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The Value of Using an Evolutionary Framework for Gauging Children's Well-Being

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Earlier conceptions of the essential nature of developmental experiences found axiomatic that "early childhood is destiny." This view was deeply embedded in two paradigms—psychoanalysis under the Freudian view, which emphasized parenting influences, and behaviorism, which emphasized early conditioning and reinforcement history (although both psychoanalytic psychotherapists and behaviorists assumed that patterns could be unlearned with some effort). When developmental psychology changed in paradigm to an ecological system perspective that acknowledges multiple levels of influence (Bronfenbrenner, 1979), emphasis shifted to a focus on human resiliency in the face of risk factors (Lester, Masten, & McEwen, 2007). Neuroscience has bolstered the resilient view of development with evidence that the brain remains plastic throughout the life span (e.g., Doidge, 2007; Merzenich et al., 1996). Early childhood is thus viewed within the prism of lifelong interactions among ecosystems and individual neuro-affective propensities, highlighting developmental person-by-context interactions and abundant individual variability in emotional resilience (Suomi, 2006; Worthman, Plotsky, Schechter, & Cummings, 2010).

In the enthusiasm to embrace ideas of life span resiliency, psychology has often soft-pedaled the lasting neurobiological influences of early childhood experience. When researchers have documented the remarkable resiliency of children (e.g., Lester et al., 2007), they often point to better outcomes than might be predicted from certain preclinical studies of early developmental trajectories (Kagan, 1997). In a way, resiliency literature focuses on “good enough” development. As long as children do not end up, for example, as dropouts or inmates, their development is termed a success. Many psychologists and parents seem satisfied with resiliency as a goal for child development. But trends for such outcomes are not always positive. A decade ago, one in four teenagers in the United States was at risk for a poor life outcome (Eccles & Grootman, 2002), and in recent analyses such trends have not improved (Heckman, 2008). The national prevalence of *young* children (under 5 years) with psychosocial problems has been on the increase to between 10% and 21% (Powell, Fixen, & Dunlop, 2003). The rates of *young* children whose behavior displays aggression, delinquency, or hyperactivity are on the increase, at times estimated to be as high as 25% (Raver & Knitze, 2002). The American Academy of Childhood and Adolescent Psychiatry is now describing a “crisis” in children’s mental health: 1 in every 5 children has a diagnosable psychiatric disorder, and 1 in every 10 suffers from a mental illness severe enough to impair everyday living (American Academy of Child and Adolescent Psychiatry, 2011). These epidemiological data, as well as recent psychiatric and neurobiological research, seriously challenge the concept of universal resilience, suggesting it may be misleading, simplistic, and incorrect (e.g., Hardwired to Connect, 2003; Lanius, Vermetten, & Pain, 2010; Schore, 2003; Szajnberg, Goldenberg, & Hatari, 2010).

Another reason to be concerned about the current developmental psychological conception of resilience comes from recent research, which is tempering views that the faults of early childhood can be easily outgrown. Indeed, many cannot be, or if they can, the process requires serious and considerable intervention (Perry, Pollard, Blakely, Baker, & Vigilante, 1995; Schore, 1994, 2001a). The evidence across animal, human psychological, neurobiological, and anthropological research is increasing and converging to demonstrate lifetime vulnerability of brain and body systems among those with poor early care. Even when medicines are available to alleviate symptoms of dysfunction, the underlying suboptimal structures remain. This problem may be particularly true for emotional and moral functioning (Narvaez, 2008).

A host of public, personal, and social health problems that may have their roots in early experience have been skyrocketing in the United States and increasingly around the world (e.g., psychological problems such as attention deficit/hyperactivity disorder, autism, anxiety, and depression, not to mention psychosomatic conditions such as diabetes, hypertension, and a variety of autoimmune disorders; see, e.g., Felitti & Anda, 2005; Sanchez, Ladd, & Plotsky, 2001; U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, 1999; World Health Organization and World Organization of Family Doctors, 2008). Although considerable progress is now being made, science does not have a complete understanding or consistent reliable remedies, nor preventive strategies, for addressing these rising problems.

The emergence and spread of the affective and social neurosciences (Cacioppo & Bernsten, 1992; Panksepp, 1998, 2005) make this an auspicious time to reconsider the early life needs of human mammalian systems in light of fostering optimal development (Worthman et al., 2010). This research has provided a greater focus on intrinsic aspects of social functioning—especially primary emotional neuro-affective processes that may need to be enhanced. These disciplines have helped identify the types of brain functions that are typically found in mammalian brains, but they have not scientifically specified how these functions are *normally* (under conditions of optimal development) expressed in humans (but see Schore, 2001b). Nor do we know how they develop and become modified by cultural practices. Without a clear vision of how the emotional foundations of human brains develop and function, psychological science will not be well grounded in scientifically established evolutionary principles (Meaney, this volume; Panksepp, 2010).

