

Similarities and Differences in Maternal Responsiveness in Three Societies: Evidence From Fiji, Kenya, and the United States

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The first relationship between an infant and her caregiver, typically the mother, lays the foundation for cognitive, social, and emotional development. Maternal responsiveness and affect mirroring have been studied extensively in Western societies yet very few studies have systematically examined these caregiving features in non-Western settings. Sixty-six mother–infant dyads (7 months, $SD = 3.1$) were observed in a small-scale, rural island society in Fiji, a village in Kenya, and an urban center in the United States. Mothers responded similarly to infant bids overall, but differences were found across societies in the ways mothers selectively respond to affective displays. This has implications for understanding early emotion socialization as well as understanding variation in infant social ecologies across the globe.

The first social relationship, that between an infant and her caregiver, has been a focus of intense interest to developmental psychologists for over a century, stemming from early work examining the quality and nature of this early interaction (Bowlby, 1982, 1988; Stern, 1985). Theorists agree that parent–child interactions shape cognitive, social, and emotional development later in life (Bowlby, 1982, 1988; Stern, 1985; Vygotsky, 1930/1978). From early investigations of the mother–infant dyad, maternal responsiveness was identified as being an important component of an infant’s social world in the 1st year of life. It has been defined as the *prompt* and *appropriate* response produced by a mother in response to her child’s needs (Ainsworth, 1979; Bell & Ainsworth, 1972). Scholars have examined the nature of the mother–infant relationship with a focus on behaviors produced during the dyadic

interaction to identify patterns of maternal responsiveness and its impact on child socioemotional and cognitive development (Bigelow & Birch, 1999; Striano & Rochat, 1999). One working hypothesis is that maternal responsiveness shapes the social expectations of infants later in life. Another is that maternal mirroring shapes emotional development (Fonagy, Gergely, Jurist, & Target, 2002). To date, only a handful of studies have systematically investigated mothers outside of an urban, Western social context (Abels et al., 2005; Kärtner, Keller, & Yovsi, 2010). To understand specifically what constitutes a “timely” and “appropriate” response for infants, it is critical to determine how this early interaction varies in diverse social ecologies.

Evidence suggests that the ways mothers respond to infants vary significantly both across and within cultures (Bornstein, Putnick, Cote, Haynes, & Suwalsky, 2015; Casiglia, 1998; Hewlett, 1996; Richman, Miller, & LeVine, 1992). This

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variation is thought to impact social, emotional, and cognitive development. At present, the literature systematically documenting variation in maternal styles is sparse, yet at the same time, the implications of understanding this variation are significant. The aim of the present study is to compare and quantify maternal responsiveness specifically exploring the socialization of infant positive and negative affective expressions in three societies: one rural traditional, small-scale isolated island society in Fiji; one rural village society in Kenya; and one urban Western society in the United States.

In the West, new mothers are encouraged to be highly responsive to their infants and to attend to their emotional bids with *timely* and *appropriate* responses (Blehar, Lieberman, & Ainsworth, 1977; Stern, 1985). There is debate about what is considered timely and appropriate, however, the purpose of the present study is to examine two specific features of maternal responsiveness that are considered essential to healthy development: contingent responding and emotional (affect) mirroring. Under the umbrella of maternal responsiveness, contingent responsiveness and affect mirroring have been identified as important and universal features of the mother–infant relationship (Gergely & Watson, 1999). Contingent responsiveness refers to the propensity of the mother to respond promptly to her infant's bids or requests—typically any vocalization, facial expression, or movement by the infant—within 1 s of the onset of the “request” and this response is thought to shape infant social expectations. Affect mirroring has been identified as a peculiar phenomenon in which mothers show a propensity to mirror the emotional expressions of their infants—when an infant smiles or coos, the mother smiles or coos in response (Gergely & Watson, 1999). When an infant frets or cries, the mother reflects the emotional expression by producing a frown or fret in response to her infants' emotional display. Mothers differ in their degree of responsiveness and this is detected and later expected by infants (Bigelow & Birch, 1999; Cassidy, 1994; Striano & Rochat, 1999). In addition, affect mirroring is thought to shape infants' emotional understanding and self-development by providing them with an external reflection of their internal state—a social biofeedback model as proposed by Gergely and Watson (1999). Timely and appropriate responding has been identified as critical to the healthy development of an infant (Chavajay & Rogoff, 1999). Research with clinical populations indicates that infants born to mothers suffering from depression or psychosis receive less maternal contingent

responding, affecting infants' social expectations (Goodman & Gotlib, 1999).

