

Born for Art, and the Joyful Companionship of Fiction

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"My aim is to shew, although this is not generally attended to, that the roots of all sciences and arts in every instance arise as early as in the tender age, and that on these foundations it is neither impossible nor difficult for the whole superstructure to be laid; provided always that we act reasonably with a reasonable creature."

(John Amos Comenius (1592-1671) in *The School of Infancy*, Chapter viii, Section 6, on the education of rhetoric. Translated by D. Benham. London, 1858. Quoted by Quick, 1894, pp. 144-145).

Playful Human Nature and the Creation of Culture

All human communities take pleasure in fictional, poetic worlds, inventing arts and techniques that go far beyond immediate vital needs and facts. Often fantasy seems more important to us than informative language or logic, especially if we are a young child, a performer, an artist -- or, as both Albert Einstein and Alfred North Whitehead have said, a scientist seeking inspiration, aiming to think free of conventional 'truths'. We may become obedient to the most arcane procedures or complicated explanations arguments and laws (Bruner, 2003). A sense of humour brings relief from oppressive rules.

Why does it matter so much that our recreations, beliefs and invented ways of making things should be done 'properly', and why are we so ambitious to invent new more complex twists of logic to 'justify' our case. Why do we judge our companions by their abilities to share their thoughts inventively, calling the differences 'personality'? No other mammal has so much invention to cope with. The strange human urge to shape and share fantasies of action and experience is with us from birth. It is innate, not acquired, but must grow in company (Trevarthen, 2001a, 2005, 2009a, 2011a).

A mother loves to test her infant's invention. While breast feeding, washing or dressing, she will interrupt the task to touch invitingly and speak musically to her infant, watching for a 'thoughtful' reaction. Her infant's knowing response comes, and makes her smile, then exclaim with joy. Why is the infant so alert to how she acts in this provocative way, which does not meet needs for comfort and care? Why does the baby turn to hear and see her? Sometimes an expectant mother addresses her unborn infant, imagining the baby is attentive to her talk. After birth she is rewarded -- the infant immediately knows and prefers her voice (DeCasper and Prescott, 2009). And the communication of fanciful notions grows quickly. What other use has the sense of fun in absurd jokes and mannerisms that even a six-month-old can display, which can be used cunningly to tease

loved ones and provoke joy in them (Reddy, 2008)? The inventive instinct becomes the fantasy play of toddlers.

The idea that this is the true and original story of uniquely human inherent needs and skills for adaptation to a culture receives support from a report of how infants are played with and spoken to in a hunter-gatherer society that has managed to keep legendary social ways and ancient language (Takada, 2005). It carries a clear message about the best environment for our modern infants and young children. Mothers, fathers and others of the family are to be an infant's companions in the fun of human fantastic story-making.

I agree with Dan Hughes and Bruce Perry that in health the human brain grows to build creative relationships (Hughes, 2006; Perry and Szalavitz, 2010). That is what love is about, and why it is a cruelty to treat an infant without joy and imagination, even if the child's love of life is not actually terrified and wounded by violence in the family (Trevvarthen 2001a).

How the Human Past Might Have Led To Our Fantastic Present

The emergence of modern human beings is signalled by what remains of their imaginative art, not by their skills of technical manipulation. The Neanderthals, who they replaced, made exquisitely crafted stone tools and weapons, but appear to have had no pictorial artistry, or instrumental music.

Both of these *Homo sapiens sapiens* was creating to satisfy delicate aesthetic appreciation 35,000 years ago (Conrad et al., 2009; Clottes, 2010).

Anthropological researches encourage an idea that first modern humans had imaginative parenting. Along with frequent breast-feeding and co-sleeping with enjoyment of the special comfort of human fine-haired skin, the shared care of allo-parents, and the companionship of family groups (Hrdy, 2009), early human adults must have been playful with infants. The whole family surely took joy in the experimental and humorous actions of their babies. They will have followed each infant's growing curiosity about how to deal with objects playfully and cooperatively, joining them in learning by 'intent participation' how to make and use toys and tools and how to deal with plants and animals, friends and strangers (Bakeman et al., 1990; Rogoff, 2003). I am sure that in the EEA the infant's affectionate ingenuity, beginning first in an intimate motherly attachment, was responded to happily and provocatively by fathers, siblings, uncles, aunts and grand parents, helping to make a community culture that could pass on the rituals of art, technique and understanding of ancestors. Busy modern families do the same when happily at home in a peaceful village sub-community, away from the 'services' of a demanding urban society -- distanced for a time from employment by the 'system', fancy technology, artificial mobility and means of global communication with all manner of human contrivance, and from competition for commodities and status in the system (Habermas, 1987; McGilchrist, 2009; Smyth and Dewar, 2009).