The Emotional Foundations of Brain Development, Thought, and Behavior

Affective neuroscience research has specified some of the subcortical anatomies and neurochemistries of basic emotional systems that constitute ancestral memories for a few of the most important feelings that guide human and animal existence (see Panksepp, 1998, for a review). Basic emotion systems constitute genetically ingrained psychobehavioral potentials that help an animal behave adaptively. These potentials are shaped by experience, influencing the functioning of both subcortical and neocortical structures that regulate communication quality (e.g., prosody) and guide adaptive responses to life events (Zinken, Knoll, & Panksepp, 2008). The healthy integration of the lower primary-process emotional-affective powers of the mind and the emergent secondary (learning) and tertiary (thoughtful) cognitive landscapes are left to environmental influences, especially to families and the surrounding cultural milieus (see Worthman et al., 2010).

Developmental science has highlighted sensitive periods in mammalian emotional, social, and cognitive functioning (e.g., Nelson & Panksepp, 1998; Schore, 1994). Only a few of these developmental programs are well mapped in animal models (e.g., vision and other sensory systems, as well as social bonding in several species); fewer still are mapped in the human species (e.g., language), and most cannot be, except for a few psychophysiological correlates of neural activities (e.g., functional magnetic resonance imaging). For ethical reasons, in the domain of emotions, we must resort to animal models to obtain generalizable primary- and secondary-process neurobiological principles relevant to the human condition (LeDoux, 1996;

Panksepp, 1998, 2005, 2010). Fortunately, a great deal of evidence now indicates impressive homologies in subcortically concentrated, genetically provided emotional and motivational systems (i.e., key brain areas and chemistries) among all mammals that have been studied; these have substantial cross-species consistencies with abundant predictive robustness in psychiatrically oriented preclinical research (Panksepp & Harro, 2004).[1,2]

The Environment of Evolutionary Adaptedness and Mammalian Needs

Mammals require abundant nurturing care for optimal postnatal development (Weaver, Szyf, & Meaney, 2002). Catarrhine mammals in particular require profound social care (Konner, 2010).

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[1] Other animals, such as birds, have developed in similar directions (Orosz & Bradshaw, 2007).

[2] Still, the claim of homologies between humans and other animals needs to be made with certain qualifications. Diversity is the hallmark of evolution as different species adapted to different ecological niches (for a review see, West-Eberhard, 2003), so no details of basic emotional and motivational systems are identical across any species (Panksepp, 1998). Moreover, abundant rapidly responding epigenetic effects as well as regulation of protein synthesis by microRNAs distinguish individuals with identical structural genes (e.g., Szyf, McGowan & Meaney, 2008). However, differences in details rarely reflect differences in underlying principles. For instance, oxytocin is now recognized as a brain chemical that helps regulate social bonding in many mammals (Carter, 1998, 2003; Insel, Gingrich, & Young, 2002**<AQ: Changed Inset et al. to Insel, Gingrich, & Young to match references—as meant? THIS IS FINE**>; Nelson & Panksepp, 1998) with some unique implications and predictions for humans (Panksepp, 2009). At the same time, brain opioids and the ancestral nonapeptide arginine-vasotocin, with a single amino acid difference from oxytocin, carries out homologous functions in birds, such as robust inhibition of separation distress (Panksepp, 1998).

John Bowlby (1951; following Hartman, 1939), psychiatrist-turned-ethologist who created attachment theory, conceptualized the deep human need for profuse sociality as a consequence of our ancestral "environment of evolutionary adaptedness" (EEA; Bowlby, 1951), the sum of environmental characteristics under which human brains and bodies evolved. We can assume these needs took a specific form when the human genus emerged from ancestral great apes to develop cultural practices that appear to have remained largely stable for 99% of human genus history (e.g., Fry, 2006, 2009). Most of these practices evolved with catarrhine mammals more than 30 million years ago (Konner, 2010). In modern societies, the ancient practices that presumably sustained an implicit understanding of the needs of "the mammalian" brain-mind have been supplanted by "advanced" cultural practices that may be losing touch with our ancestral needs. Thus, we are integrating several literatures—including mammalian animal models and anthropological visions of our evolutionary heritage and evolved, expected care in early life.

Our evolutionary heritage has most often been described in relation to early life experience even though it was experienced over the course of a lifetime. Thus far, scientists have focused primarily on evolved, expected care during infancy and early childhood largely because of confidence that these early phases are more tightly linked to primary-process, primordial biological adaptations rather than to tertiary-process cultural elaborations (but see Levine et al., 1994, for a review emphasizing enculturation in parenting; and see Lumsden & Wilson, 1981, for the influence of culture on fitness-enhancing genetic adaptations). Substantive evidence, albeit indirect, comes from extant studies of foraging communities around the world, as anthropologists summarize the best current evidence of evolved, expected care for optimal development of infants and young children (e.g., Hewlett & Lamb, 2005). According to the review of findings:

> [Y]oung children in foraging cultures are nursed frequently; held, touched, or kept near others almost constantly; frequently cared for by individuals other than their mothers (fathers and grandmothers, in particular) though seldom by older siblings; experience prompt responses to their fusses and cries; and enjoy multiage play groups in early childhood. (Hewlett & Lamb, 2005, p. 15)

These characteristics generally match the early experiences of highly social mammals, especially apes.