Interventions for depressed mothers are developed based on the assumption that responsiveness and close monitoring of the child's emotional state are “good” for the health and well-being of the infant. Although to some degree, this must be the case, on the other hand, our knowledge of what is “good” currently has a “one size fits all” approach. We know what urban middle-class Western mothers do and we know a bit about a few non-Western societies. Yet our knowledge of mothers from small-scale, rural, non-Western societies having very little influence of Western values and beliefs is sparse. To fully understand the caregiver–infant relationship and its impact on development, we must first examine its elements in subsistence-based societies that more closely resemble that of our human ancestors—one without significant Western influence. Without a deeper understanding of how caregivers engage with babies across diverse societies, our knowledge remains limited. While the current study does not address the impact of these differences on development, the aim is to examine the mother–infant dyadic relationship in culturally distinct settings—specifically focusing on the addition of an isolated, traditional rural society in the outer islands of Fiji. While significant progress has been made over the past decade in the cross-cultural investigation of mothers, to our knowledge, the existing cross-cultural literature examining maternal responsiveness and affect mirroring is limited to rural large towns and urban centers. We compare a rural, small-scale, non-Western island society (Fiji) with relatively little access to Western culture, with a rural non-Western village setting (Kenya) having influence from Western society through accessible nearby towns. Finally, we compare with data collected in an urban middle-upper-class society of American mothers. The current study aims at providing further comparative examination of what might constitute the early social experiences across highly contrasted cultural context.

Parenting styles and the early social environment of infants vary significantly both between and within societies (Bornstein & Cote, 2001; Dixon, Tronick, Keefer, & Brazelton, 1984; Hewlett, 1996; Konner, 2005; LeVine, 1994; Richman et al., 1992). In fact, the Western approach for parenting may be distinct from most other societies. Ethnographic reports of children across different sociocultural contexts suggest that parents differ in their developmental goals and parenting models—with some

having a “nonindulgent” model of childrearing, in sharp contrast to a “pedagogical” approach of Western parents (Lancy, 2008, 2010). Lancy (2010) suggests that parents in Western, Educated, Industrial, Rich, and Democratic (WEIRD; see Henrich, Heine, & Norenzayan, 2010) societies emphasize parents’ role as teachers, whereas other societies emphasize parents’ role as provider and protector. Among the Gusii in Kenya, LeVine describes Gusii parents of Kenya as viewing infant care in terms of protection and nurturance (LeVine et al., 1994). In addition, LeVine indicates that parents intentionally delay direct instruction until the child is able to produce and comprehend simple commands. In contrast, under the pedagogical model, parents bear the responsibility of teaching, acculturating, and shaping early learning—a different model from that of non-Western, traditional societies where the responsibility rests on the child to seek out and participate in opportunities to accumulate skills and knowledge. Keller and colleagues distinguish interdependent societies such as the rural Nso of Cameroon that emphasize a more related interactive style, from others, such as German middle-class parenting culture that emphasizes an individualistic interactive style (Keller, Kärtner, Borke, Yovsi, & Kleis, 2005). These parental models would be expressed from the outset of development.

Ethnographic reports and naturalistic observations suggest that parents’ behavior toward infants in the 1st year of life may vary markedly across cultures (LeVine & Norman, 2001). However, more quantified evidence of such differences is warranted. In contrast to urban, Western parent–infant dyadic exchanges, ethnographic reports point to the fact that many parents in small-scale, rural societies deemphasize face-to-face exchanges, and regard eye contact as threatening and linked to unfriendly gestures (Dixon et al., 1984; LeVine et al., 1994; Ochs, 1982). Converging empirical evidence supports such contention, pointing to sociocultural differences in behavior toward an infant (Bornstein & Cote, 2003; Greenfield, Keller, Fuligni, & Maynard, 2003). Abels et al. (2005) show that in rural India there is significantly less eye-to-eye contact and exclusive attention of mothers toward their 3-month-old infants compared to urban mothers of the same region. Likewise, Keller and colleagues report differences in mother–infant face-to-face interactions, eye gaze, and maternal contingent responses comparing dyads in rural Cameroon, Greece, and Costa Rica (Keller et al., 2004). The authors link these differences to parental models of development emphasizing an interdependent or independent

model of development, also referred to as relational or autonomous. Differences in the dyadic interaction between mothers and infants has also been linked with children’s performance on later social-cognitive tasks including mirror self-recognition (Keller et al., 2004).

