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The evolved developmental niche and child sociomoral outcomes in Chinese 3-year-olds

Darcia Narvaez[1], Lijuan Wang[1], Tracy Gleason[2], Ying Cheng[1], Jennifer Lefever[1], and Lifang Deng[3]

[1]Department of Psychology, University of Notre Dame, Notre Dame, IN, USA
[2]Department of Psychology, Wellesley College, Wellesley, MA, USA
[3]Institute of Psychology, Beihang University, Beijing, China

Responsive parenting is known to lead to multiple positive child outcomes, including sociomoral development. We examined the extent to which additional caregiving practices are also critical for positive sociomoral outcomes in early childhood. We looked specifically at what we call the evolved developmental niche (EDN), as described for young children by anthropologists, which includes frequent touch, breastfeeding, caregiver responsiveness, multiple adult caregivers, play, and natural childbirth. We collected behaviour and attitude data on these practices from 383 mothers of 3-year-olds in China using a self-report maternal survey. Mothers also completed standardized measures of their child's behaviour regulation, empathy, and conscience. We found significant effects for most caregiving practices and attitudes on child outcomes after controlling for maternal income and education, and most effects remained significant after controlling for responsivity. These findings suggest that practices representative of the evolved developmental niche may be important, above and beyond responsivity alone, for fostering sociomoral development.

Keywords: Moral development; Parenting; Evolution; Self-regulation; Empathy; Conscience.

Although parenting practices vary widely among cultures, the extent to which a child becomes a well-adjusted member of society depends significantly on socialization within a culture (Harkness & Super, 2006). However, some

Correspondence should be addressed to Darcia Narvaez, Department of Psychology, University of Notre Dame, 118 Haggar Hall, Notre Dame, IN 46556, USA. Email: dnarvaez@nd.edu

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caregiving practices, such as those rooted in our evolutionary heritage, might be beneficial to all children. One practice, maternal responsivity, has perhaps the clearest ties to sociomoral outcomes like secure attachment (e.g., Kochanska, 2002), empathy (Zahn-Waxler & Radke-Yarrow, 1990), self-regulation (Weinfield, Sroufe, Egeland, & Carlson, 2008), and development of conscience (Kochanska, 1994). We were curious whether other caregiving practices, such as breastfeeding and co-sleeping, might be equally critical for fostering positive sociomoral outcomes.

Every mammal provides a developmental niche for its offspring that is designed to interact optimally with the maturational schedule of the offspring (Gottlieb, 1991; MacKinnon, 2011). Developmental systems theory describes development as the construction of traits based on the quality of the developmental niche interacting with the shifting state of the organism (Oyama, Griffiths, & Gray, 2001). Anthropologists have described a set of caregiving practices that characterize cooperatively breeding catarrhine mammals, who emerged over 30 million years ago, as well as small-band, hunter-gatherer communities—the social structure in which the human genus spent over 99% of its existence (Hrdy, 2009; Konner, 2010). Concerned about the decline in child wellbeing documented in the USA and possible sources, Narvaez and colleagues (Narvaez et al., 2011) examined the effect of caregiving practices that form part of the human evolved developmental niche (EDN) on child outcomes in a US sample and found significant relations, even after controlling for household income and maternal education. We followed up on this work by examining the correlates of these caregiving variables on a sample in China, reasoning that positive relations between the EDN and child outcomes in a Chinese sample would bolster support for the importance of these caregiving practices for moral development across cultures. After all, in marked contrast to the USA, traditional Chinese culture is collectivistic, emphasizing cooperation and interdependence (Triandis, McCusker, & Hui, 1990). We investigated both maternal attitudes and behaviours because they are often linked (Harkness & Super, 2006).

We examined children's behaviour regulation, empathy, and conscience. These outcomes were chosen because: (i) they are considered important components of sociomoral development (Kochanska, 2002); (ii) research in the USA has demonstrated variation in these outcomes as a function of early experience (see Narvaez, Panksepp, Schore, & Gleason, 2013, for reviews); and (iii) these outcomes were related to the EDN in previous work (Narvaez et al., 2011).

The evolved developmental niche

Although we cannot know precisely what caregiving practices occurred over the course of human evolution, nor should we assume that practices were invariant, studies of extant foraging communities and other cooperatively breeding species emphasize practices such as high levels of responsivity to infant signals,

extensive breastfeeding, nearly constant touch, multiple adult caregivers (i.e., alloparenting), family cohesion, co-sleeping, playful interactions, and natural childbirth (Hewlett & Lamb, 2005). Ostensibly, if these caregiving practices were a significant part of human evolutionary history, then their presence might be associated with development of healthy neuropsychobiological mechanisms that promote prosocial outcomes (Narvaez, 2008; Narvaez & Gleason, 2013). We review some of the literature supporting this claim.

Maternal responsivity. Among early hominims, young children's needs were met quickly and without resistance (Hewlett & Lamb, 2005). Responsive caregivers and their particularly helpless infants (Trevathan, 2011), in mutual co-regulation, shape the infant brain for self-regulation, establishing emotional patterns that promote confidence and mental health, including adept stress regulation and good vagal tone (Fleming, O'Day, & Kraemer, 1999; Porges, 2011; Uvnas-Moberg, 1997; Weaver, Szyf, & Meaney, 2002). Theoretically, this physiological and psychological support might explain the connections between responsive parenting and heightened moral functioning, such as greater empathy (Siegel, 1999) and concern for others (Eisenberg, 2000). Responsivity predicts early conscience development (e.g., Kochanska, 1994, 2002). Furthermore, parental *attitudes* toward responsivity also relate to children's developmental outcomes. More recently, Narvaez et al. (2011) found from an American sample that responsivity attitudes were significantly positively correlated with child empathy, inhibitory control, and self-regulation at age three, even after controlling for maternal education and income.