In this chapter, we use an evolutionary framework that includes our evolutionary heritage, sometimes referred to as the "environment of evolutionary adaptedness" (EEA), along dimensions relevant today, to examine early-life-experience effects. We discuss several of these early childrearing characteristics in light of related scientific studies and current practices as known. For most practices, research has not identified exactly when and to what extent compromises of evolved, expected care causes problems. Moreover, these compromises may differ as a function of timing, intensity, length, and context (to name a few variables; also see Davis & Sandman, 2010; Lupien, McEwen, Gunnar, & Heim, 2009). Nevertheless, research reviewed in this volume points to problematic or less than optimal outcomes when these general principles are violated.

Natural Childbirth

Current birthing and childrearing practices no longer come close to the traditional practices of evolved, expected care (see Trevathan, 2011; this volume). Specifically, in the course of childbirth, mammalian parents typically follow the natural rhythms of the mother and child that obviously never involved the many current medical interventions that are common. In contrast, current human societal practices induce physical pain in infants through a variety of perinatal practices, some of which began in an era when when infants were presumed to feel no pain. Since World War II, most children in the United States have been born in hospitals (Devitt, 1977), where birth has been medicalized and obstetric practices are the most intrusive in the world, sometimes increasing risks to infants and mothers that lead to high rates of mortality for both groups (Wagner, 2006). Cesarean birth, although sometimes vital for the survival of both mother and baby, now accounts for over 31% of births in the United States (Hamilton, Martin, & Ventura, 2009). Cesarean birth interferes with physiological responsiveness in the mother to the newborn (Swain, Tasgin, Mayes, Feldman, & Leckman, 2008), circumventing the ecstatic wash of hormones that typically accompanies natural vaginal birth (Klaus & Kennel, 1976). Hopefully now mostly in the past, hospitals employed harsh birthing practices (e.g., spanking, separation of mother and child) and imposed such things as bright lights, noxious odors, and painful procedures on neonates, all of which can have detrimental effects on development (see Liu et al., 2007, for a review). Still other current practices also affect later development: Gestational ultrasounds can influence neuronal migration (Ang, Gluncic, Duque, Schafer, & Rakic, 2006), and circumcision obviously causes considerable pain and can impair biological functions (Anders & Chalemian, 1974; Emde, Harmon, Metcal, Koenig, & Wagonfeld, 1971) and social responsivity and attachments (Marshall et al., 1982). And stress, such as that induced by medical birth practices, may foster brain changes that can become permanent if their duration is intense, long, or unmitigated (Lanius et al., 2010). Consequently, common practices around birth in the United States may be disrupting mother–infant entrainment and affecting optimal emotional and social development. What is more, birth experiences can influence mother–child bonding and subsequent breastfeeding success (Klaus & Kennel, 1976; Trevarthen, 1987, this volume). Babies who experience skin-to-skin contact immediately after birth are more self-regulated and have a more attuned relationship with their mothers than those who were swaddled or separated; however, the negative influence of swaddling appears to be mitigated by breastfeeding within the first hours after birth (Bystrova et al., 2009).

Breastfeeding: Contents, Length, and Correlates

Mammalian milk is species specific for each of the more than 4,000 mammalian species (American Academy of Pediatrics Section on Breastfeeding, 2005). Human milk is of the thin, rather than thick, variety, which is related to frequent ingestion or at least frequent suckling (on average every 20 minutes for infants as recorded by anthropologists; see Hewlett & Lamb, 2005; Konner & Worthman, 1980). Human mothers, who provided immunity through the placenta, continue to provide immunity after birth, first with colostrum immediately after birth and thereafter with breast milk. Although infants have gastric enzymes for digesting their mother’s colostrum and milk, digestive enzymes for other foods do not develop for several months. Breast milk abounds with infection-fighting agents that foster immune and digestive health in the young child. Specific to the environment in which the mother and infant find themselves, mammalian milk produces antibodies for various infective agents (e.g., Slusser & Powers, 1997). Nutritional practices consistent with evolved, expected care would further facilitate survival and enhance thriving.

The American Academy of Pediatrics recommends that human breast milk be the gold standard against which alternative infant food should be weighed in terms of its impact on human growth and development. Human breast milk, besides providing a balanced spectrum of macro- and micronutrients, also contains various enzymes, growth factors, hormones, and other live, health-protective agents including the five basic immunoglobulins, IgG, IgA, IgM, IgD, and IgE; breast milk fats and cholesterol co-occur with enzymes, such as lipase, that break down fats (for a review, see Goldman, 1993). Most of these elements are not contained in infant formula. For example, breast milk contains the protein adiponectin that affects how the body processes sugars and fatty substances in the blood; higher levels of adiponectin are related to lower levels of disease and obesity (Martin et al., 2006). Only recently have infant formulas started to supplement tryptophan, the precursor of serotonin, which is linked to the sleep–wake cycle and emotional tone; both are involved in many brain functions including reducing depression (Goldman, 1993; Delgado, 2006). Maternal milk is a rich source of unsaturated fatty acids, bioactive nutrients that are essential to early brain development (Yehuda, Rabinovitz, & Mostofsky, 1999). Not all formulas include DHA (docosahexaenoic acid, an essential omega-3 fatty acid) in presumably optimal proportions, which is important for visual and cognitive development (Hart et al., 2006; Lauritzen, Hansen, Jørgensen, & Michaelsen, 2001; Michaelsen, Lauritzen, Jørgensen, & Mortensen, 2003). Breast milk supports the growth of Lactobacillaceae, found 10 times higher in breastfed infants, which inhibits gram-negative bacteria and parasites (Newburg & Walker, 2007). In comparison to formula, breastfeeding decreases risks in the infant for specific diseases from small to large including infections, diarrhea, meningitis, ear infections, diabetes, and cancer and is protective from disease in general (for a review, see AAP, 2005).