Research focusing specifically on the affective responses of mothers indicates interesting variability in the selective responses of mothers toward infant emotional displays. Mothers often discourage infants from increased excitement—whether positive or negative—indicating that infants are discouraged from producing significant emotional displays (LeVine et al., 1994). LeVine also describes Gusii mothers in Kenya as devaluing a positive display on the part of their infant. Rather than encouraging a laugh or bout of excitement, they would turn away (avert gaze) when babies display positive emotions. In addition, !Kung mothers in Botswana respond promptly to !Kung infant cries but do not respond to the 2-month social smile milestone in ways Western mothers typically do (Barr, Konner, Bakeman, & Adamson, 1991). There are other more recent examples of this in the empirical literature. For example, Nso mothers in Cameroon respond less to positive displays of their infant (Kärtner et al., 2010). The same authors examine mothers’ responses to infant nondistress vocalizations in the 1st few months of life. They report that German mothers show an increase in visual contingency and a decrease in proximal contingency as infants begin to produce social smiles. In contrast, rural Cameroonian Nso mothers do not show such pattern in response to newly emerging social smiles (Kärtner et al., 2010). The authors interpret these findings as early evidence of culture-specific parenting and parental goals. What remains unclear is how parents respond to nondistress negative emotional bids such as a fret, a fuss, or a frown, as opposed to a cry (referred to hereafter as a “fuss”). If infants begin learning about emotional displays in the 1st year of life, one would expect societies with different emotional display rules to begin socializing infants by responding differentially to both positive *and* negative bids.

Overall, the abundance of literature with Western mothers and the handful of studies conducted with non-Western participants suggest that mothers are responding to infants in both qualitatively and quantitatively different ways across cultures. To understand such differences, more precise, microanalytical data are needed, particularly from small-scale societies with very little influence from Western parenting ideals. The aim of this project is

thus twofold: (a) to examine maternal responsiveness to infant nondistress negative (fuss) and positive facial displays and vocalizations (i.e., contingent responding), and (b) to examine maternal mirroring of infant positive and negative emotional displays. Finally, we explore maternal beliefs about developmental milestones to examine whether expectations regarding infant psychological and physical development may be related to societal variation in maternal responsiveness. Determining how mothers across societies respond to infant emotional displays as well as mothers' expectations for developmental milestones are crucial to developing a better understanding of the mechanism underlying the socialization of emotion in the 1st year of life.

Previous research has shown that as early as 3 to 6 months, mothers selectively respond to infant emotional displays as a function of infant age and gender (Malatesta & Haviland, 1982). Our study builds upon the existing cross-cultural framework, closely examining a snapshot of the early social environment in an isolated, traditional, small-scale island society. This is the first examination of the mother–infant relationship in a small-scale society with very little Western influence. Past work has examined the social ecology of the infant in rural towns in central and eastern Africa. The primary notable differences between a small-scale society such as those comprising Fijian villages and rural towns such as those inhabited by the Gusii of Kenya and the Nso of Cameroon are: (a) *population density*—individuals in an isolated, small-scale society typically constitute a lower population density (compared to rural areas near towns) and therefore are having repeat interactions and rarely interacting with strangers, and (b) *access to market economy*—due to the isolated nature of a small-scale island society, they typically have little access to the global market economy. What is notable and relevant in this distinction for this study is that market integration affects access to and influence from Westernization (with a small-scale island society having less influence and access than a large rural town). For example—at the time of this study, there were no newspapers, mail delivery, or phones in the villages on the islands where the research took place (in Fiji). Finally, small-scale societies are living in ways that resemble more closely the life of our human ancestors—with subsistence living as opposed to farming for profit. Such a comparison allows us to extend our findings and speculate on the evolutionary origins of this behavior.

On the basis of the existing literature we formulated the following hypotheses: (a) we expected similarities in the overall levels of contingent responding across all three societies; (b) we expected differential responding to emotional displays in rural, non-Western societal contexts (Fiji and Kenya) compared to Western mothers in the United States, with Fijian and Kenyan mothers responding less to positive emotional expressions of infants (LeVine et al., 1994; Wörmann, Holodyski, Kärtner, & Keller, 2012); and (c) based on the ethnographic reports, we also expected societal differences in mothers' expectations for psychological milestones of infants and similarities in general and physical milestones (LeVine, 2007; Ochs, 1982). What is new about this project is the testing of these hypotheses in three culturally distinct societies, including one small-scale, traditional, and isolated society (Fiji). Such testing could have implications for our understanding of the fundamental mechanisms underlying attachment formation and the socialization of emotion in the 1st year of a child's life.

Method

We examined mothers interacting with their infants in a face-to-face situation in the infants' 1st year of life in three societies—a small-scale, isolated island society in Fiji; a rural village near a large town center in Kenya; and a university in the United States. The study was conducted over a period of 3 years (2007–2009). All interactions were videotaped and later scored for mothers' and infants' behaviors during the interaction. We examined maternal behaviors for responsiveness and the propensity to mirror affective displays.