The Growth of Meaning In Company, With a Multiplex, Polyrhythmic Body and Mind

Bjorn Merker (2009), comparing us with other primates, concludes that the first step to humanness was the evolution of 'ritual culture', going beyond the shared learning of 'instrumental' skills for getting food such as apes show, or finding a place in a rivalrous society of smart status-conscious companions by appropriate use of deference in tone and manner of communication, by which many social species regulate their 'politics'. Research on infant action games and baby songs, such are found in every existing human group, supports his thesis (Ekerdal and Merker, 2009)

Stephen Malloch and I have made an acoustic exploration of the infant's vocal and gestural talents for what we call 'communicative musicality', which has 'pulse', affective 'quality', and the persuasive time-sense of 'narrative' (Malloch, 1999; Trevarthen, 1999, 2008, 2009b; Trevarthen et al., 2011). This artful moving and thinking, which elaborates an early human talent for fantasy in 'mimesis' (Donald, 2001), is dependent the sympathy of companions. It has aesthetic and moral emotions, which may be cultivated and refined with learned social rules, but which are part of its sociable human emotional nature.

On the "aesthetics of childhood", Pauline von Bonsdorff (2009) has this to say: "The aesthetics of childhood is not just about children, but about the human situation.

We were all children once, and childhood is on the whole a permanent structure of individual lives, of culture and society."

Ellen Dissanayake, who has studied prehistoric creations and the values given to art in many cultures, concludes that art begins in the intimacy if mother-infant play (Dissanayake, 2009a), agreeing with Merker that the temporal arts give energy to the development of a collaborative spirit in a community, encouraging cultural invention (Dissanayake, 2009b).

Before language is mastered, there are growth-regulated steps of brain and body in motives and control of movement, by which an infant becomes a collaborator in human meaning and human feeling (Trevarthen, 1998, 2011a; Reddy, Hay, Murray and Trevarthen, 1997; Trevarthen and Aitken, 2003; Trevarthen and Reddy, 2007; Trevarthen et al., 2006). The development of each individual's well-being and self-confidence in society, and the process by which a culture is passed on depend on a developing ability in the child to 'learn how to mean' (Halliday, 1975) and to learn the narratives of culture (Bruner, 1990, 2003). The steps archaeologists trace from the first small settlements to organised agriculture, the making of cities and the invention of writing appear to depend on such motives (Renfrew, 2006), and on the acceptance by the community of artificial 'institutional facts' (Searle, 1995), which are not the same as what a rational philosopher takes to be 'real facts'.

We come to a new view of the expanding consciousness of a young child as a life story created with love in companionship, a 'narration' or communicative 'project' that is guided by specifically human social feelings, by a 'socio-cultural brain' actively using its body in expressive, imaginative and person-sensitive ways. These new sympathies extend the heritage of mammalian emotions for

regulating individual and social enterprises, and the imitative skills of other primates (Trevvarthen, 2009b, 2011b; Trevvarthen et al., 2006).

Epigenetics, Developmental Ingenuity and 'Resilience'

We can learn about the biology of humanity and its cultures from three generations of Batesons. Grandfather William (1894) discovered the principle of homeosis or regulation of gene expression by epigenetic factors, making a common theory of phylogenesis, embryology and genetics. His theory is the foundation of modern epigenetics (Lewis, 1994; Stern, 2000).

William's son, Gregory, pioneered systems theory and cybernetics, and stressed the two sides of an organism's adaptation to the world, the time-tested instincts, and special abilities to be modified in 'use'. Gregory said,

"No animal or plant can ever be 'ready made'. The internal recipe insists upon compatibility but is never sufficient for the development and life of the organism. ... It must acquire certain somatic characteristics by use, by disuse, by habit, by hardship, and by nurture. ... [and] the acquisition of bad habits, at a social level, surely sets the context for selection of ultimately lethal genetic propensities" (Bateson, G. 1979, pp. 234-235).