Breastfeeding in the environment of evolutionary adaptedness presumably went on for anywhere from 2 to 5 years or longer (average weaning age of 4 years; for a review, see Hrdy, 2009, also for alloparent provisioning practices). These patterns are still evident in aboriginal populations little influenced by outside cultures. Five to 7 years is about the time needed for the immune system to develop adult-level functioning (Parham, 2004). In the United States, only

11.3% of mothers breastfeed exclusively at 6 months (which is recommended), and only 15.7% are breastfeeding at all at 12 months (Scanlon et al., 2007), although subgroups have different rates (McDowell, Wang, & Kennedy-Stephenson, 2008). See Sulaiman, Amir, and Liamputtong (this volume) for a review of the challenges to breastfeeding in the modern world. A shorter duration of breastfeeding (less than 6 months) may be a predictor of adverse mental health outcomes throughout the developmental trajectory of childhood and early adolescence (Oddy et al., 2010). The World Health Organization recommends a minimum of 2 years of breastfeeding (the American Academy of Pediatrics recommends a minimum of 1 year).

Patterns of mother–infant interaction differ between breastfeeding and bottle-feeding. The amount of mother's gaze, tactile stimulation, and mutual touch are significantly elevated in breastfeeding compared to formula feeding (Lavelli & Poli, 1998). In comparison to formula feeding, breastfeeding is linked to improved mental outcomes such as increased IQ—with longer breastfeeding being better (e.g., Mortensen, Michaelsen, Sanders, & Reinisch, 2002; although see Kramer et al., 2001). The IQs of the 90% of children who have a genetic variant in *FADS2* appear to be benefited especially by breastfeeding (Caspi et al., 2007). For a meta-analysis of the positive effects of breastfeeding on brain development, see Michaelsen and colleagues (2003). Studies suggest a greater degree and severity of illness among formula-fed infants regardless of background (e.g., Garza, 1987; AAP, 1997). Note, however, that the positive effects of breastfeeding may well be attenuated in this research. After all, studies comparing formula feeding and breastfeeding often evaluate consequences over short time periods such as 3 or 6 months (for a review see Kramer & Kakuma, 2004). For a more veridical comparison between the experiences of our prehistoric ancestors and modern humans, the comparison group should be children breastfed for at least 2 years if not longer.

Physical Closeness, Affectionate Touch, and Social Bonding

The effects of physical affection on optimal functioning in mammals have garnered attention for some time (e.g., Harlow, 1958). For most mammalian offspring, losing contact with a caregiver is distressing. Even short bouts of separation from the mother causes lifelong changes in stress responsivity for infant rats (Levine, 2005). Although when developmentally appropriate, mild and graded brief separations can help the offspring cope with the stress of longer separations later (Katz et al., 2009) but otherwise can have lasting negative effects. Hofer's (1987, 1994) work with rats has shown that multiple systems are regulated by the presence of the mother and quickly become dysregulated when she is physically absent. Even in species less social than ours, physical separation activates painful emotions (Ladd, Owens, & Nemeroff, 1996; Panksepp, 2003; Sanchez et al., 2001) and influences the dynamics of various emotion-regulating hormones and neuropeptides (Cirulli, Francia, Berry, Aloe, Alleva, & Suomi 2009). Monkeys isolated from adults when young spend their lives with deficits of 5-HIAA, the main metabolite of serotonin, resulting from reduced serotonin production and utilization, which have been linked to impulsive violent and antisocial behavior in mammals (Kalin, 1999; Suomi, 2006). Excessive separation distress during early development sets up the nervous system for depressive disorders later in life, through well-established affective systems of the brain (see Panksepp & Watt, 2011, and Watt & Panksepp, 2009, for overviews).

