comparable cross-cultural data on childcare practices. Thus, the behavioral observations represent an etic perspective but were contextualized by extensive ethnographic fieldwork by Hewlett and Fouts. Nonetheless, most codes used in the study are linked to indigenous concepts. Breastfeeding in particular is an emic category associated with a word among the Aka, Ngandu, and Bofi. With the exception of “affection” and “stimulation,” most behavioral codes are associated with discrete emic concepts or words. However, there is no single word for affection or stimulation in the Aka, Ngandu, or Bofi languages. Instead, there are individual words to describe each of the behaviors that we categorized together as “affection” (e.g., hugging and kissing) and “stimulation” (i.e., bouncing, tickling).

Means and standard deviations for each behavioral variable are shown in Tables 1 and 2. To compare maternal and child behaviors during breastfeeding without over-representing infants and children who had the highest frequencies of breastfeeding, we prorated each child and maternal behavior relative to the number of observational units during which each infant or child was engaged in breastfeeding (see Table 2).

To determine whether children's age, maternal levels of work, and modes of production predicted breastfeeding patterns, five separate multivariate analyses of variance

(MANOVAs) were conducted. For each set of behaviors (sets coincide with sections of Tables 1–2) occurring during breastfeeding, a MANOVA was conducted with subsistence type (forager or farmer), age category (three to four months, nine to ten months, or toddler), and maternal work level (high or low) entered as independent variables. We created maternal work levels by compiling mean rates of mothers' work during observations (in all contexts, not just during breastfeeding) and then used a median split to create two groups: high levels of maternal work and low levels of maternal work. When multivariate effects were detected, we conducted subsequent univariate analyses (ANOVAs). Tukey's HSD post hoc tests were used when univariate age effects were identified. To identify cultural group differences, within-age pair-wise comparisons were conducted for each variable using *t*-tests. Results of the MANOVAs and ANOVAs are included in Table 3. Only significant ( $p \leq .05$ ) and near-significant ( $p \leq .10$ ) two-tailed effects and interactions with effect sizes of .25 or above (Cohen's *f*) are denoted in the tables and text.

In the last section of the observational results, we summarize observations related to child and mother regulation and initiation of breastfeeding. We discuss some results from previous studies on weaning (Fouts et al. 2005) and attachment (Hewlett et al. 2000a), but other results are based on ad hoc observations and are thus not subjected to statistical analyses.

### Observational Results

**Structure of breastfeeding.** Subsistence type, age, and maternal work level predicted overall structural patterns of breastfeeding. There was also a significant interaction between age and maternal work. Specifically, foragers breastfed for more of the day and had more frequent bouts than farmers. Age differences were also apparent: three- to four-month-olds had longer bouts than nine- to ten-month-olds and children (Tukey's HSD,  $p \leq .01$ ) while three- to four-month-olds had less frequent bouts than children (Tukey's HSD,  $p \leq .01$ ). Infants and children whose mothers worked more during the day (in all contexts) breastfed less during the day and for fewer bouts per hour than other infants and children. The statistical interaction

TABLE 2. Caregiver and Child Behaviors Observed during Breastfeeding

	3–4 months		9–10 months		Children	
	Aka	Ngandu	Aka	Ngandu	Bofi forager	Bofi farmer
<i>n</i>	20	21	20	20	14	5
<i>Maternal activities:</i>						
Working	22.23 (21.07)	3.83 (6.55)	26.31 (20.07)	14.66 (16.26)	4.98 (7.23)	29.81 (31.64)
Talking to others	40.63 (17.95)	38.36 (18.17)	43.10 (11.66)	44.12 (16.89)	13.95 (9.86)	14.58 (7.30)
<i>Caretaking:</i>						
Caregiving	3.75 (1.95)	6.00 (6.71)	3.48 (2.78)	9.31 (6.32)	5.79 (6.02)	1.80 (1.91)
Holding	98.71 (3.51)	97.29 (5.87)	90.86 (11.89)	85.80 (17.68)	81.30 (16.44)	42.92 (30.04)
<i>Caregiver social-affectionate behavior:</i>						
Affection	3.26 (3.94)	3.85 (4.24)	2.82 (3.14)	2.51 (2.52)	0.67 (1.58)	0.14 (0.31)
Stimulation	.08 (.26)	.11 (.30)	0	0.90 (1.63)	0.13 (0.27)	0
Vocalizing	2.32 (3.26)	2.85 (3.60)	1.54 (2.75)	3.42 (4.54)	1.15 (1.27)	2.57 (2.30)
<i>Infant/child social behavior:</i>						
Play	0.40 (1.04)	1.05 (2.79)	1.26 (2.07)	19.59 (28.83)	23.68 (14.79)	13.10 (6.27)
Vocalizing	1.68 (2.85)	4.73 (5.77)	0.49 (0.84)	3.08 (5.35)	0.51 (1.36)	0.41 (0.93)