Participants and Location

We tested 66 mother–infant pairs (31 female) comprising 26 rural Fijian Islanders, 24 urban Americans, and 16 rural Kenyans (Bukusu). An additional six mother–infant pairs were tested but were excluded because five infants exceeded the age of interest (> 12 months) and one due to experimenter error. All mothers were self-declared primary caregivers. Infant ages ranged from 2 to 12 months with a mean age of 7 months ($SD = 3.1$) and was comparable across societies, analysis of variance (ANOVA), $F(2, 63) = 0.75, p = .48$. There were comparable numbers of males and females across societies (Fiji 12 female, United States 11

female, Kenya 8 female). On average, mothers were 28 years old (range = 17–45, $SD = 7.1$) with 12 years of formal education (range = 5–20, $SD = 4.1$). An ANOVA with society as a between-subjects factor and mothers age and formal education in years indicates that there was a significant difference across societies in maternal age, $F(2, 45) = 11.28$, $p = .000$, and education, $F(2, 39) = 94.99$, $p < .000$; Fijian $M_{age} = 29.3$ ($SD = 7.9$), $M_{edu} = 10.7$ ($SD = 1.8$); American $M_{age} = 32.2$ ($SD = 5.1$), $M_{edu} = 16.8$ ($SD = 1.7$); and Kenyan $M_{age} = 22.3$ ($SD = 3.4$), $M_{edu} = 8.2$ ($SD = 1.7$). Note also that age and education information was collected for 48 and 42 participants, respectively. This was a result of three rounds of data collection. During the first round (Year 1), we did not collect age and education information. A post hoc comparison of maternal age using the Fisher least significant difference test (LSD) test indicates that the sample population from Kenya was significantly younger than the sample population from the United States ($p = .000$) and Fiji ($p = .001$). In addition, societies differed significantly in the years of formal education attained, with Kenyan mothers having fewer years of formal education and U.S. mothers having the most ($p < .000$ for all comparisons except Fiji–Kenya $p = .001$). We conducted a bivariate correlation analysis examining maternal age and years of formal education. There was a significant correlation between maternal age and education (Pearson's $r = .43$, $p = .005$). Examining each society separately indicates that this correlation is significant for Fijian mothers (Pearson's $r = -.51$, $p = .04$) and not U.S. ($p = .43$) or Kenyan ($p = .49$) mothers; therefore we did not conduct a principal component analysis and we included these as separate variables.

Fiji

We conducted this study in three locations in Fiji: two rural island villages ($n = 20$) and one village near a town ($n = 6$). All mothers were born, raised, and spent the majority of their adult life in rural island villages, and exploratory analyses indicates no difference in maternal behavior across these locations so we included them as one group representing rural Fijian society. The two rural villages are located in opposite locations of the Fijian archipelago. The villages included in this study on Yasawa Island are 1–2 days of travel by boat from the main island of Viti Levu, with limited air access. The villages in Lau are 5 days of travel by boat with no other affordable access (hydroplane access is greater than \$10,000 one way and there is

no strip of land for an airplane or helicopter to land). Neither island society had access to television or newspapers at the time of this study, with the exception of the medical station in the village of Tovu, Lau, which occasionally allowed public viewings of sports games on Sundays. We tested additional participants on the main island, Viti Levu, in a village nearby the town of Lautoka. The village consists of families previously from the Yasawa Islands. Yasawa and Lau are similar in that they both rely on subsistence agriculture and marine foraging and fishing for livelihood. There were no functional televisions in the village near Lautoka at the time of this study and electricity and plumbing were rare. This is of particular importance as the goal of this project was to examine maternal behaviors in regions having little influence of Western society. Early caregiving practices are similar in these three regions as mothers are the primary caregivers in the first few years of life, with assistance from other family members and nearby females. Typically, the mother receives help with domestic chores while she nurtures and feeds her infant in the first 6 months of life. It is also common for older siblings, grandmothers, or other relatives to assist with child caregiving but rarely in the 1st year of life (at least not in any significant way). Each village is small, having a population of less than 150, with no secondary school on either of the island groups (with the exception of the village on Viti Levu which has access to schools). All participants were recruited by word of mouth after obtaining consent from the village elders to conduct the study in these regions.

Kenya

The study was conducted in the western region of Kenya near the rift valley, bordering Uganda. Mothers were recruited and tested in Chemwa Village (population approximately 1,200), which comprised approximately 200 households and is located near a large town center—Bungoma town. The region consists primarily of individuals from the Bukusu tribe in Kenya (also known as Luhya). For the purpose of this article, Kenyan participants could be considered similar to the previously reported Nso of Cameroon (Kärtner et al., 2010) based on the economic and political structure as well as the population size. Access to electricity is limited; therefore, households experience little influence of Western media (no television or magazines in the villages). Media exposure comes in the form of national (Kenyan) newspapers and local radio.