Gregory's daughter, Mary Catherine, studied a 'proto-conversation' between a mother and her 9- week-old infant, marking the subtle rhythms of the dialogic 'system' -- how the two sides of an adaptive action were played out between mother and child in what may be called 'four-part harmony', each person giving and receiving sympathetic affection. She identified this as the foundation for language and the 'healing practices' of diverse cultures, which her mother, Margaret Mead, and her father had investigated. She gave the first clear description of infant 'intersubjectivity':

" These interactions were characterized by a sort of delighted, ritualized courtesy and more or less sustained attention and mutual gaze. Many of the vocalizations were of types not described in the acoustic literature on infancy, since they were very brief and faint, and yet were crucial parts of the jointly sustained performances." (Bateson, M. C., 1979, p. 65).

Creating the Life Story of a People

Endel Tulving (2002) proposes that an 'episodic memory', recalling key moments of experience for future reference, is a special human talent. It seems to be what makes 'processual', problemthinking, inventive intelligence possible. It builds each individual's personal history, an 'autonoesis' that links emotion-charged moments of action and awareness in 'phenomenological present' recalled as specially significant in a fictional plan of life's ambitions and achievements.

Stern has given us an account of how 'vitality dynamics' seen in communication with infants or psychiatric patients are cultivated in the arts as 'layered composite narratives' (Stern, 2010, p, 131). A healthy mind builds proud memories in loving company with specially trusted family and friends, making a good story.

Loneliness, shame, depression and sadness are the emotions that identify loss of this collective story-making, which can be called 'socio-noesis' (Trevvarthen, 2007). The developing human psyche and brain have needs for company, and

human psychopathology defines a deep confusion in self-awareness and well as an incapacity to communicate sympathetically with other human imaginations and purposes (Northoff, 2011) and to contribute to work in society (Heckman, 2007).

Growth of a Human Brain Expectant for Culture

Our knowledge of human evolution (Renfrew, 2006) makes clear that the evolution of human cultural understanding has been made possible by growth of a larger brain that first appeared in our ancestors more than 2,000,000 years ago, and that made a great advance only 200,000 years ago with the appearance of *Homo sapiens sapiens*. A new kind of epigenetics in brain tissues motivates new ways of using the body to engage with what is discovered, done and made.

Learning culture, according to the science of neuroanthropology, changes the shape of the parts of the brain undergoing development in individuals, as they seek to communicate and cooperate in a 'meaning-sustaining' community (Han and Northoff, 2008; Domínguez Duque, Turner, Lewis, and Egan, 2010). The human brain has an extended ontogenesis, one that transforms shared biological regulations of vital states between the *bodies* of developing foetus and mother to a psychological co-regulation of intentions, interests and inner feelings of *minds* by movements of intersubjective communication. We have called the first *amphoteronomic* ('together' regulation of bodies, in contrast to auto-nomic 'self' regulation), and the second *synrhythmic* (dependent upon close temporal engagement of rhythms of movement that express mind states) (Trevarthen et al., 2006).

At birth the infant has special expressive and receptive organs adapted to monitor mental processes in the self and in others by keeping track of the prospective awareness made manifest in the shape and timing of movements (Trevarthen, 2001b). A key ingredient is a polyrhythmic time generator in the brain built to track and make productive use of proprioceptive and visceral dynamics throughout the body (Meissner and Wittmann, 2011). This time sense, a hierarchical biochronology of rhythms, is innate and matching between the infant and an attentive adult enabling them to attune in agile jazz-like synchrony and alternation, leading and following one another in a way that generates pleasure and make learning of new creations easy (Gratier, 2008; Gratier and Trevarthen, 2008). The life dynamics that flow in one human brain and body, including subtle new variations of the affective systems of the brain that have long regulated activities and social cooperation's throughout the mammals, make engaging melodies, making 'good time', getting 'in the groove', emotionally (Panksepp and Trevarthen, 2009). They direct and organize intentions and awareness in the brain and give value to memories and imaginings. They motivate learning in an intimacy that changes what the brain perceives, can do, plans to do, and remembers.