Note: Standard deviations are in parentheses below the means.

between age and maternal work level was significant for overall levels of breastfeeding and frequency of breastfeeding (bouts per hour). Levels of overall breastfeeding and bouts per hour were negatively related to age among infants and children where mothers worked frequently during the day, whereas amount of breastfeeding and bouts per hour were positively associated with age for offspring whose mothers worked less frequently during the day.

Within-age-group comparisons revealed that Aka three- to four-month-old infants were breastfed significantly more often (bouts per hour) and for shorter bouts than Ngandu infants. The same general pattern was identified for nine- to ten-month-old Aka and Ngandu infants, although the group difference in bout length was not statistically significant. Furthermore, Aka infants nursed more than Ngandu infants at both ages, but this difference was only significant for nine- to ten-month-old infants ( $t[38] = 2.61, p \leq .01$ ), though the differences in breastfeeding would have been greater if we also included allomaternal breastfeeding because this was common among the Aka. A similar trend was evident in comparisons of Bofi foragers and farmers, although only levels of breastfeeding differed significantly ( $t[17] = 2.05, p \leq .05$ ).

**Maternal activities while breastfeeding.** Maternal activities while breastfeeding were predicted by infant–child age and maternal work. Significant interactions existed between subsistence type and age and between subsistence type and maternal work. Specifically, mothers talked to others less while breastfeeding children but not infants (Tukey's HSD,

$p \leq .001$ ). Mothers who worked while breastfeeding also tended to work more in general. The statistical interaction between subsistence type and age was only apparent for working while breastfeeding. Forager mothers worked less while breastfeeding children whereas farmer mothers worked less while breastfeeding infants. Likewise, the interaction between subsistence type and maternal work levels during the day was only apparent for levels of working while breastfeeding; this shows that forager and farmer mothers who worked infrequently had similarly low levels of breastfeeding while working. In contrast, among mothers who worked frequently, forager mothers were more likely than farmer mothers to breastfeed while engaged in work activities. Cross-cultural comparisons within age groups showed that Aka mothers were significantly more likely to work while breastfeeding than Ngandu mothers regardless of infant age, although forager mothers worked less than farmer mothers throughout the day overall.

**Caretaking while breastfeeding.** Caretaking and holding while breastfeeding were predicted by subsistence type and age, and there was a statistical interaction between these two factors. Subsistence type and age also predicted levels of holding. While breastfeeding, foragers' offspring were held more than farmers' offspring, and younger infants were held more than older infants and children (Tukey's HSD,  $p \leq .01$ ). Statistical interactions were apparent for both holding and caregiving, with holding by foragers at high levels in all age groups (albeit with a slight decrease with age) whereas holding by farmers decreased dramatically between infancy