Physical touch and affection have long-lasting general health effects as well (see Field, this volume). Meaney and colleagues have documented differences in gene expression within the brain–body pituitary–adrenal stress axis, based on the extent of maternal touch soon after birth (Meaney, this volume; Szyf, Weaver, & Meaney, 2007; Weaver et al., 2002). Examining only one of dozens, perhaps even thousands (as observed in unpublished work on primates by Steve

Suomi and the aforementioned investigators), of genes affected, Meaney and colleagues found that rats with high-touch (high-licking) mothers in the first 10 days of life had elevated gene expressions for glucocorticoid receptor proteins. Glucocorticoid hormones produced in all mammals in response to stress need to be well regulated to prevent excessive stress, hippocampal dysfunction, and eventual depression (McEwen, 2007). Rats with diminished maternal touch had weaker stress axis regulation, resulting in more anxiety and lifelong heightened responses to stress across a diverse range of brain and behavioral measures (Champagne & Meaney, 2001). Moreover, these effects spiraled across generations. A low-nurturing mother bred low-nurturing daughters, epigenetically further compounding the effects of poor care on brain system development over generations (Weaver et al., 2002). Cross-foster studies show that the effect is environmental and not genetic (Francis, Diorio, Liu, & Meaney, 1999). Meaney, Szyf, and colleagues have now demonstrated the same epigenetic mechanism occurring in the brains of human adults abused as children who subsequently committed suicide (McGowan et al., 2009).

Animal studies on the critical importance of early tactile experience in mammalian development are paralleled by human studies on the essential role of maternal "affective touch" on infant development in the first year of life (Ferber, Feldman, & Makhoul, 2008; Jean, Stack, & Fogel, 2009). The infant and mother utilize "interpersonal touch" as an initial communication system (Gallace & Spence, 2010), especially for the relay and regulation of emotional information (Hertenstein, 2002; Hertenstein & Campos, 2001). Echoing animal research, human studies indicate that a lack of interpersonal touch in mother–infant interactions has an enduring negative effect on psychological, especially emotional, development (e.g., Moszkowski et al., 2009).

In the ancestral context, represented by the EEA, and as is normal for our ape cousins, babies and young children were presumably kept physically in contact with their mothers and others all the time, day and night. McKenna and colleagues (1994) have documented hidden regulators during human mother–child cosleeping, including facilitation of regular feeding/suckling (Ball & Klingaman, 2007; Ball & Russell, this volume; Buswell & Spatz, 2007; McKenna & Gettler, this volume; Thoman, 2006). Skin-to-skin contact promotes healthy sleep cycles and adaptive behavioral arousals and exploratory activities (Feldman, Weller, Sirota, & Eidelman, 2002; McKenna, Ball, & Gettler, 2007). Early experiences with physical touch influence brain structures and wiring, facilitating secure attachments, which in turn promote adaptive social and cognitive functioning in adulthood (for a review, see Cushing & Kramer, 2005). Early social loss and insecure attachment are linked to a predisposition for depression and other mental health problems (e.g., Beatson & Taryan, 2003; Watt & Panksepp, 2009). These findings must be considered in light of the fact that only about 13% of US infants regularly sleep in a bed near caregivers (National Institute of Child Health and Human Development, Early Child Care Research Network, 2003).

Prompt (Caring) Response

After 9 months of gestational synchrony, human mothers and neonates under natural conditions typically move into an interactional synchrony of sound and movement within the first hours after birth (e.g., Condon & Sander, 1974; Papousek & Papousek, 1992). Some call this right-brain affect regulation (Schore, 1994, 2003) or “limbic regulation” (Lewis, Amini, & Lannon, 2000), in which caregivers act as external regulators of psychological and biological development (Hofer, 1994; Schore, 2001b). This positive emotional entrainment is of clear importance in long-term development after birth (for reviews, see Reddy, 2008; Tronick, 2007).

According to the mutual regulation model, the infant is viewed as a subsystem, with the caregiver as the other subsystem, within a “larger dyadic regulatory system” (Tronick, 2007, p. 9) that is in a constant dance of match and mismatch of coordinating intersubjectivity (Reddy, 2008). The infant’s experience of repairing communication mismatches with coping strategies (also dependent on mother responsiveness) is believed to lead to a sense of mastery and a positive affective core, whereas opposite outcomes occur for an infant who unsuccessfully uses coping strategies in trying to repair communication mismatches. Consonant with this model, Schore (1994, 2000, this volume) describes the cocreation of an attachment bond of social-emotional communication and interactive regulation between the infant and the sensitive primary caregiver in the first 2 years of life. Optimal human development is thus rooted in social synchrony with others (Reddy, 2008; Schore, 1994; Trevarthen, 2005). Moreover, collective intelligence of human groups is largely based on social sensitivity (Woolley, Chabris, Pentland, Hashmim, & Malone, 2010).