Television and Western media exist in Bungoma town, which is about 1 hr away by bicycle taxi. The daily life of mothers consists of childrearing, maintaining a household, and income-generation activities, as well as participation in community organizations. Most households in this region rely on small income stores and labor on sugarcane and maize crops for a daily wage. The socialization goals and parenting practices of mothers in this region have been identified as distinct from Western styles of parenting in the 1st year of life, with an emphasis on nurturing and protecting rather than psychosocial development (LeVine, 1994). In fact, mothers are encouraged not to stimulate their infants in ways that facilitate a high level of arousal—whether it is negative (fussing or crying) or positive (laughing or showing excitement; LeVine, 1994). Mothers are the primary caregivers in the 1st year of life, yet they receive a significant amount of assistance with domestic chores from other women, young girls in the village, and other children.

United States

The study was conducted at a laboratory in Atlanta, Georgia, an urban U.S. center. All mothers were recruited from a database comprising families recruited by a variety of recruitment methods such as mailings, contacting local day-care centers as well as birthing centers. Mothers were upper-middle class and many mothers were working outside of the home with infants receiving part-time care from unrelated others.

Procedure

In all three societies, informed consent was obtained orally in the native and familiar language by a local research assistant. In Kenyan and Fijian societies permission to conduct the studies was granted first by village elders. After consent was obtained, mothers and their infants were brought to the testing location and seated in a quiet corner of a laboratory (U.S.) or a room in a house (Kenyan or Fijian) or outdoor area (Kenyan). Both the mother and infant were seated on the floor or ground, with the infant facing the mother and within the mother's arms reach. The primary experimenter, a local, was seated behind the mother and out of sight of the infant. An additional adult, the first author (TB), was present for all testing in all three societies; however, she remained out of view of the infant in Fiji and Kenya as some infants were frightened of her. We asked mothers to engage nat-

urally with their infants with the goal of keeping the infant content for about 10 min. We asked mothers not to pick up the infant; however, touching was allowed and was at the discretion of the mother. They were also told that if the infant cried we would stop the camera, but if the infant fussed, they could signal to us to stop and that we would only use the first few minutes of video and that would be sufficient for the study. Note that the mothers were not instructed to talk or play with their infants; rather, they were told to "do whatever they preferred," but to keep the infant within the view of the camera. Although questions arise regarding the validity of the face-to-face structured and rigid laboratory set up in a small-scale society, the goal was to capture a slice of maternal responsiveness.

In order to capture the head and torso view of the dyad, we used two video cameras (Sony DCR-SR45, Tokyo, Japan), placing one behind and slightly above the shoulder of the mother and another behind and slightly above the head of the infant. We combined all videos into a single, split-screen video using *i-movie* software (Apple, Cupertino, CA). Due to occasional interruptions and unexpected distractions, we trimmed each video to capture the first 3 min of uninterrupted interaction. The videos were then coded using an event-recording software *Jwatcher* (developed by Blumstein, Daniel, & Evans, University of California Los Angeles and Macquarie University, Sydney).

Coding

We coded infant and mother behaviors separately scoring each video seven times—four times to code mothers' behaviors and three times for infant behaviors. Maternal behaviors were divided into four modalities, coded separately: facial, vocal, gaze, and tactile. Infant behaviors were divided into three modalities, coded separately: facial, vocal, and gaze. Each of the modalities contained a series of mutually exclusive codes to identify behaviors occurring within that modality.

Facial and vocal behaviors were coded for valence—positive, negative, and neutral. A positive facial expression consisted of a smile or grin—an upward turn of the corners of the mouth, whereas a positive vocalization consisted of an increase in pitch or a rising intonation, or laughing. A negative facial expression was a frown or grimace and a negative vocalization was a fuss, cry, or decreasing intonation. We defined four categories of maternal tactile responses after watching a selection of videos

from each society and determining a repertoire of possible maternal tactile behaviors. We coded four kinds of tactile behaviors—vestibular movement, caressing, contact without movement (such as resting a hand on the infant), and stimulating (tickling, poking, or moving the infant's limbs). Vestibular included repositioning or rocking the infant's body and included a core body movement (a shift in position, even if slight). Stimulating included tapping, poking, flailing, and puppeting the infant's limbs. Any limb shaking, moving, or poking at the infant was included as this code. Another code was caressing the infant—this included any smooth caressing motion of the mother's hand onto the infant. The last code was contact without movement occurring when the mother's hand was resting but not moving on the infant. These codes were all mutually exclusive and nonoverlapping. We also coded infant and maternal gaze behavior separately. There were two possible gaze behaviors—looking at the partner and looking away from the partner. Each behavior received its own unique code; therefore, a button press indicated the onset of one behavior and a subsequent button press indicated the end of that behavior and the onset of a new behavior. Within each coding modality, all behaviors were mutually exclusive.