**TABLE 3.** Analyses of Structural and Social Characteristics of Breastfeeding

		Wilks's Lambda	F	df	Error df	p
<i>Breastfeeding structure:</i>						
Subsistence type		0.83	6.04	3	87	≤.001
	% of daylight hours spent breastfeeding	n/a	7.78	1	89	≤.01
	Mean number of bouts per hour	n/a	11.62	1	89	≤.001
Age category		0.78	3.78	6	174	≤.001
	Mean number of bouts per hour	n/a	5.20	2	89	≤.01
	Mean bout length	n/a	7.38	2	89	≤.001
M-work level		0.739	10.23	3	87	≤.001
	% of daylight hours spent breastfeeding	n/a	9.82	1	89	≤.01
	Mean number of bouts per hour	n/a	31.26	1	89	≤.001
Age by m-work level interaction		0.75	4.59	6	174	≤.001
	% of daylight hours spent breastfeeding	n/a	4.93	2	89	≤.01
	Mean number of bouts per hour	n/a	9.65	2	89	≤.001
<i>Maternal activities:</i>						
Age category		0.62	11.76	4	176	≤.001
	Talking to others during breastfeeding	n/a	24.45	2	89	≤.001
M-work level		0.83	8.80	2	88	≤.001
	Working during breastfeeding	n/a	17.80	1	89	≤.001
Subsistence by age interaction		0.74	7.33	4	176	≤.001
	Working during breastfeeding	n/a	15.41	2	89	≤.001
Subsistence by m-work level interaction		0.85	7.74	2	88	≤.001
	Working during breastfeeding	n/a	11.31	1	89	≤.001
<i>Caretaking:</i>						
Subsistence type		0.83	9.37	2	88	≤.001
	Holding	n/a	17.46	1	89	≤.001
Age category		0.53	16.27	4	176	≤.001
	Holding	n/a	35.71	2	89	≤.001
Subsistence by age interaction		0.74	7.26	4	176	≤.001
	Holding	n/a	9.81	2	89	≤.001
	Caregiving	n/a	5.54	2	89	≤.01
<i>Social-affectionate interactions:</i>						
Age category		0.85	2.42	6	174	≤.05
	Affection	n/a	4.93	2	89	≤.01
<i>Infant social behavior:</i>						
Age category		0.76	6.52	4	176	≤.001
	Play	n/a	7.25	2	89	≤.001
Subsistence by age interaction		0.88	2.83	4	176	≤.05
	Play	n/a	5.25	2	89	≤.01

Note. Results of the 2 × 3 × 3 (subsistence type × age category × m-work level) MANOVAs are reported on the fixed variable lines. Results of univariate analyses are included on the behavioral variable lines, after each significant multivariate main effect.

and childhood. Caregiving while breastfeeding was highest for forager children and lowest for those of farmers.

Cross-cultural comparisons within age group showed that Ngandu nine- to ten-month-olds were more likely to

receive caregiving while being breastfed than were Aka infants ( $t[26.08] = 3.77, p \leq .001$ ); most care given to Ngandu infants involved changing their clothes and washing them. Bofi forager children were more likely to be held while

breastfeeding than were Bofi farmer children ( $t[17] = 3.60$ ,  $p \leq .01$ ). When children were not being held while breastfeeding, they often stood or sat next to their mothers.

**Social and affectionate interactions during breastfeeding.** Social and affectionate interactions during breastfeeding were predicted by age: toddlers received less affection while breastfeeding than did nine- to ten-month-olds (Tukey's HSD,  $p \leq .05$ ) and three- to four-month-olds (Tukey's HSD,  $p \leq .01$ ).

**Infant and child social behavior while breastfeeding.** Social behavior during breastfeeding was predicted by age, and there was an interaction between age and subsistence type. Three- to four-month-olds played less but vocalized more than older infants and children; older farmer infants and toddlers played more often than young infants, whereas forager infants in both age groups played far less than toddlers.

Cross-cultural comparisons within each age group showed that Ngandu infants of both ages were more likely to vocalize while breastfeeding than Aka infants (three- to four-month-olds:  $t[29.50] = 2.16$ ,  $p \leq .05$ ; nine- to ten-month-olds:  $t(19.93) = 2.13$ ,  $p \leq .05$ ). Comparisons between Bofi foragers and farmers showed that forager children were more likely to play while nursing than were farmer children ( $t[16.11] = 2.18$ ,  $p \leq .05$ ), with forager children often playing with their mothers' body parts while nursing.