Chinese studies also support the connection between responsive caregiving and positive sociomoral outcomes. For example, sensitivity in Chinese mothers was positively related to children's sociability, empathy, and attachment (Liu et al., 2010), and Chinese preschoolers' social cognition was predicted by maternal warmth (Li & Sang, 2006).

Breastfeeding. Beyond considerable health benefits, breast milk is beneficial for psychological development including higher IQ (e.g., Caspi et al., 2007; Mortensen, Michaelsen, Sanders, & Reinisch, 2002; although see Kramer et al., 2001), visual and cognitive development (Hart et al., 2006; Lauritzen, Hansen, Jørgensen, & Michaelsen, 2001; Michaelsen, Lauritzen, Jørgensen, & Mortensen, 2003). Lengths of breastfeeding among foraging groups range from two to five years (four years on average; Hrdy, 2009; Konner, 2005). In an American sample, Narvaez et al. (2011) found that breastfeeding length predicted child empathy at age three, controlling for maternal demographics.

In China, over 80% of mothers in most provinces initiate breastfeeding and continue to breastfeed at four months, but exclusive breastfeeding rates are lower (Xu, Qiu, Binns, & Liu, 2009). Although breastfeeding influences regulation of the sleep–wake cycle, positive emotional tone, and brain functions such as

reducing depression (Goldman, Goldbum, Garza, Nichols, & O'Brien Smith, 1983), research in China has provided equivocal results on the effects of breastfeeding on child outcomes. In comparing the effects over three years of breast milk versus cow's milk given to high-risk Chinese premature infants for 6 to 18 months, breastfed children had significantly better development in physical activities, language, and social behaviour (Zan et al., 1996). On the other hand, breastfeeding length was negatively related to psychomotor development and sociability in Chinese 1-year-olds (Huang, Li, Yi, & Zhu, 1997).

Physical closeness and touch. Multiple systems are regulated by the presence of a mammalian mother and quickly become dysregulated when she is physically absent (Hofer, 1994). Early experiences with physical touch also influence brain structures and wiring, fostering secure attachments, which promote social and cognitive functioning in early childhood and in adulthood as well (see Cushing & Kramer, 2005, for a review). Maternal harsh touch was found to be associated with children's emotional/behavioural problems at age two (Weiss, Wilson, Seed, & Paul, 2001). Those who received a greater amount of nurturing touch had fewer internalizing problems whereas those who received more harsh touch had more internalizing problems. Narvaez et al. (2011) found maternal positive touch behaviour in infancy was positively correlated with child empathy at age three, and touch behaviour at age three years was positively correlated with child empathy, inhibitory control and self-regulation, all after controlling for maternal demographics. Touch attitudes were correlated with child inhibitory control. As in the USA, Chinese newborns exposed to 15 to 20 minutes of professional massage twice daily cried less and slept longer than unmassaged newborns (Zhao, 2011). The effects of such programmes are associated with physical and psychological gains even at age three years (Zhang, 2004).

Alloparenting. Human foragers lived in small, socially intensive and intimate, extended-family groups in which mothers received caregiving assistance from many other adults (e.g., father, grandparents), providing a social safety net for mother and child, increasing a child's survival and decreasing maternal stress (see Hrdy, 2009, for a review). In modern-day China, research has shown mixed effects of presence of extended family on child outcomes. For example, in a study of 1-year-olds, larger family structure was associated with higher scores on a psychomotor index and higher sociability and cooperation than smaller family structure or care by a nanny (Huang et al., 1997). In contrast, multi-family structures (i.e., children living with parents, grandparents, uncles/aunts, and cousins) were related to lower levels of sociability and empathy development in comparison to living with parents alone or with parents and grandparents (Liu et al., 2010). These and other studies (van IJzendoorn, Sagi, & Lambermon, 1992) suggest a possible curvilinear relationship (an inverted "u") between

number of caregivers and child outcomes, also suggesting that it matters how relationally close the caregivers are.

Family cohesion. Modern family routines and time spent together—our operationalization of family cohesion—are important for wellbeing (Steinglass, Bennett, Wolin, & Reiss, 1987). Family rituals lower anxiety (Spagnola & Fiese, 2007), foster a sense of belonging (Turner, 1967), relate negatively to children's internalizing (Brody & Flor, 1997), and correlate positively with child competence outside the family (Bronfenbrenner & Evans, 2000). In an American sample, Narvaez et al. (2011) showed that family cohesion predicted self-regulation and inhibitory control when controlling for the demographic covariates.

Co-sleeping. McKenna et al. (1994) have documented hidden regulators during human mother–child co-sleeping, including facilitation of regular feeding/suckling (Ball & Klingaman, 2007). Narvaez et al. (2011) did not find effects of co-sleeping on child outcomes, but since Chinese rates of co-sleeping are higher than in the USA (Jiang et al., 2007), we expected positive correlations with our child outcomes measures.