Advances in the Psycho-Biology of Attachment and Human Needs

In response to the remarkable presentations of this section on the psychobiology of in early stages of human vitality with maternal support, I try to relate scientific inspection of the details of the organism at the sub-subject, sub-personal level, so I can begin to comprehend the rich intersubjective and inter-personal level of human presence, and its special epigenetics. We need the evidence for mechanisms of neural, neurochemical, hormonal, and molecular (genetic and epigenetic) regulation of mind functions -- what Charles Sherrington (1906) called 'projicience' for identifying objects to serve prospective control of purposes and projects, and the 'affective appraisals' that sustain well-being of the autonomic/visceral and amphoteronomic/attachment processes. But there are advantages of going back to how Darwin observed about human nature and its emotions before any of these wonders of animal and human biology were accessible, or indeed to the rich philosophical picture Adam Smith gave of human commercial enterprise and its moral foundations a century before Darwin. If we are to protect young children, their bodies and their brains, from harm in the complex, busy and sometimes cruel world they come to live in, a world that has to satisfy artificial rituals and beliefs of an adult industrial and e-literate society, we will have to value more and give response to what children bring to human life, the eager spirit of their joyful projects beyond their seeking to survive as organisms, and especially what kind of company they expect from us, their parents, brothers and sisters, teachers and professional care-givers. It turns out a newborn infant person has clear expectations of human sense, and is active in starting a personal quest for meaningful stories in good company.

"The old model of thinking of the newborn infant as helpless and ready to be shaped by his environment prevented us from seeing his power as a communicant in the early mother-father-infant interaction. To see the neonate as chaotic or insensitive provided us with the capacity to see ourselves as acting 'on' rather than 'with' him." (Brazelton, 1979, p. 79)

Primary-Process Emotional Systems and Child Development

Panksepp gives us a rich account of ancestral neural systems of emotion in mammals. He believes these same systems constitute the 'affective consciousness' of infants, which is 'anoetic' or 'unknowing', comparable with that of anencephalic children. Affectionate parents guide the infant's immature embodied impulses toward more cultivated 'secondary-process' forms of feeling-with- knowledge. He employs Tulving's concept of autonoesis or 'self-knowing' in human beings, reliant on 'tertiary-process higher-order cognitive mechanisms' and an 'episodic memory', concluding that a mother's intimate loving first protective against fear and sadness, and a father's more physical playfulness later encouraging mastery of anger, are required for the maturation of 'higher' emotions and a responsible and self-confident 'personal history' in society. For development of understanding of intimate sensuous affection he believes it is best, for a young child, "to educate by empathic example rather than cognitive instruction." A child's temperament and emotional health depend on both 'inbuilt' and 'developmentally emergent' sources, the latter depending on

greatly expanded learning powers of the human cerebral cortex, which is proposed to function like the programmable RAM of a computer, a 'cognitive information processing device'.

The discovery that rat pups 'laugh' as they 'tease' one another inspires a generous interpretation of the biology of joy in companionship. Aesthetic and moral sensibilities have a foundation in more elaborate human 'dynamic affects' (Stern, 2010), which are adapted to create and retain imaginative narratives of life in movement for the Self and in community with others. Surely the evolutionary expansion of the human cortex, with its somato-topic mapping of circuits of agency and experience (Trevvarthen, 1985), was accompanied by a rapid evolution of new emotional and motivational powers in the subcortex. Basic complex emotions are evident in accurate descriptions of how infants know our minds (Reddy, 2008). Panksepp concludes, "we will have to have integrated scientific views of higher and lower BrainMind functions that do not yet exist in a mature forms either in our scientific research, our academic discussion and our educational endeavors". His research is a clarion call to find these views.

Neurobiology and the Evolution of Mammalian Social Behaviour

The research of Carter and Porges explores the evolutionary elaboration of hormonal systems that link the vital functions of one mammalian body to those of a social partner, especially between sex partners and between mothers and their young, but in other cooperative affiliations too. Two hormones, oxytocin (OT) and arginine vasopressin (AVP), play key roles in development of social bonds and in mental health. They motivate female nurturance and more masculine active resistance to danger and uncertainty. Human young have an exceptionally long dependence on physical and physiological support and protection, and attachment between children and parents is strong and usually lifelong. These emotional regulations are elaborated in the cultural celebrations of community in art and technique, and the hormonal mediations are modified by the context of behavior and experience. "The capacity of these neuroendocrine systems to undergo long-lasting functional modifications presents an epigenetic model that may help to explain the origins of traits that have been called personality or temperament." Clearly the biological regulations, and differences between male and female reactions, are not just subservient to cognitive or rational deliberations and instruction. A young nervous system is sensitive to the quantity and quality of intimate contact with a caregiver, and the sharing of playful enjoyments in "symbiotic regulation", which benefits both caregiver and infant. Psychiatric disorders consequent on early stress or neglect affect both individual experience and the capacity to benefit from relationships.