**Breastfeeding regulation and initiation.** In previous studies, Hewlett and colleagues (2000a) have shown that Aka infants were much more likely (58 percent of bouts) to initiate bouts of breastfeeding than Ngandu infants (2 percent of bouts). Bofi forager and farmer children both predominantly initiated breastfeeding bouts, but among the farmers, attempts to breastfeed were not always successful because breastfeeding appeared to be regulated by mothers. For example, when toddlers were being carried in the typical back wrap fashion, they would cry or physically indicate when they wanted to nurse. If mothers chose to loosen the wrap and bring them forward, they were allowed to breastfeed. When farmer children were not being carried in back wraps, they often approached mothers and attempted to nurse, but this only led to breastfeeding when mothers helped by removing clothes to expose their breasts, stopped working, or repositioned to allow nursing while they worked. If mothers did not respond in such ways, children often continued by pulling at the mothers' clothes or trying to squeeze onto their mothers' laps despite their preoccupation with work (e.g., pounding manioc). Sometimes mothers passively or actively allowed children to squeeze in, but on other occasions mothers scolded their child by telling them to stop or to go somewhere else.

Mothers among the foragers and farmers are the primary individuals who breastfeed infants and children. Among the foragers, however, allomaternal breastfeeding is common in

the first four months of life, whereas allomaternal breastfeeding even in early infancy among the farmers is rare. Allomaternal breastfeeding in later infancy and childhood was never observed among the farmers and was seldom observed among the foragers.

## DISCUSSION

Core cultural values and models of childcare among each group seem to be associated with both structural and social features of breastfeeding. Among the foragers, the core value of personal autonomy is apparent in childcare practices, including breastfeeding, with children directing breastfeeding and weaning without overt mediation by mothers. Children's control over breastfeeding perhaps contributes to the relatively high frequencies of breastfeeding in infancy and childhood. Furthermore, the freedom children have to make many choices from an early age presumably perpetuates the core framework of personal autonomy among the Aka and Bofi forager communities.

The farmers' emphasis on child obedience and parental authority is similarly evident in breastfeeding practices, with farmer mothers regulating breastfeeding, especially with respect to access. Furthermore, farmer cultural models of cultivating strength in children were expressed through earlier weaning and reduced holding and carrying, with the farmers believing that longer breastfeeding and extensive holding and carrying retard the development of strength. This focus on the development of strength relates to core cultural values emphasizing the material basis of social relations and particularly resource defense.

Some of the most obvious differences between the foragers and farmers related to the structure of breastfeeding. The structural pattern among the foragers was consistent with Konner's (2005) evolutionary model of forager childcare patterns: nursing was frequent (more than three times an hour) and weaning was relatively late (at about three to five years of age). Overall, forager infants and children breastfed more than farmer infants and children, at more frequent intervals, in shorter bouts, and previous studies have indicated that Ngandu and Bofi farmers wean children earlier than Aka and Bofi foragers do (Fouts et al. 2005; Hewlett 1991). Other scholars have noted that foragers tend to breastfeed longer than farmers (Ellison 2001; Konner 2005; Sellen and Smay 2001) and thus tend to have longer interbirth intervals than farmers.

Frequent and short nursing bouts were more common among the Aka than among the Ngandu, and higher levels of nursing among the Bofi foragers than among the Bofi farmers may reflect forager core values emphasizing respect for personal autonomy and giving or sharing whatever you have. During the day, Aka infants were frequently carried in slings by their mothers with free access to the breast, allowing them to initiate nursing on their own. Aka infants were also more likely to breastfeed while their mothers were working than were Ngandu infants. In these respects, Aka infant breastfeeding was highly infant directed, with