Play. Play promotes brain and emotion regulation development, and lack of it alters social, sexual, and conflict interactions with peers (Panksepp, 2007; van den Berg et al., 1999). In an American sample, Narvaez et al. (2011) showed that playing with mothers is correlated with children's empathy and inhibitory control after controlling for demographic covariates. Because of these links between play and both regulation and social skills, we anticipated links between play and all three of our outcome variables.

Childbirth. Unlike the other practices of the EDN, we predicted that childbirth experience would have effects on other caregiving behaviours rather than directly on child sociomoral outcomes. Specifically, we expected that cesarean birth would negatively affect responsivity and touch behaviour because without labour, hormones that influence bonding are reduced, affecting mood and subsequent behaviour and response to infant cries (Brinsmead, Smith, Singh, Lewin, & Owens, 1985; Swain, Tasgin, Mayes, Feldman, & Leckman, 2008). We expected attitudes about childbirth would be related to greater empathy in the child because they indicate greater maternal empathy for the needs of the child.

Hypotheses

Our first hypothesis was that associations would emerge between the EDN and sociomoral outcomes (as they had in the US sample) in unique patterns for each

EDN component. Second, we predicted that the contributions of EDN components that related to each of the sociomoral outcomes (i.e., behavior regulation, empathy, and conscience) would remain, even with responsivity controlled. Although responsivity is likely to play a role in the development of each of the outcomes of interest, we hypothesized small but significant contributions from our EDN components beyond the effects of responsivity alone.

METHOD

Participants

Mothers ($M_{age} = 32.59$ years, *range* = 24–44 years) of 383 children (195 boys) from six preschools in Beijing, China, participated. Children ranged in age from 2.67 to 4.33 ($M_{age} = 3.16$, $SD = 0.22$). Most (99%) mothers were married and living with the target children's biological fathers, and 81% were working. For education, 2.4% had less than a high school degree, 9.9% completed high school, 4.5% had a secondary specialized degree, 22.4% had an associate's degree, 42.9% completed college, and 17.9% had post-college training. Yearly income varied substantially: 38.7% lower income, 33.7 middle income, and 37.6% higher income.[1]

Measures

Measures in this study included those that evaluate use and endorsement of EDN-consistent caregiving practices, as well as measures of child outcomes including behaviour regulation, empathy and conscience. The purpose was to investigate the relationship between the EDN components and these positive child outcomes. Measures of child outcomes were adopted from prior studies.

Measures of EDN-consistent caregiving practices (Narvaez et al., 2011). We used a battery of maternal response measures that evaluate use and endorsement of EDN-consistent caregiving practices. Except for the measure of maternal responsivity, all measures were developed by the authors and validated previously with a US sample(i.e., breastfeeding, physical closeness and touch, alloparenting, family cohesion, co-sleeping, play, and natural childbirth). All negative items were reverse scored and composite scores were obtained by averaging the items of each measure.

1. Specifically, we had the following categories of household income: RMB < 15k, 2.8%; 15k–45k, 13.9%; 45k–80k, 12.0%; 80k–120k, 16.2%; 120k–160k, 17.5%; > 160k, 37.6% (6.4RMB ~ 1USD).

Maternal responsivity. Maternal responsivity was measured using the Parent Attitudes towards Caregiving scale (PAC-R; Easterbrooks & Goldberg, 1990): 10 items, e.g., "I feel a child should be given comfort and understanding when [he/she] is scared or upset"; $\alpha = .84$; on a 6-point Likert-type scale (1 = *Strongly disagree*, 6 = *Strongly agree*). It is a composite of attitudes towards warm and supportive parenting.

Breastfeeding behaviour and attitudes. Two items were used to measure breastfeeding behaviour: (1) breastfeeding choice—whether breastfeeding occurred at all (yes/no); and (2) breastfeeding length—if so, for how long. Attitudes towards breast- and formula-feeding—11 items, e.g., "Nowadays technology makes it possible for formula to be just as good for babies as breast milk" (reverse scored); $\alpha = .69$—were measured with a 5-point Likert scale (1 = *Strongly disagree* to 5 = *Strongly agree*).

Physical closeness and touch behaviour/attitudes. Two touch behaviour measures were used: *Touch in Infancy* (4 items; $\alpha = .25$) and *Touch Now* (4 items; $\alpha = .56$). Each contained two positive touch items ("I touched or held [target child] [as a baby/now]" and "I cuddled/kissed, hugged [target child] [as a baby/now]") and used a 5-point Likert-type scale (5 = *Almost all day*, 1 = *Never*; and 5 = *Many times a day*, 1 = *Never*, respectively). Each also contained two negative touch items ("I slapped, hit or pinched [target child] [as a baby/now] when needed" and "I spanked [target child] [as a baby/now] when needed") and each time point had different response scales (Infancy: 5 = *Many times a week*, 1 = *Never*; Now: 4 = *Many times a day*, 1 = *Never*). Attitudes towards physical closeness and touch (7 items, e.g., "Showing affection to target child"; $\alpha = .56$), used a 3-point response scale (1 = *Not part of how I parent*, 2 = *I don't feel strongly either way*, 3 = *Part of how I parent*).

Alloparenting. As a proxy measure of alloparenting, mothers identified the child's primary caregivers in the first three years of life from a list that included various relatives, child care centre workers, nannies, and "other". Numbers of kin and non-kin primary caregivers were calculated.