First, two independent coders were trained on each of the coding modalities for the mother and the infant (facial, vocal, gaze, and tactile) by coding, comparing scores, and discussing until discrepancies were eliminated. Then, the independent coders coded an additional 30% of videos and reliability was calculated for each category. Agreement was declared for each code if the behaviors occurred in the same temporal order and within 1 s of one another. One second was determined by the onset of the first occurring target behavior; the second occurring target behavior must occur within 1 s of the onset of the first target behavior. Errors included missed codes, erroneous codes, or time lags of more than 1 s. Sequential lag analysis was calculated using GSEQ software (Bakeman & Quera, 1995) for each modality for each participant (mother and infant separately). We calculated event alignment kappas for each modality (facial, vocal, gaze, touch) based on a tolerance window of 2,000 ms and 80% overlap. This means that each coded behavior was determined as a "hit" if they overlapped for 80% of the behavior duration (prior to the next code press). A behavior was considered a "miss" if it was coded by only one rater or did not overlap by 80% within the 2,000-ms tolerance window. The event alignment kappas were as fol-

lows: mother facial (.87), mother gaze (.81), mother touch (.76), mother vocal (.77), infant facial (.92), infant vocal (.72), and infant gaze (.86).

All behaviors and the time in which they occurred were combined into one master data record for each dyadic interaction. This array of behaviors and coding method allowed us to identify any changes in behavior and therefore determine whether an infant behavior precipitated a change in the mother's behavior, thereby constituting contingent maternal responding.

Results

Infants

First, we examined infant behaviors to identify any systematic differences in the frequency of behaviors. We conducted a multivariate ANOVA with infant behaviors (positive and negative, facial and vocal) as the dependent variable, society as the between-subjects factor, and infant age, maternal age, and years of formal education as covariates in the model. Infant age was a significant predictor of infant smiles ($p = .04$, partial $\eta^2 = .11$, small effect) and infant negative vocalizations ($p = .02$, partial $\eta^2 = .14$, small effect). Young infants smiled more and produced fewer negative vocalizations than older infants. There was no significant effect of society, maternal age, or education on these infant behaviors.

Mothers

Next, to identify systematic differences in mothers' behaviors, we ran a multivariate ANOVA with maternal behaviors as the dependent variables (positive and negative facial and vocal and four kinds of tactile behaviors), society (3) as the between-subjects factor, and infant age, maternal age, and years of formal education as covariates in the model. Overall, mothers smiled more with increasing age ($p = .013$, partial $\eta^2 = .16$, small effect). Mothers in Fiji produced significantly more negative facial expressions than U.S. or Kenyan mothers ($p = .04$, partial $\eta^2 = .16$, small effect); LSD post hoc comparisons for Fiji and United States, $p = .012$ (mean difference = 0.94), and Fiji and Kenya, $p = .035$ (mean difference = 0.88). Finally, mothers in the United States rested their hand (without moving) on their infant during the interaction significantly more frequently than Fijian and Kenyan mothers, $p = .001$, partial $\eta^2 = .31$, medium effect; LSD $p = .000$ (mean difference = 5.11), $p = .000$, respectively (mean dif-

ference = 6.60). Interestingly, Kenyan mothers did not touch their infants as frequently as Fijian ($p = .017$, mean difference = -5.38) and U.S. ($p = .006$, mean difference = 6.33) mothers. All analyses first included covariates maternal education, age, infant age, and between-subjects factor sex of the infant. However, when the variables were not significant, they were dropped from the analyses and are not reported here (see Table S1).

Contingent Responding

A contingent response was defined as any change in mothers' behavior within 1 s of the *onset* of an infant behavior, as mothers typically respond within 1 s to an infant's behavior. We did not restrict the kinds of maternal responses in these analyses as we considered any change in behavior a possible way of communicating recognition of the infant's bid for mother's attention and therefore a contingent response. On the basis of this operational definition, we calculated contingent responding using R software (R Foundation for Statistical Computing, Vienna, Austria) and exported the frequency of maternal responses per infant behavior. There was no a priori assumption of appropriate responding; therefore, any change in the mother's behavior within 1 s of the onset of an infant behavior was taken to be a contingent response.

First, we examined the propensity for mothers to respond to an infant within 1 s of an infant-initiated change in behavior (any change), referred to here, and in the literature, as "maternal contingency." We calculated maternal contingency proportion by dividing the number of maternal contingent responses by infant bids. We examined the proportion of maternal contingent responses to infant negative and positive facial and vocal bids (see Table 1). We ran a repeated measures ANOVA with proportion of contingent responses for modality and valence as our repeated measures (4) and society (3) as our between-subjects factor. Consistent with the existing literature, there was no between-subjects effect, meaning there was no significant difference by society in the propensity for contingent responding, $F(2, 63) = 0.069$, $p = .934$ (see Table S1). There was a Society \times Valence interaction, $F(2, 63) = 4.18$, $p = .020$, $\eta^2 = .12$ (small effect). Independent t tests indicate that there was a significant difference between Fiji and United States on valence—with Fijian mothers responding more contingently than U.S. mothers to negative facial bids, $t(48) = -2.03$, $p = .048$ (two-tailed) and U.S.