In early life, the right brain is forming its emotional circuitry and structures in collaboration with caregivers (for reviews, see Schore, 1994, 2001b). Responsive caregivers, in mutual coregulation, shape the infant brain for self-regulation within and across multiple sensory systems (e.g., respiratory, hormonal), influencing multiple levels of functioning (Hofer, 1994) and establishing emotional patterns that promote confidence and mental health. The early developing right brain, which is shaped by the attachment relationship and dominant for the processing of bodily based emotional information, is deeply connected to the autonomic nervous system (Schore, 2005), providing a solid grounding for an emotionally well-integrated personality (McGilchrist, 2009; Nadel & Muir, 2005). Porges’s polyvagal theory details how early attachment bonding experiences program the sympathetic and parasympathetic branches of the infant’s developing autonomic nervous system, thereby shaping later social and emotional reactivity (Carter & Porges, this volume; Porges, 2007). Indeed, responsive care with coregulated communication patterns is related to good parasympathetic vagal tone, which is critical for well-functioning digestive, cardiac, respiratory, and immune as well as emotional systems (e.g., Donzella, Gunnar, Krueger, & Alwin, 2000; Propper et al., 2008; Stam, Akkermans, & Wiegant, 1997). Nonresponsive parenting leads to poor vagal tone (e.g., Calkins, Smith, Gill, & Johnson, 1998; Porter, 2003). Other systems are also affected negatively. For example, having a depressed mother (whose nurturing responses are limited) alters the functioning of the hypothalamic–pituitary–adrenal axis (HPA; e.g., Beatson & Taryan, 2003; see Dawson, Ashman, & Carver, 2000, for a review).

Unfortunately, a common cultural misperception, arising partly from the behaviorist tradition, is that letting babies cry themselves to sleep represents adequate, or even appropriate, parenting (Gethin & MacGregor, 2009). When babies are left to cry, with no parental attempt at timely comforting, their brains are flooded with high levels of potentially neurotoxic stress hormones such as cortisol (Blunt Bugental, Martorell, & Barraza, 2003; Gunnar & Donzella, 2002). Brain opioids, which promote feelings of well-being, diminish during human sadness (Zubieta et al., 2003), and psychic pain circuits are aroused (Eisenberger, Lieberman, & Williams, 2003; Panksepp, 2003). Over time, if these experiences are regular and extended, brain stress response systems can be wired permanently for oversensitivity and overreactivity (Anisman, Zaharia, Meaney, & Merali, 1998), leading to predispositions for clinical depression and anxiety (Barbas, Saha, Rempel-Clower, & Ghashghaei, 2003; de Kloet, Sibug, Helmerhorst, & Schmidt, 2005; see Watt & Panksepp, 2009, for a review), poor mental and physical health outcomes, and accelerated aging and mortality (for a review, Preston & de Waal, 2002).

Consistent or unrelieved distress during sensitive periods in early life reduces the expression of γ-aminobutyric acid (GABA) genes, leading to anxiety and depression disorders as well as increased use of alcohol for stress relief (Caldji, Francis, Sharma, Plotsky, & Meaney, 2000; Hsu et al., 2003). When emotional dysregulation becomes chronic, it forms the foundation for further psychopathologies (Cole, Michel, & Teti, 1994; Panksepp & Watt, 2011), especially depression. Infant emotional dysregulation is related to subsequent mental illness, including a propensity for violence (Davidson, Putnam, & Larson, 2000). Stress that leads to insecure attachment disrupts emotional functioning, compromises social abilities, and can promote a permanent emotional bias toward anxious self-preservation (Henry & Wang, 1998; also see Schore, 2009, for a review).

Warm, responsive caregiving, as extensively studied (but variably defined; see Richman, Miller, & LeVine, 1992), is shown to have multiple positive effects (Fleming, Mileva-Seitz, & Afonso, this volume). Children raised with abundant care develop systems that respond well to endogenous opioids and oxytocin, leading to better stress regulation (e.g., Fleming, O'Day, & Kraemer, 1999; Heim & Nemeroff, 2001; Liu et al., 1997; Uvnas-Moberg, 1997). Responsive parenting helps children learn to regulate arousal systems on their own (Haley & Stansbury, 2003) and is linked to heightened moral functioning, including stronger early conscience development (Kochanska, 2002). Well-established vagal tone in adults is correlated with compassion and openheartedness toward others from different backgrounds (summarized by Keltner, 2009). Similarly, children with high vagal tone are more cooperative and giving (for a review, see Eisenberg & Eggum, 2008). And when combined with increased activity in positive affective systems of the brain, high vagal tone promotes human happiness (Sheldon, Kashdan, &

Steger, 2011) as opposed to sustained psychological pain (MacDonald & Jensen-Campbell, 2011).

Multiple Allomothers

Family life was established on cooperation (Roughgarden & Song, in press). In the ancestral context, with humans living in small tribal, extended family groups, mothers were probably often assisted by many other adults (e.g., father, grandparents) in caring for infants and children, suggesting that children had multiple attachment relationships. Such "cooperative breeding" is corroborated by contemporary observational studies of similar groups (see review by Hrdy, 2009). For example, youngsters require feeding long after weaning, an activity the mother necessarily shares with other adults in documented hunter-gatherer communities until the child is able to help sufficiently to provision the self and others (see Fuentes, in press). Historically, the built-in social safety net for mothers surely increased the chances of the child's survival and decreased the stress burden on the mother. Supportive social contact is known to be a positive influence during birthing and postnatal mother–child communication (Klaus & Kennel, 1976), and in fact, three attentive adults (parents and/or alloparents) appear to be optimal for children to thrive (Sagi et al., 1995; van Ijzendoorn, Sagi, & Lambermon, 1992).