Family cohesion. Family cohesion behaviour (5 items, e.g., "Our family has certain 'family time' when we do things together at home"; $\alpha = .65$) was measured with a 4-point response scale (1 = *Less than monthly*, 2 = *1–3 times a month*, 3 = *1–2 times a week*, and 4 = *Almost every day*). Attitudes toward family cohesion were evaluated through ratings of the importance of the same items ($\alpha = .84$) using a 5-point Likert-type scale (1 = *Not at all important* to 5 = *Very important*).

Co-sleeping. Mothers reported co-sleeping with the child (yes/no) and for how long (1 = *Never*, 2 = *A few days*, 3 = *A few months*, 4 = *A year*, 5 = *1–2 years*, 6 = *More than 2 years*, 7 = *Still co-sleeping*). Attitudes towards co-sleeping were measure for babies (8 items, e.g., "Parents and children sleeping together is best for baby's health"; $\alpha = .68$) and for young children (9 items, e.g., "Children need to learn to fall asleep on their own"; $\alpha = .86$) using a 5-point Likert-type scale (1 = *Strongly disagree* to 5 = *Strongly agree*).

Play behaviour and attitudes. As a proxy for play experience, mothers reported how much time children spend doing 10 playful activities (e.g., sing together, pretend play, read together) *with mother* ($\alpha = .82$) or *with other adults* ($\alpha = .93$) using a 4-point Likert-type response scale (1 = *Less than monthly*, 2 = *1–3 times a month*, 3 = *1–2 times a week*, and 4 = *Almost every day*). Play *attitudes* were assessed with importance ratings of the same activities *with mom* ($\alpha = .93$) and *with others adults* ($\alpha = .96$) using a 5-point Likert-type scale (1 = *Not at all important*, 5 = *Very important*).

Childbirth experience and attitudes. Mothers were asked whether they had a cesarean section (yes/no) and for their attitudes towards natural childbirth (e.g., without drugs; 5 items; $\alpha = .76$) on a 5-point scale (1 = *Not at all important*, 5 = *Very important*).

Child outcomes. Child outcomes were measured via maternal report using standardized measures of children's functioning with 7-point Likert-type response scales (1 = *Extremely untrue of your child*, 7 = *Extremely true of your child*). The child outcomes included measures of behaviour regulation, empathy and conscience.

Behaviour regulation. Behaviour regulation, more specifically, inhibitory control and self-regulation, was measured using two existing scales. The inhibitory control subscale of the Child Behaviour Questionnaire (CBQ; Rothbart, Ahadi, Hershey, & Fisher, 2001, 13 items; $\alpha = .76$) measures the child's ability to control his or her impulses (e.g., "Is good at following instructions"). The self-regulation subscale of Kochanska's (1994) My Child scale (20 items; $\alpha = .73$) specifically focuses on adhering to rules with minimal assistance (e.g., "When unsupervised, is likely to stop himself or herself on his or her own when just about to do something wrong").

Empathy. Maternal perceptions of the child's empathy were measured using the empathy subscale of My Child (Kochanska, 1994, 13 items, e.g., "Will try to comfort or reassure another in distress"; $\alpha = .77$).

Conscience. Conscience was examined using two subscales from My Child (Kochanska, 1994): guilt (18 items, e.g., "May hang his or her head and look down after being naughty"; $\alpha = .77$) and concern after wrongdoing (8 items, e.g., "After having done something naughty, asks to be forgiven"; $\alpha = .81$).

Translation. With the exception of the CBQ, which had already been translated into Chinese, all questions were translated and then checked by two separate native speakers of Chinese, both on the research team.

Procedure

Participants received packets from their children's preschool teachers that included a cover letter explaining the study, a consent form, and the study measures. Those who returned the materials were given two books as gifts.

RESULTS

Effects of the evolved developmental niche (EDN) on child outcomes

Our first goal was to establish whether any of the EDN–consistent caregiving practices were related to any of the child outcomes (see Table 1 for descriptives). A regression model was fitted to predict each child's outcomes by each EDN component, using maternal education and household income as covariates. Alpha was set at .05, and regression coefficient estimates and effect sizes are displayed in Table 2.

Maternal responsivity. As hypothesized, maternal responsivity was significantly positively related to children's inhibitory control, empathy, guilt, and concern. The lack of relation between maternal responsivity and self-regulation was contrary to expectation.

Breastfeeding choice, length, and attitudes. We hypothesized that breastfeeding variables would relate to all three of our predicted child outcomes, with stronger relations to behaviour regulation and empathy than to conscience development. These expectations were partially supported with small effects. Breastfeeding *choice* did not significantly influence any child outcomes, but breastfeeding *length* was positively related to children's inhibitory control, as well as to both conscience variables (guilt and concern; see Table 2). In addition, maternal attitudes towards breastfeeding were positively related to children's empathy and concern.