Table 1

Mean Proportion of Maternal Contingent Responses (CR) and Affect Mirroring (AM) to Infant Bids by Society

	Fiji ($n = 26$)	Kenya ($n = 16$)	U.S. ($n = 24$)
Maternal CR			
CR to infant smiles	0.54 (0.34)	0.61 (0.36)	0.66 (0.28)
CR to infant frowns	0.47 (0.42)	0.26 (0.33)	0.23 (0.38)
CR to infant vocal positive	0.18 (0.32)	0.36 (0.41)	0.44 (0.47)
CR to infant vocal negative	0.37 (0.38)	0.40 (0.35)	0.30 (0.36)
	Fiji ($n = 3$)	Kenya ($n = 4$)	U.S. ($n = 5$)
Maternal AM			
AM to infant smiles	0.10 (0.13)	0.13 (0.11)	0.10 (0.10)
AM to infant frowns	0.01 (0.02)	—	0.05 (0.13)
AM to infant vocal positive	0.40 (0.29)	0.12 (0.18)	0.32 (0.34)
AM to infant vocal negative	0.02 (0.05)	—	0.05 (0.11)

Note. Standard deviations are given in parentheses.

mothers responding more contingently to positive vocal bids $t(48) = 2.35$, $p = .023$ (two-tailed).

Affect Mirroring

Affect mirroring is defined as a contingent response (any change in mothers' behavior within 1 s of the *onset* of an infant behavior) that is matched in modality (facial, vocal) and valence (positive, negative). Our first goal was to examine the proportion of affectively matched responses by modality and by infant bids. In other words, is the likelihood that an infant can expect to receive an affectively matched response by her mother different across societies? We conducted a multivariate ANOVA with the proportion of affectively matched responses per infant bids by modality and valence as the dependent variables (4) and society as the between-subjects factor (3). There was no significant difference by society, $F(8, 14) = 1.2$, $p = .36$; however, the frequency of affectively mirrored responses were low (see Table S1); therefore, this is difficult to interpret. We compared the proportion of mothers who displayed any form of affect mirroring at least once (67% of all participants) with those who did not produce any mirroring (33% of

all participants), using nonparametric binomial statistics with a test proportion of .50. Overall, mothers were significantly more likely to engage in affect mirroring than not, $p = .009$. The proportion of mothers who mirrored their infants' affect was greater than chance in mothers from the United States, 75%, $p = .02$, but only 62% of Fijian mothers, $p = .33$ and 38% of Kenyan mothers, $p = .45$ (see Table 1). In other words, infants born to a mother in the United States would be more likely to receive affect mirroring contingent responses from the mother than an infant born to a Fijian or Kenyan mother. Next we looked at the magnitude of mirroring behaviors using an ANOVA with four kinds of mirroring behaviors (positive and negative facial and vocal affect) as the dependent variables and society as the between-subjects factor. Of the mothers who mirror their infants' affect, they do so to a comparable degree across societies, $F(8, 40) = 0.72$, $p = .68$. Interestingly, post hoc comparisons indicate a significant difference in the degree to which U.S. and Kenyan mothers mirrored infants' positive vocalizations (LSD, $p = .049$, mean difference = 2.49).

Beliefs About Developmental Milestones

In order to examine whether mothers differ in their psychological and general expectations for the milestones of their infant, we administered a structured interview to 66 mothers. We report data from 64 mothers: Fiji (33), Kenya (15), and United States (16). Two additional Fijian mothers were interviewed but excluded as they appeared not to understand the questions. All interviews were conducted orally in Fiji and Kenya as literacy could not be assumed and administered as a written questionnaire to mothers in the United States. The interview consisted of a series of questions about the onset of milestones of infants and young children. Ten questions were asked and later divided into two categories for analysis: (a) psychological (four items) and (b) directly observable (six items). Mothers were asked to respond with an age of onset (in months) for each question.

We conducted an ANOVA with the predicted age of onset in months for all 10 questions as the dependent variables (10) and society (3) as the independent variable. Maternal age and education were included as covariates in the first analysis and subsequently removed and not reported here, as they were not significant. There was a significant difference across societies in mothers beliefs about developmental milestones, $F(20, 106) = 6.35$, $p = .000$,

partial $\eta^2 = .55$ (large effect). Between-subject effects indicate that this difference exists for all four of the psychological or less directly observable milestones, all four $ps = .000$, partial $\eta^2 = .29-.44$ (medium to large effects). Mothers differed across societies in their expectations for infants' first smile ($p = .000$, partial $\eta^2 = .29$, medium effect), talking ($p = .000$, partial $\eta^2 = .41$, large effect), sitting ($p = .018$, partial $\eta^2 = .12$, small effect), and babbling ($p = .006$, partial $\eta^2 = .16$, small effect). There was no difference in the expected age of onset for eating solid food ($p = .74$) or walking ($p = .19$; see Figure S1).