Porges has charted evolutionary transformations in the neural systems that link brain with autonomic regulations of the body that enable intimate collaborations between the vital states and intelligences of individuals. His 'polyvagal theory' of mammalian social behaviour explains how reptilian 'self-regulations' became mammalian 'other regulations' serving more elaborate social life. All of the movements that mediate in the proto-conversation between an infant and a mother described by M. C. Bateson (1979) -- the shifting contact between the

eyes with their white sclera's, the subtle modulations of upper and lower face expressions, the changes of pitch and melody of vocalizations by actions of muscles in the throat, jaws, tongue and lips, and the listening to the tones of speech – are directed by visceral motor neurons that were originally evolved for vital selfregulations -- of breathing, heartbeat, and prospective awareness of the environment seen and heard. All are uniquely elaborated in humans for a new kind of intersubjective awareness that leads to transmission of ideas and descriptions of experience in language.

We need, I believe, to add hands to this theory of human self-regulating, creative, communicative and therapeutic motor control. In primates the forelimbs become involved in new self-regulations of the body's comfort, as well as foraging for food and its transport to the mouth, and they evolve in humans into organs of gesture. Besides transmitting intimate messages of comfort and using resonant objects to make music that imitates song, and making all manner of tools and mechanical contrivances, human hands can acquire a full language capacity. And they are highly expressive in dramatic and artful intersubjective ways in infancy (Trevvarthen et al., 2011)

Dopamine and Caregiver Responsiveness

Mileva-Seitz, Afonso and Fleming add an account of dopamine (DA) to the exploration of the biology of affectionate behaviour and infant care. In mammals this catecholamine neurotransmitter motivates intense affectionate maternal care of offspring, changing the responses and actions of the female brain around birth. There are individual differences in this maternal responsiveness, which may have consequences for the development of the young.

Human mothers engage in both intimate bodily contact with their infants, holding, caressing and breast-feeding them, and also communicate by the subtle expressions of eyes, face and voice described above. Their sensibility to the odour and touch of their infants is enhanced around birth and both mother and infant rapidly acquire greater sensibility for one another with early experience.

The loving mother's sense of comfort and resistance to stress is correlated with their level of sympathy and perception of distress in their infants. The mood of new mothers becomes more labile. In some this leads to a brief period of postnatal depression, which can, if severe, have consequences for the infant's responses to her, and for socio-emotional development and learning.

These authors give consideration to evidence for variability on human mothers' responses to their infants concluding, "there is direct evidence of an association between polymorphic variation in human DA genes and individual differences in maternal behavior." It appears that maternal sensitivity of new mothers is inversely correlated with their capacity to engage in abstract reasoning or 'executive function", which may explain the stress modern mothers have in juggling the demands of employment and infant care. The development of larger brains in humans may get in the way of warm mothering. This recalls the concerns of McGilchrist (2009) about the effects of modern 'environment detached' cultivation of the human brain and mind.

Epigenetics and the environmental regulation of the genome and its function

Meaney takes us to a detailed consideration of molecular events around gene transcription, addressing the question of epigenetic regulation of human behavior and experience, how experience can affect 'reading' of the genome, changing or 'remodelling' neural function and learning, thereby affecting personality, stress response, vulnerability and resistance to a wide range of chronic illness and risk for psychopathology.

Research with rats demonstrates effects of maternal care on adult behaviour of the offspring, including their parenting behaviour. The neurotransmitter serotonin is associated with feelings of pleasure and regulation of digestion and well-being in relation to environmental events, and also regulates glucocorticoid receptor gene transcription in hippocampal neurons, thus affecting memory and learning. Meaney presents evidence that, "variations in parental care can modify the epigenetic state of selected sites of the human genome", changing 'activity dependent' intercellular signaling in the brain. Indeed monozygotic twins are always increasingly different in agency, temperament, and stress resistance (Piontelli, 2002). But the genomic sequence is not just a passive player in the processes of expression, and moreover, "specific epigenetic modifications, once established, might be actively maintained", and may even be transmitted across generations. Meaney's work gives new life to William Bateson's ideas of more than a century ago.