TABLE 1
Descriptive statistics for caregiving practices and child sociomoral outcomes

Variables	*n*	*Mean*	*SD*	*Minimum*	*Maximum*
EDN variables					
Breastfeeding choice (0/1)	376	0.90	0.30	0	1
Breastfeeding length (months)	324	8.47	5.84	0.5	34
Breastfeeding attitudes (1–5)	376	3.60	0.49	2	4.91
Touch behaviour in infancy (1–5)	383	4.01	0.56	2	5
Touch behaviour now (1–4)	383	2.89	0.46	1	3.75
Touch attitudes (1–3)	380	2.80	0.27	1.43	3
Maternal responsivity attitudes (1–6)	381	5.50	0.50	1	6
Number of kin primary caregivers	383	1.66	1.61	0	10
Number of non-kin primary caregivers	383	0.36	0.59	0	3
Family cohesion behaviour (1–4)	376	3.14	0.58	1.2	4
Family cohesion attitudes (1–5)	375	4.47	0.59	1.2	5
Co-sleeping behaviour (0/1)	376	0.83	0.38	0	1
Co-sleeping length (0–6)	376	4.27	2.14	0	6
Co-sleeping attitudes in infancy (1–5)	375	3.33	0.54	1.75	5
Co-sleeping attitudes in childhood (1–5)	374	2.76	0.44	1.33	4.56
Play with mom (1–4)	375	3.37	0.50	1.50	4
Play with other adults (1–4)	373	3.14	0.76	1.00	4
Play with mom attitudes (1–5)	373	4.29	0.62	2.2	5
Play with other adults attitudes (1–5)	373	4.05	0.78	1.78	5
C-section birth (0/1)	383	0.24	0.42	0	1
Childbirth attitudes (1–5)	199	3.99	0.60	2	5
Child sociomoral outcomes					
Inhibitory control (1–7)	371	4.50	0.68	2.00	6.69
Self-regulation (1–7)	379	3.90	0.55	1.61	5.50
Empathy (1–7)	376	4.75	0.69	1.00	6.67
Guilt (1–7)	381	4.10	0.66	1.83	6.17
Concern (1–7)	372	4.97	0.83	1.75	7.00

Notes: Variable ranges are shown in parentheses next to variable names. The sample size for closeness of non-kin primary caregivers is 120 because many children had no non-kin primary caregivers. The sample size for birth attitudes is 199 because we used a planned missingness design and only half of the mothers completed the measure.

Physical closeness and touch behaviour/attitudes. Although internal reliability of the *Touch in Infancy* questions was low (.25), which may have greatly reduced the observed correlations between its composite scores and child outcomes, *Touch in Infancy* and *Touch Now* were, as predicted, significantly positively related to children's behaviour regulation (inhibitory control and self-regulation), empathy, and concern. *Attitudes* toward touch were related to inhibitory control and empathy.

TABLE 2
Regression coefficient estimates (and effect sizes) for EDN variables by child outcomes

	Behaviour regulation			*Empathy Conscience*	
EDN variables	*Inhibitory control*	*Self-regulation*		*Guilt*	*Concern*
Maternal responsivity	.266*** (.038)	.033 (.001)	.362*** (.082)	.156* (.014)	.423*** (.071)
Breastfeeding choice	.079 (.001)	−.036 (.001)	.157 (.004)	−.046 (.002)	.211 (.007)
Breastfeeding length (months)	.015* (.023)	.005 (.017)	−.008 (.012)	.016* (.017)	.019* (.021)
Breastfeeding attitudes	.053 (.001)	.039 (.002)	.202** (.025)	.023 (.001)	.183* (.014)
Touch behaviour in infancy	.180** (.021)	.126* (.017)	.290*** (.065)	.033 (.609)	.195* (.018)
Touch behaviour now	.326*** (.051)	.150* (.017)	.293*** (.047)	.130 (.009)	.420*** (.061)
Touch attitudes	.484*** (.038)	−.012 (.001)	.352** (.022)	−.035 (.001)	.307 (.011)
Number of kin primary caregivers	.014 (.001)	.015 (.002)	.011 (.000)	.041 (.008)	−.067* (.016)
Number of non-kin primary caregivers	.128* (.012)	.082 (.008)	−.033 (.000)	.085 (.005)	−.086 (.004)
Family cohesion behaviour	.210** (.029)	.177*** (.035)	.076 (.003)	.104 (.006)	.357*** (.065)
Family cohesion attitudes	.256*** (.046)	.060 (.004)	.224*** (.040)	.132* (.011)	.315*** (.052)
Co-sleeping choice	.082 (.001)	.011 (.002)	−.059 (.000)	.138 (.016)	.032 (.002)
Co-sleeping length	−.005 (.000)	−.025 (.011)	.006 (.000)	.011 (.003)	.015 (.003)
Co-sleeping attitudes in infancy	.010 (.000)	−.041 (.003)	.131 (.011)	.031 (.000)	.164 (.011)
Co-sleeping attitudes now	.008 (.000)	−.014 (.003)	.077 (.003)	.114 (.004)	.021 (.000)
Play with mother	.255*** (.033)	.163*** (.021)	.225** (.029)	.072 (.001)	.246** (.022)
Play with other adults	.113* (.016)	.112** (.021)	.116* (.021)	.080 (.006)	.127* (.016)
Play with mother attitudes	.278*** (.060)	.105* (.010)	.252*** (.056)	.145* (.016)	.261*** (.038)
Play with other adults attitudes	.191*** (.048)	.131*** (.033)	.113* (.019)	.101* (.013)	.103 (.011)
Childbirth attitudes	.227** (.064)	.070 (.115)	.316*** (.124)	.227** (.095)	.512*** (.176)

Notes: All analyses were run using maternal education and household income as covariates. Effect sizes were computed using Cohen's (1988) method for variables and covariates. By convention, effect sizes of .02, .15, and .35 are *small*, *medium*, and *large*, respectively. *$p \leq .05$; **$p \leq .01$; ***$p \leq .001$.