In contrast to our ancestral context, modern life includes several caregiving arrangements that most likely compromise optimal child development. Single parenthood, for instance, can be detrimental to the well-being of the child (Amato, 2007), likely owing to overall decreased social support. Another current practice in the United States is that most children are cared for by nonkin caregivers, who may be less attuned to the needs of individual children than family members might be (Belsky, 2001), and where less than optimal care is often provided due to lack of resources (Peisner-Feinberg, Bernier, Bryant, & Maxwell, 2000). The more time that children spend in any nonmaternal childcare situations across the first 4.5 years of life, the more likely they are to exhibit externalizing problems and conflict with adults at age 4.5 and in kindergarten (National Institute of Child Health and Human Development, Early Child Care Research Network, 2003; although the rare high-quality care may mitigate these effects). In comparison to children at home (a proxy for care that is closer to that provided in the ancestral context), cortisol readings are higher for children in daycare, especially for those under 3 years of age (Vermeer & van Ijzendoorn, 2006), and increase rather than decrease throughout the day (Dettling, Gunnar, & Donzella, 1999). The expulsion rate of prekindergarten children (Gilliam, 2005) and the number of children under age 5 with psychosocial problems (Powell et al., 2003) or on psychotropic medications have increased dramatically in recent years (Zito et al., 2000), and although these trends have not yet been causally connected to deficient childcare, they do suggest that early caregiving is problematic in some way. Poor-quality daycare settings are often not able to cope with children’s needs, particularly if they exhibit psychosocial problems or special needs.

Play

Mammalian childhoods, especially among primates, are characterized by playful interactions. The natural play of mammals has only recently been ethologically characterized for humans (Scott & Panksepp, 2003) and put under close scientific scrutiny in animal models (Panksepp, Siviy, & Normansell, 1984; Pellis & Pellis, 2009; Siviy & Panksepp, 2011; Spinka, Newberry, & Bekoff, 2001; Vanderschuren, Niesink, & Van Ree, 1997). Gray (2009; this volume), and Pellegrini (this volume) describe the evolved usefulness of play. Play is now known to promote affectively beneficial gene expression profiles (Burgdorf, Kroes, Beinfeld, Panksepp, & Moskal, 2010), brain development (Gordon, Kollack-Walker, Akil, & Panksepp, 2002; Gordon, Burke, Akil, Watson, & Panksepp, 2003; Panksepp, 2007; van den Berg et al., 1999), and emotion regulation development (Panksepp et al., 2003; van den Berg et al., 1999). Mammals who are deficient in play have difficulty regulating aggressive urges (Potegal & Einon, 1989). Those with little play experience early in life have altered social, sexual, and conflict interactions with peers (van den Berg et al., 1999). Insufficient play may promote behavioral disorders such as attention deficit/hyperactivity disorder (Panksepp, 2007), diminished academic achievement (Barros, Silver, & Stein, 2009), and aggression (Flanders & Herman, this volume). Unfortunately, physical play in kindergarten is disappearing (Miller & Almon, 2009); moreover, educators often have difficulty distinguishing play from aggression and are commonly uncertain about how to manage play urges in young children (Tannock, 2008).

What Happens to Mammals Who Do Not Receive What They Need?

Mammalian brains are experience expectant (Greenough & Black, 1992), with age-related regulating sets of experiences and environmental supports promoting brain construction and wiring (e.g., Cushing & Kramer, 2005). Caregiving consistent with evolved, expected care could be conceptualized as a set of experiences anticipated by the human mammalian brain that foster empathy and sociality (Narvaez & Gleason, this volume; Nelson, this volume). Of course, all organisms, including humans, adapt to whatever life-supportive environments they encounter. Mammals, including young humans, adapt to emotionally deficient environments by relying on the more primitive survival modes of their brains, often becoming aggressive, depressive, and/or antisocial (Henry & Wang, 1998; Lewis et al., 2000; Teicher, 2002). Perhaps, then, the increasing incidence of emotionally disorganized children is a form of adaptation that is an “adaptive maladaptation,” from a mental health perspective, formed in response to “toxic social environments” (Garbarino, 1995)—environments deficient in the kinds of inclusive social supports our ancestors received. That is, such maladaptations were not part of the evolved adaptive apparatus but reflect a pathological outcome of emotional stressors in human infants reared in socially deficient environments without adequate social supports, resulting in deficient limbic and neocortical development. Schore (1997, 2002), for example, offers interdisciplinary evidence that indicates that relational attachment trauma alters the developmental trajectory of the right brain and thereby imprints a predisposition to later forming psychiatric disorders, including personality disorders.

Under the ancestral conditions (small-band hunter-gatherers; Fry, 2006), individuals would have developed a stronger disposition to cooperate and to exhibit “strong reciprocity” (Gintis, Bowles, Boyd, & Fehr, 2009, p. 8). Oppositional, aggressive, and/or dangerous individuals would not have earned the trust of the community and likely would have died at younger ages in our ancestral context than cooperative individuals. Poor cooperators may more readily survive today because of the sufficient calories and attention provided through the cultural safety nets of modern societies. Nonetheless, through the neglect of children’s various primary social-emotional needs, our society may be starting to normalize abnormality.