Human Nature and Early Experience

Suomi extends the pioneering work of Harlow, which gave inspiration and solid scientific support to Bowlby's theory of the effects of maternal deprivation. In remarkable ways rhesus monkeys resemble human beings at all stages of life, in their vital self-regulations, brain functions and social development. Their 'infancy' starts them off to the same phases of maturation from birth to physical and social maturity, at four times the human rate. It begins with the same strong emotional bond between the mother and her offspring, then leads more independent adventures in a school of peers, but with the benefit of the mother's continued affectionate concern as a 'stable base'. Indeed the neurophysiological foundation of our capacity to be part of or 'mirror' one another's intentions and feelings was (accidentally) discovered in a monkey before it was imagined in a human being. Now the fate of monkey offspring in controlled circumstances with or without maternal support is studied by the most sophisticated techniques of biochemistry, molecular genetics and functional brain science, and the harvest of data is rich. We can understand better how timidity and cautious fear, or careless risk taking and aggression are mediated in the brain, how genes have variable responsibility for personality depending on circumstances, including maternal care, and how subtle modulation of gene ordering and expression can enhance or diminish the effects in the body and in behaviour.

I am delighted to see that close and 'respectful' observation at the early newborn stage reveals a hitherto unimagined ability of a monkey mother and offspring to engage in intense face-to-face communication by means of explicit face

expressions. But two things appear to be missing or very limited in this monkey-talk: there is no vocal protoconversation, and the hand gestures made by monkeys, young or old, have less 'narrative' attraction. Nevertheless, the passion of intimate attachment is there, and in humans similar face-to-face communication remains the arena for conversation and the growth of language. The research is giving a cornucopia of evidence of the importance of maternal affection for neurohumoral regulation of the growing body and brain, for epigenetic regulation and 'developmental programming' of expression of the genome. Temperamental differences between young monkeys are revealed to play a key part in the dynamic regulation of roles in a highly stratified society where individual differences count, not just as forms of pathology, but as ways of collaborating and adapting to changing circumstances. The evidence helps dispel the medical impulse to call every behaviour that is ab-'normal' a disorder or disease. The fact that a young monkey with a certain allele can become timid or aggressive or both, and too fond of alcohol, with poor mothering, yet perfectly well-behaved and sober with good affectionate attachment to a mother, underlines the importance of the EEA for gene effects.

The Neurobiological Basis of Empathy and its Development

Since that discovery of 'mirror neurons' in monkeys, the psychology of behavioral sharing has been radically changed. It is now fashionable to believe that intentions can transfer between brains by a direct mapping of the form of movement done to what is seen to be done. However, the findings from research using functional brain imaging with human subjects are complex, especially for the communication of emotional states by movements that have no instrumental purpose in the objective world.

Nelson accepts the definition of empathy as, "an affective response in one individual that is triggered by the observed or imagined feeling state of another individual" and he distinguishes empathy from 'sympathy' or 'compassion', because states shared empathically are to be 'isomorphic'. This rules out 'complementary' states of emotion 'shared with' another (the original meaning of the Greek word *sympatheia*) to attain a new state of relationship. Such a mutual assistance in emotion would appear to be essential in freely creative interpersonal contacts, with dynamic shifts of different feeling and expectation. Empathy is an 'estimation' (in Greek a projection into, or taking in) of an other person's feelings, a somewhat detached trying to have the same feelings. He divides the development of the human social brain in three periods: *infancy*, where the mother is the socializing agent; *juvenile*, where experience of play with peers while the mother acts as a safe base promotes development of empathy; and *adolescence* occupied with transition from the home to peer groups concerned with reproduction and maintaining social status in the group. He hypothesizes, "changes in sub-cortical structures such as amygdala, striatum and hypothalamus and maturation of prefrontal regions which can exert regulatory control on attention and behavioural responses". Emotional development is seen to be a slow acquisition of systematic explanatory awareness.