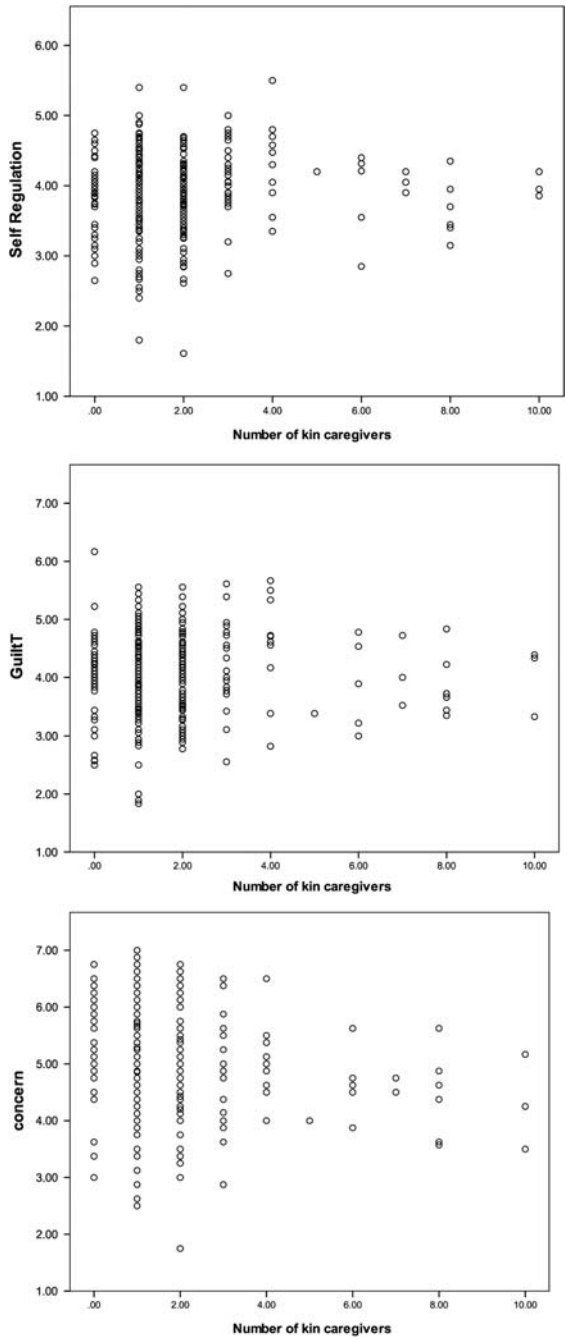

Figure 1. Scatterplots of the relations between the number of primary kin caregivers and child outcomes.

Alloparenting. This sample had a wide range in number of caregivers (see Table 1). Results in Table 2 show that (i) with more kin primary caregivers, on average child conscience (concern) scores linearly decreased; (ii) number of non-kin primary caregivers positively predicted child behaviour regulation (inhibitory control); and (iii) average closeness of kin primary caregivers positively predicted child conscience (concern). No other correlations were significant. However, because the literature suggested that some optimal number of caregivers might exist (i.e., three; van IJzendoorn et al., 1992), we plotted number of kin primary caregivers against child outcomes using scatterplots, anticipating a curvilinear relationship. Figure 1 displays the scatterplots for behaviour regulation, guilt, and concern; these plots suggested quadratic relations. Therefore, we fitted both a multiple linear regression model and a multiple quadratic regression model (both with covariates) to investigate the relation between the number of kin primary caregivers and each child outcome (see Table 3). After controlling for maternal education and household income, the number of kin primary caregivers positively predicted behaviour regulation scores when number of primary kin caregivers was less than 4.31, yet negatively predicted scores when the number was greater than 4.31. For guilt, the cut-off number was 4.57.

Family cohesion. Family cohesion *behaviour* was significantly positively related to children's behaviour regulation (inhibitory control, self-regulation), and conscience (concern). Furthermore, *attitudes* towards family cohesion were significantly positively related to all outcomes, save self-regulation.

Co-sleeping choice, length, and attitudes. No significant relations emerged for co-sleeping choice, length, or attitudes in relation to any child outcomes. We realized, however, that the effects of co-sleeping behaviour might be moderated by attitude, since co-sleeping might be by choice or by necessity. We analysed the effects of co-sleeping behaviour on child outcomes using attitude as a moderator and maternal education and household income as covariates. Effects of co-sleeping behaviour on empathy were significantly more positive for mothers with more positive co-sleeping attitudes *in infancy* and *now* ($B = 0.412$, $SE = 0.187$, $p = .028$; $B = 0.536$, $SE = 0.236$, $p = .024$, respectively) and the effects of co-sleeping behaviour on conscience (concern) were significantly more positive for mothers with more positive co-sleeping attitudes *in infancy* and *now* ($B = 0.460$, $SE = 0.230$, $p = .050$; $B = 0.596$, $SE = 0.298$, $p = .046$, respectively). Contrary to expectation, no relations between co-sleeping and behaviour regulation emerged.

Play behaviour and attitudes. Play *behaviour* reported with mother and with other adults was significantly positively related to all outcomes, except for guilt.

TABLE 3
Quadratic model for the effects of number of kin primary caregivers on child outcomes (and *p*-values) after controlling for maternal education and household income

	Behaviour regulation		*Empathy Conscience*		
EDN variables	*Inhibitory control*	*Self-regulation*	*Empathy*	*Guilt*	*Concern*
Number of kin primary caregivers (linear term)	.052 (.433)	**.112 (.031)**	−.030 (.623)	**.192 (.002)**	−.076 (.327)
Number of kin primary caregivers (quadratic term)	−.005 (.541)	**−.013 (.045)**	.006 (.465)	**−.021 (.008)**	.001 (.892)
Effect size	.002	**.015**	.002	**.030**	.016

Notes: Effect sizes were computed using Cohen's (1988) method for variables and covariates. By convention, effect sizes of .02, .15, and .35 are *small*, *medium*, and *large*, respectively. Values in **bold** indicate significant effects.