infants able to initiate breastfeeding at will with minimal, if any, intervention by mothers. By Western standards, both Ngandu and Aka infants were breastfed “on demand,” but the Ngandu pattern was infant led rather than infant directed: Ngandu infants were often carried on their mothers’ backs, secured by cloth wraps; when they cried, fussed, or otherwise indicated that they wanted to nurse, their mothers had to untie them and bring them around to nurse. Our study provides quantitative support for Bird-David’s (2008) relational perspective of childcare and breastfeeding. Bird-David promoted consideration of both maternal and child behavior and urged researchers not to assume a parent-directed pattern of interaction or Western-constructed dichotomies of demand and schedule feeding, especially when studying hunter-gatherers. Similarly, our data demonstrate that Aka, Ngandu, and Bofi infants and children make considerable contributions to breastfeeding interactions. This was especially striking among the foragers whose pattern was largely infant or child directed. Frequent infant-directed breastfeeding is also common among most nonhuman primates (Konner 2010); thus, the distinctive pattern of mother-directed breastfeeding (or little or no emphasis on infant–child agency) that is common in Western societies (Bird-David 2008) seems to represent a dramatic cultural shift that is in need of explanation.

Even though the Bofi farmer children in this sample tended to be younger than the Bofi forager children, they nursed less than the forager children. Bofi forager children essentially had free access to nursing when their mothers were present. These children often sat on their mothers’ laps or next to their mothers and could grab the breast to nurse at will. By contrast, Bofi farmer children were often observed trying in vain to nurse when their mothers were working. These observations seem to suggest that Bofi farmer mothers discouraged nursing by continuing to work and not facilitating nursing. As a result, the lower levels of nursing we observed may also have reflected the discouragement of nursing associated with early stages of weaning.

Farmers vocalized to infants while breastfeeding more than foragers did, while foragers held infants more. Aka and Bofi forager cultural models emphasize physical closeness whereas the farmer cultural models downplay the importance of physical proximity (e.g., holding too much causes children to be short). Consequently, farmer caregivers are more distal and more likely to communicate with infants verbally. Among the Aka and Bofi foragers, for example, children may be carried or held throughout the day up to three or four years of age; children usually spend most of the day in physical contact with adult caregivers. Aka and Bofi forager parents rarely direct or scold children verbally, even in seemingly dangerous situations (e.g., when infants reach toward hot kettles). Ngandu and Bofi farmers, in contrast, emphasize verbal communication, and farmer parents are more likely to direct children to learn new skills (Berry et al. 1986).

Consistent with Yovsi and Keller’s (2003) study, we also found that mode of production was predictive of many aspects of breastfeeding interactions. Despite this broad similarity, the breastfeeding patterns of the Bofi and Ngandu farmers seem quite distinct from those of the Nso farmers who Yovsi and Keller studied. Specifically, Yovsi and Keller described the Nso as emphasizing proximal care (by contrast to the Fulani), and we found that Ngandu and Bofi farmers were more distal in their breastfeeding than the Aka and Bofi foragers. Certainly, these differences among the farming groups (i.e., Nso vs. Bofi and Ngandu) are made more dramatic by comparing them with quite distinct groups (i.e., the Fulani vs. the Aka and Bofi foragers). Also in contrast, the Aka and Bofi foragers emphasize proximity like the Nso; but unlike the Nso, independence is a core value among the Aka and Bofi foragers.

Beyond mode of production, age was a consistent predictor of breastfeeding patterns in our study, even though breastfeeding remained more common among the foragers than farmers into childhood. Nonetheless, breastfeeding experiences seem to be influenced by aspects of infant and child development, and thus findings concerning breastfeeding at one age should not necessarily be generalized to other ages. In our study, breastfeeding of three- to four-month-olds was quite unlike that of nine- to ten-month-olds and children. In particular, three- to four-month-olds had longer bouts of nursing than nine- to ten-month-olds and children, which is not surprising because three- to four-month-olds are almost entirely reliant nutritionally on breastfeeding whereas nine- to ten-month-olds and children also consume solid foods.

Beyond the structure of breastfeeding, there were age-related differences in the interactions that occurred during breastfeeding. Younger infants were held more and were less likely to play while breastfeeding than were the older infants and children. These trends could be attributed to developmental constraints, because three- to four-month-olds are typically unable to sit unaided and must be held while breastfeeding. Nine- to ten-month-olds and children also have a larger repertoire of motor and social skills than three- to four-month-olds, and this likely enhances their ability to play while breastfeeding. Typical play while breastfeeding involved playing with their own body parts, with their mothers’ clothing or body, and holding or tapping sticks or other objects. Infants of both ages tended to vocalize while breastfeeding more than children did; this may have reflected children’s ability to speak and thus to rely less on nonverbal vocalizations than preverbal infants.