Familiar provocative behaviours of infants' and parents' joking and teasing, and the soliciting of prosocial response, described by Reddy (2008) give evidence of an early appearance of awareness of others' actual and potential states of mind. The damaging effects of institutionalization, and the consequences of abnormal development in autism receive clearer explanation if it is taken that innate motive systems normally act as epigenetic regulators of the expression of sympathetic emotions seeking social response. They are injured by neglect or abuse, and they may be distorted by abnormal prenatal development that closes down important avenues of development.

The Interpersonal Neurobiology of Attachment and Emotional Development

Schore gives us conclusive evidence, from many sources, that both the self-sustaining vital functions and the affectionate love-regulated interpersonal neurobiology are mediated more in the right hemisphere of the human brains of infant and mother, and later in the right brains of infant and father. This side of the MindBrain is most active and growing in infancy, preparing the growing body and its functions and activities for survival first, then for a life of learning in human company. Schore proposes that Bowlby's EEA can be identified with how the mother as primary caregiver, "shapes, for better or worse, the experience-dependent maturation of the brain systems involved in attachment." This puts great responsibility on a mother's affectionate care "at implicit nonverbal levels" and the support she gives to the "right lateralized self-regulatory systems" of her child, including those mediated by the vagus that promote oxygenation of the expanding neocortical tissues by parasympathetic regulation of cardiac function, as Porges describes.

Schore concludes that in late gestation and early months of infancy a mother's intimate care and concern promotes development of a posterior parieto-temporal cortico-limbic sensory system of the right hemisphere, supporting the child's capacity to overcome hunger and fatigue and to calm distress. When both mother and infant are active in more 'playful' exchange of expressions of their emotions, mid-frontal-limbic circuits of their right hemispheres are engaged. Development of this expressive right fronto-limbic system in the later months of infancy engages with paternal feelings of affection for the toddler, which are important in shaping the child's regulation of more proactive emotional states of anger and resistance -- in a word, for 'moral' development and listening to the voice of conscience. This recalls Freud's 'superego', but with the benefit of the shared fun of vigorous play rather than just stern discipline. In the EEA, the father would surely have collaborated with the mother in enjoyment of the infant's vitality, complementing her signs of emotion by which, "she smiles approval and thus encourages her child on the right path, or frowns disapproval" (Darwin, 1873, p. 365).

It is important to note that territories of *both* hemispheres are already adapted for their different interpersonal purposes in a young infant long before the left hemisphere growth spurt (Tzourio-Mazoyer, et al. 2002). Gestural asymmetry is evident in neonatal imitation (Nagy, 2006) and early post-natal development of

these gestures reveals that the two hemispheres of the infant, and of the mother, have complementary emotional functions, protective self-related actions of the left hand indicating greater activity of the right hemisphere, while expressive or 'assertive' actions are righthanded and presumably guided from the left hemisphere (Murray and Trevarthen, 1985; Trevarthen, 1996).

With Panksepp, Schore emphasizes that perinatal and postnatal development depends on developments in emotional systems. Growth of the infant's body and mind guides the optimal developmental path, as well as the support and help it requires in what Vygotsky (1978) called the 'zone of proximal development' of the child. Responsive guidance of emotional impulses is important for maturation of internal well-being or physiological health, psychological creativity, and especially for socio-emotional cooperation in a work-oriented world.

Since Spitz' description of 'anaclitic depression' following loss of support of an affectionate mother, which he called 'hospitalism', and Bowlby's definition of 'maternal deprivation', hospitals and orphanages have improved care of infants. There is still shocking evidence of the effects of loss of parental care –withdrawal of infants from engagement with other persons, loss of vitality, poor regulation of anxiety, fear and anger through childhood, and lifelong incapacity to cope in relationships and in society. This leads to massive social and economic cost (Heckman, 2007). Research abundantly confirms that lack of warm maternal support and companionship can have lasting effects on brain growth and function, which may or may not be alleviated by subsequent therapeutic attention (Perry and Szalavitz, 2010). Long periods of day care in the first year are clearly detrimental.

In conclusion, our attention is drawn to key topic for this volume, the mounting evidence that the US, an 'advanced' culture in terms of population, organized structure, productivity and material wealth, offers less social or community support to families than other 'advanced' cultures. The evidence shows the US, with its poor maternal and paternal leave policies, is "providing a growthinhibiting EEA" for many families, including prosperous ones. Schore recommends that "developmental neuropsychological studies of infants before, during, and after early day care is now essential."

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