Effect sizes were slightly higher for play with mother than play with others. Maternal *attitudes* toward play were significantly positively related to all outcomes for play with mother and for all outcomes except concern for play with other adults.

Childbirth. As expected, cesarean section was negatively correlated with responsivity ($r = -.15$, $p = .003$) and with touch behaviour now ($r = -.10$, $p = .042$). Maternal attitudes towards natural childbirth were significantly positively related to all child outcomes except self-regulation.

Effects of EDN components on child outcomes above and beyond maternal responsivity

As expected, maternal responsivity was significantly related to most child outcomes, except self-regulation, and our second goal was to test whether the effects of our other EDN components would remain even if maternal responsivity was controlled. Consequently, we fitted two nested models to the data: a reduced model where child outcomes were predicted by responsivity and covariates, and a full model where an EDN component was entered to the model in addition to responsivity and covariates. Changes in R^2-values and p-values of the EDN variables in the full models are displayed in Table 4. EDN components explained small but significantly greater proportions of the variance in the child outcomes after controlling for maternal responsivity with a few exceptions, demonstrating that the EDN components are instrumental for promoting positive child outcomes on top of responsivity.

Gender effects. We also examined gender differences. Girls had significant higher average scores in empathy (4.84 vs. 4.66, $p = .011$), self-regulation (3.98 vs. 3.81, $p = .004$), and inhibitory control (4.57 vs. 4.42, $p = .032$) than boys. Gender, however, did not serve as a moderator on the effects of EDN components on child outcomes.

DISCUSSION

The goal of this project was twofold: first, in a Chinese sample, we investigated whether connections between the evolved developmental niche (EDN) and three sociomoral outcomes in 3-year-old children would emerge as they did in our earlier work with a US sample (Narvaez et al., 2011) and whether patterns for each EDN-consistent caregiving practice would be unique. Second, given the centrality of maternal responsivity to children's moral development (Kochanska, 1994, 2002), we examined whether the effects of EDN components would remain significant after controlling for responsivity. The findings presented here indicate

TABLE 4
Variance (and *p*-values) in outcomes explained by EDNs controlling for responsivity

	Behaviour regulation		*Empathy Conscience*		
EDN variables	*Inhibitory control*	*Self-regulation*	*Empathy*	*Guilt*	*Concern*
Breastfeeding length (months)	**2.5%** (.041)	–	–	**3.1%** (.018)	**3.8%** (.024)
Breastfeeding attitudes	–	–	0.9% (.118)	–	0.6% (.415)
Touch behaviour in infancy	**1.3%** (.034)	**1.5%** (.023)	**3.9%** (.000)	–	0.8% (.093)
Touch behaviour now	**2.7%** (.002)	**1.5%** (.021)	**1.4%** (.022)	–	**2.4%** (.003)
Touch attitudes	**1.4%** (.025)	–	0.0% (.512)	–	–
Number of kin caregivers (linear)	–	–	–	–	**1.3%** (.033)
Number of kin caregivers (quadratic)	–	**1.4%** (.029, .042)	–	**3.1%** (.001, .005)	–
Number of non-kin caregivers	**1.1%** (.049)	–	–	–	–
Family cohesion behaviour	**1.8%** (.011)	**3.2%** (.001)	–	–	**3.9%** (.000)
Family cohesion attitudes	**2.6%** (.002)	–	**1.4%** (.020)	0.6% (.127)	**2.4%** (.005)
Play with mom	**2.0%** (.008)	**1.9%** (.009)	**1.3%** (.027)	–	1.0% (.070)
Play with other adults	**1.2%** (.027)	**2.0%** (.004)	**1.3%** (.015)	–	**1.1%** (.040)
Play with mom attitudes	**4.1%** (.000)	1.0% (.058)	**3.9%** (.002)	**0.7%** (.042)	**1.6%** (.011)
Play with other adults attitudes	**3.9%** (.000)	**3.1%** (.001)	**2.3%** (.043)	**0.7%** (.044)	–
Childbirth attitudes	4.7% (.058)	–	**10.2%** (.014)	**7.1%** (.022)	**9.8%** (.000)

Notes: Only significant relations from Tables 2 and 3 are included. Proportions represent ΔR^2 values (change in R^2 between the reduced model with responsivity and covariates—maternal education and household income—and the full model with responsivity, covariates, and an EDN) and numbers in parentheses are the *p*-values of the effects of the EDNs in the full models. Proportions in **bold** have *p*-values less than .05.

a small but significant role for the EDN in children's development of behaviour regulation, empathy, and conscience, and the patterns suggest that EDN components contribute to moral development in different ways. Moreover, these caregiving practices make contributions beyond responsivity alone. Lastly, these findings, in relation to our earlier work (Narvaez et al., 2011), call for direct investigation of cultural similarity and variation in these relations.