Alternative views

Hrdy (1999) has suggested that children reared under adverse conditions (e.g., with stressed parents) may develop personalities (e.g., anxious) that are better prepared for subsisting in a challenging environment. For example, when children are presented with manageable, graded emotional challenges, they can become more resilient (e.g., Katz et al., 2009). However, relational neglect and/or attachment trauma presents the infant not with graded but with highly stressful, undernourishing, and thereby overwhelming experiences. In fact, severe attachment stressors decrease adaptive abilities to respond emotionally, think efficiently, and relate well to others (Lanius et al., 2010). As a result, these children are truly *not* “prepared” for the social environment they face in everyday life. What is more, trauma may not need to be severe to have detrimental effects. Undercare, in terms of our ancestral practices, may also lead to suboptimal functioning (see Narvaez & Gleason, this volume). Surely the range of undercare in ancestral environments was much narrower and limited for our ancestors because children lived within a village of support. They experienced much more physiological stress but many fewer social stresses than childrearing environments today. Social stress has much greater ill effects on child physical and mental well-being than physiological stress (see Konner, 2010, for a review).

Others suggest that humans are demonstrating how adaptive and resilient they are despite the huge spectrum of stressful childhood experiences expressly because they survive in the face of daunting challenges (e.g., Belsky, Steinberg, & Draper, 1991). This perspective, however, ignores the quality of life, and even its length, as important variables in understanding adaptation. Suomi and colleagues (Howell et al., 2007), for example, found that male rhesus monkeys with low central serotonin levels early in life, a genetic phenotype that can be modulated environmentally, demonstrate high levels of violence and often experienced premature death; those that survive to adulthood (10 years later) achieve high rank, but it is not clear how functional they are otherwise (D’Souza & Craig, 2008; Rutter, 2008; Suomi, 2006; Uher & McGuffin, 2008). After all, dominant human males typically do not out-reproduce less dominant males (Lansing et al., 2008).

The wide range of personalities found today (many “pathological”) were likely not found in ancestral contexts. Rearing practices that reduced childhood crying were adaptive (Trevathan, 2011); children were probably more “indulged” (Konner, 2005), resulting in apparently conciliatory personalities (Fry, 2006), not the wide range of antisocial personalities that are documented currently. Support for this argument comes from anthropological reports (e.g., Thomas, 1959; Turnbull, 1961) and a review by Prescott (1996), who compared violent and peaceful societies from Textor's (1967) analyses of 400 societies and found that peaceful societies were more physically nurturing (touch, holding, affection) than violent societies. The evolved, expected care we describe appear to lead to not only more cooperative personalities but also more peaceful cultures (Fry, 2006; Narvaez & Gleason, this volume).

Perhaps because of a long evolutionary history with relatively egalitarian social structures in ancestral environments (Binmore, 1998) and a deep sense of fairness exhibited among primates (e.g., Brosnan, 2006; Brosnan & de Waal, 2003; de Waal, 2009; now extended to various species), humanity's troubled history during the recent "modern" era of inegalitarianism (the last 10,000 years or so) may be linked to the more powerful members of society exhausting societal resources from a status race to the top (Diamond, 2005. One reading of modern history is that the human global trajectory is less than optimal (Millennium Ecosystem Assessment, 2005) and seems to be following the same self-destructive pattern as societies that collapsed in the past (Diamond, 2005—only with worldwide ramifications.

A latent variable that underlies one's reaction to the state of children today is one's subjective view of human nature. If one believes that humans are naturally violent and individualistic, then one is not surprised that so much violence, aggression, and alienation pervade society. However, if one believes that humans are typically nonviolent but prosocial, one is more likely to view aggression and alienation as indicative of an unbalanced state of affairs that can be remedied. Clearly, we take the latter position.

Conclusion

Current US societal practices and accepted childrearing outcomes do not adequately consider the original adaptive conditions of our ancestry and the prosocial emotional dynamics that helped human ancestors to thrive. Despite the growing evidence for the negative effects of particular early experiences, especially as moderated by emotionally sensitive childrearing practices on the developing brain, scientific research, theory, and policy recommendations do not yet match up with emerging findings. At the same time, we do not wish to romanticize a human ancestral past that cannot be reconstructed precisely, but to provide a plausible thesis, supported by cross-species data, that includes sensitive studies of the emotional-cognitive capacities of our evolutionary ancestors, as gleaned from studies of our closest evolutionary kin, the other great apes (de Waal, 2009). The primordial emotional infrastructure of mammalian brains (Panksepp, 1998, 2005; Panksepp & Biven, 2011) clearly coevolved with a particular co-constructing environment such as is described here. In order for science to play an effective role in helping to reverse current negative trends in well-being, we need to foster a widespread understanding of the types of psychobiological needs that humans possess as a result of their evolutionary nature. Paying attention to the converging evidence about optimal early care is a place to start. This volume is a contribution to that effort.

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