Discussion

The first relationship between and infant and her caregiver is critical for developing social expectations that are thought to be retained later in life, and the quality of this relationship is thought to remain stable throughout the life course. Yet very little is known about the precise mechanism by which this relationship develops. What constitutes appropriate and timely responses to an infant is unclear and is bound to the social and ecological context of the infant. Our goal was to examine the sociocultural differences described in detail by ethnographers in the 1st year of the social life of the infant across diverse cultural settings to begin to understand this important mechanism. This study is a unique contribution to the literature on maternal responsiveness as it is the first close examination of the mother–infant relationship in a small-scale, traditional society. Our findings suggest that a specific level of contingent responding in the 1st year of life may be essential and common across infant experiences. Yet our data also show that mothers are responding selectively to different kinds of infant bids—with mothers playing an implicit role in shaping their infants' emotional life as they adjust to their particular sociocultural milieu.

Based on previous research in rural societies, we expected mothers to respond to infants' bids to a similar degree across the societies compared here (see Broesch & Bryant, 2015, for similarities). We also expected mothers to differ across societies in their selective response to infant affective displays. Mothers in Fiji, Kenya, and the United States respond contingently to infant bids to a similar degree. In addition, there are no differences in the frequency of behaviors produced by infants, allowing mothers a comparable number of opportunities

to respond to infants. Also consistent with the existing literature, mothers across societies respond contingently with vocalizations more than facial or tactile responses (Kärtner et al., 2010). In addition, Malatesta and Haviland (1982) report that mothers differ in how they respond to infant affective displays based on the age and gender of the infant. According to this research, the socialization of affect expression is occurring very early in infancy and is shaped by a suite of factors. Our findings indicate that when an infant produces a positive or negative facial or vocal expression, the response that he or she receives will depend, in part, on which cultural group she is being socialized into. By examining maternal responses to infant bids, we show that when an infant produces a negative facial expression (e.g., a frown), she is more likely to receive a response from a Fijian mother compared to a mother living in urban United States. Overall, mothers who mirror their infants' affective displays are doing so at similar rates. However, more mothers in the United States are mirroring their infant's affect compared to Fijian and Kenyan mothers.

To summarize, we find similarities in the absolute overall contingency rates of mothers across all three societies. However, mothers in Fiji and Kenya appear to differ from mothers in the United States in their selective responses to infant emotional displays. Although this is consistent with other cross-cultural reports of maternal responsiveness across cultures, it is the first evidence from a traditional small-scale society. Generally speaking, given that we find similarities among maternal behaviors in mothers in rural societies such as Fiji, Kenya, Nso in Cameroon, and Gusii in Kenya in contrast to WEIRD mothers typically studied with this approach, Western societies may be responding to their infants in a unique manner compared to the majority of the world's population (rural, non-Western societies). This has significant implications for our understanding of the mother–infant relationship and early social interactions as well as the socialization of emotion in infancy.

By examining mothers' beliefs about developmental milestones, we found consistencies across societies with regard to observable (physical and motor) milestones but significant differences across societies with respect to less directly observable (psychological) milestones. While this assessment was exploratory and is limited in interpretation, it implies that mothers regard the psychological development of the infant differently across socio-cultural contexts, with mothers in the United States expecting infants to have a psychological life much

earlier than Fijian and Kenyan mothers. Further studies should help us identify precisely how maternal model of infant development affects both mothers' and infants' behaviors in the course of the 1st months.

The goal of this study was to examine features of the mother–infant dyadic relationship that may be common and variable across societies. This goal had several limitations. First, the microanalytic method for investigating mothers and infants in a structured observation can be questioned with regard to its generalizability. We think that the uniqueness of the situation is most pronounced in WEIRD societies where mothers are hypercognizant of the scientific process and are therefore more sensitive to this measure. Second, the age range of the infants was wider than in previous similar studies. Although the age of infants was not significantly different across the societies, prior research focuses on narrow developmental windows for such analyses therefore the comparability of these findings may be questioned. However, the results were consistent across societies, suggesting that there may be more stability to the maternal response independent of milestones in the 1st year of life.

Overall this study contributes to a developing body of literature showing that across societies, there are invariant features of the caregiver–infant relationship in terms of the timing but not the form of maternal responsiveness. These features could be constitutive of early parent–infant attachment bonds. Our findings also complement other empirical studies in rural societies showing maternal selectively to different kinds of infant bids in the 1st year of life.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's website:

Figure S1. Maternal Reports of Expected Age of Onset (in Months) for Developmental Milestones by Society

Table S1. Mean Frequency of Behaviors Produced by Mother and Infant by Society