The evolved developmental niche and sociomoral outcomes

The connections between the EDN and children's sociomoral outcomes highlight the importance of a range of caregiving behaviours and attitudes for children's behaviour regulation, empathy, and conscience. Although the effect sizes were small, each EDN component except breastfeeding choice related to at least one outcome. Indeed, some EDN components appear to play a more significant role in sociomoral development than others: maternal responsivity, play behaviour, and touch—the latter both currently and in infancy. These may represent a nurturing orientation. Elsewhere we found that maternal attitudes towards breastfeeding, touch, play, and multiple adult caregivers (which we called nurturing parenting attitudes) were related to greater child wellbeing, sociomoral development and less behaviour problems at age three (Narvaez, Cheng, Brooks, Wang, & Gleason, 2012). In contrast to the multiple roles played by maternal responsivity, play behaviour, and touch, single relations emerged between number of non-kin caregivers and inhibitory control, and between number of kin caregivers and concern. These findings suggest that relative to one another, responsivity, touch and play may be more critical to sociomoral development (broadly construed) at age three years than alloparenting (as number of caregivers), but that alloparenting has a role to play nonetheless. Of course, alloparenting involves more than numbers and should be examined in terms of intimacy and quality. An empirical question raised by the findings is whether some EDN components might influence sociomoral outcomes indirectly rather than directly. The effects of alloparenting might be primarily through support provided to parents rather than directly to sociomoral outcomes. On the other hand, the curvilinear relationships found between kin alloparenting and self-regulation and guilt emphasize the complexity of these connections: these outcomes improve until about four adults are involved in caring for the child, but with more caregivers outcomes begin to decline. However, the number may be confounded with degree of intimate relationship. The significant factor may be relational closeness rather than number of caregivers, a speculation that needs to be tested.

The variation in relationships between caregiving variables and outcomes suggests that each EDN component makes a different contribution to sociomoral development, even if the effect sizes are small. For example, empathy was associated with play and positive attitudes toward family cohesion, but not to breastfeeding length. Breastfeeding did, however, play a significant role in

aspects of sociomoral development involving self-control—inhibitory control and conscience—perhaps as a function of breast milk's documented effects on physiological development (Goldman, 1993).

EDN-consistent practices contribute beyond responsivity

Despite the central role of responsivity to healthy emotional and psychological development (Kochanska, 2002; Weinfield et al., 2008), many of the effects of EDN components on sociomoral outcomes remained once responsivity was controlled. One way to conceptualize these unique contributions to sociomoral development is as analogous to the role of vitamins in physical development. Each EDN component might contribute to children's development in ways that seem incremental on their own, but which taken together add up to a significant influence on behaviour regulation, empathy, and conscience. For instance, half or more of the EDN components studied were associated with children's development of inhibitory control, empathy, and concern. Absence of any of these EDN components might well constitute a risk for sociomoral development, especially proactive prosocial development (Narvaez & Gleason, 2013).

Children's enormous capacity for resilience suggests that little change might be observed if only a few EDN components are missing, but a caregiving environment that does not include any of these practices would likely be associated with detrimental outcomes (Narvaez et al., 2013). This idea remains to be tested, but modern childrearing environments are significantly different from those in which human brains and physiological systems evolved (Konner, 2010). No doubt some changes are improvements, but the work presented here suggests that EDN components are a significant part of the environment of early childhood that promotes the development of a healthy, sociomoral individual. The effects of EDN-consistent practices may be cumulative, meaning that the whole of the resultant environment is greater than the sum of its parts. The effects may accumulate over time or even emerge later. Elsewhere, using an existing dataset, we demonstrated that longitudinal effects of touch and breastfeeding were established early (by 18 or 24 months) and maintained through the last tested time points of 30 and 36 months, even after controlling for maternal responsivity; for example, breastfeeding initiation (attempting to breastfeed at all) predicted less externalizing behaviours at 24 months and greater social competence beginning at 24 months; positive touch at four months predicted behaviour regulation and social competence at 18 months and cognitive development at 36 months (Narvaez et al., & Centers for the Prevention of Child Neglect, 2012).

Limitations and future research

The data were limited by being based on maternal self-report of caregiving and of child outcomes. Some constructs were tested with only a few questions and in

some cases (touch) reliability was low, perhaps because of a homogeneous sample or the need for a finer-grained response scale. This was a correlational study and cannot address questions of causation and whether other factors were at play. Future work should use observational measures as well as assess the mechanisms by which EDN-consistent caregiving behaviours and attitudes influence specific sociomoral outcomes. Also, direct comparisons of data from different cultures would enhance our understanding of the universality of EDN-consistent care effect on children's sociomoral development. Additional studies should examine how EDN-consistent experiences at different time points during development influence prosociality (e.g., play in middle childhood).

CONCLUSION

This research is the first to examine a set of caregiving practices representative of the human evolved developmental niche on child social and moral outcomes in a Chinese sample. The results associate caregiving practices and moral development beyond the effects of responsive caregiving. For most caregiving behaviours, research has not identified exactly when compromises to the early caregiving environment cause problems, but our work is suggestive for what helps children develop the capacities for social life. Although our initial examination of these practices did not test how the timing, intensity, length, and context for these practices affect child outcomes, other work has demonstrated that these caregiving practices influence neurobiological development in mammals, affecting health outcomes (see Narvaez et al., 2013; Clancy, Hinde, & Rutherford, 2013, for reviews). In a similar fashion when certain evolved caregiving practices are absent during sensitive periods, sociomoral outcomes may be compromised, leading to less self-control and more self-focus in social encounters (Narvaez, 2008).

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