Even though affection was infrequently expressed during bouts of breastfeeding, it was more often directed to infants than to children. This perhaps reflects an adaptive pattern, with affectionate caregiving being highest in infancy and declining with age as human and nonhuman primates are biologically drawn to hold and take care of infants, notwithstanding facultative strategies that may lead to neglect and infanticide under some conditions (Hrdy 1999).

Furthermore, attachment theorists emphasize that close physical proximity between caregivers and infants ensures that infants receive care, comfort, and protection (Bowlby 1969). Because mortality risks decline with age (Mace 2000), it seems adaptive to keep younger infants closer to caregivers than older infants and children.

The higher levels of maternal talking to others while breastfeeding infants rather than children is difficult to interpret from an evolutionary standpoint because it runs counter to the idea that infants require more care and attention than older children. The observational context may be relevant, however: regardless of subsistence group, infants tended to be carried to the fields or forest during the day whereas children were more likely to remain in camp or in the village. As a result, most observations of the children occurred in the camp or village during the day, when few adults (i.e., conversational partners for mothers) were present. The importance of settings for influencing caregiver-child relationships have long been recognized, especially by anthropologists and psychologists influenced by John Whiting and Beatrice Whiting's seminal Six Cultures Study (Whiting and Whiting 1975). The Whitings, like other "cultural and personality" psychologists of the time, considered "maintenance systems" (e.g., social, political, and economic systems) as primary determinants of the parenting patterns that shape child development. However, our findings do not fall in line with the Whitings' framework because the settings in which infants were often observed were similar across subsistence groups. Thus, even though modes of production or maintenance systems may structure some children's experiences, there may be some features driven by aspects of age. Likely, the higher vulnerability of infants because of their smaller size meant that infants were carried to forest and fields more than children were. Thus, the settings (forests versus fields) where infants tended to spend their days seem to be determined by biological factors (the presumed survival value of taking infants outweighing the costs of carrying them) rather than driven by a particular maintenance system.

The energetically costly demands of work and breastfeeding were balanced differently among the foragers and farmers, especially where the infants were concerned. In essence, working appeared to impede breastfeeding of infants more among the farmers than among the foragers, who were more likely to incorporate breastfeeding into subsistence work. These patterns might suggest that farming is more energetically demanding than foraging, but we have no evidence that this is the case. Also, forager parents tended to value prolonged child-directed breastfeeding (i.e., later weaning) and rarely spoke of working and breastfeeding as competing demands. Farmer mothers had specific ideas about when children should be weaned and spoke of breastfeeding as a mother-regulated process. Farmer mothers also often complained that working made breastfeeding difficult and weaning allowed them to work more.

Overall, our findings illustrate how biological and cultural factors interact and provide more useful explanations

of variations in breastfeeding structure and social interactions than either perspective alone. Indeed, all dimensions of breastfeeding that we considered could only be understood by considering both cultural and biological interactions. Presumably, mothers and children in all communities strive (although not necessarily consciously) to enhance their survival and that of their kin models in their social and ecological environments by employing cultural knowledge. We hope this study has highlighted some of the dynamic interplay between the phylogenetic legacy of breastfeeding, energetic tradeoffs by mothers and children, core cultural values, cultural models of childcare, and children's age and behaviors—all of which all affect breastfeeding patterns.

This study was limited by the fact that observational data were collected for broader studies of infant and childcare that did not include precise measures of energetic expenditures, health and nutritional status, and breastfeeding ideologies. Consequently we focused on child age, maternal work patterns, frequencies of breastfeeding, and the adaptive nature of breastfeeding patterns. Furthermore, it would have been valuable to have observed both infants and children in all four communities. Notwithstanding these limitations, this study provides quantitative and qualitative comparative ethnographic data on breastfeeding in small-scale cultures and illustrates the importance of utilizing an integrative bio-cultural approach to human behavior.

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## NOTE

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## FOR FURTHER READING

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