

Development as the interface between biology and culture. A conceptualisation of early ontogenetic experiences

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Introduction

In this chapter it is argued that the analysis of developmental processes allows us to understand the interaction between biological predispositions and environmental information with respect to the initiation of culturally informed developmental pathways. Based on evolutionary theorizing, an organismic metaperspective (Eckensberger & Keller, 1998) is adopted, considering contemporary humans, like any other species, as incorporating evolved behavioural dispositions. The biological heritage and the cultural present are components of the same developmental processes. This view postulates ‘transactional relations’ between organism and environment, rejecting any simplistic biological determinism. Behavioural development is geared at encompassing developmental tasks, which have specific functions during the life histories of individuals. Thus, development is understood as a teleonomic process instead of pursuing overarching teleological goals. It is argued, that the early social experiences of infants with their caregivers set the stage for developmental trajectories that lead to ontogenetic adaptation. A component model of parenting is introduced that captures cross-cultural as well as inter-individual differentiations.

Biological Underpinnings: The Evolutionary Heritage

Evolutionary approaches differentiate proximate from ultimate causes when describing behavioural adaptations. The analysis of proximate causes mainly concerns the question how interactive dynamics should be understood (Anastasi, 1958), focusing on somatic, social and psychological processes. The ultimate cause of any proximate adaptation is evaluated in terms of its contribution to optimal genetic reproduction (inclusive fitness, Hamilton, 1964). Therefore, the question *how* has necessarily to be complemented with the question *why* specifying origin and function of developmental patterns (Mayr, 1988; Eckensberger, 1996; Eckensberger & Keller, 1998).

As a result of the ultimate orientation, the evolutionary perspective centres on the gene as the unit of analysis. But, as Mayr (1994, p. 206) has convincingly argued: ‘... it is not the naked gene, that is exposed to selective forces directly.’ The gene is part of the genotype that is considered as ‘... a well integrated system analogous to the organ structure of an organism’ (Mayr, 1988, p. 129). In fact, it is genotypic information (deoxyribonucleic acid (DNA)) stemming from different gene loci, pleiotropy) as translated into the phenotype that is exposed to

selection: 'It is not the genes that live or die, breed or help their relatives, but the realized animal' (Daly & Wilson, 1983, p. 32).

Adaptation as 'selection in progress' (Volland, 1993) centrally depends on variability of the genotypes, which results in humans mainly from sexual recombination¹. Genetic variability allows the adaptation of the genotype to a multiplicity of environments and environmental changes, although genes are primarily adapted to the environment of the evolutionary past (EEA, Environment of Evolutionary Adaptedness), incorporating the 'experiences', i.e. survival enhancing traits of the ancestors (Delbrück, 1949; Mayr, 1988).

Genes exert their effects in *fixed programs* which are invariably coded in the DNA of the genotype, and in *open programs* which are environmentally labile and prepared to acquire information through learning (Mayr, 1988). Most macromorphological changes are tightly controlled by fixed genetic scripts (cf. Nelson, 1999), detailing that the environment is needed but does not exert major differential effects. Open genetic programs set the stage for differential effects of environmental influences. Proponents of the new field of interpersonal neurobiology (Schore, 1994; Siegel, 1999) argue that the structure and function of the developing brain are determined by how experiences, especially within interpersonal relationships, shape the genetically programmed maturation of the nervous system. The caregiver is providing experiences, which shape genetic potential by acting as a psychobiological regulator of hormones that directly, influence gene transcription. Psychoneuroendocrinological changes during critical periods initiate enduring effects at genomic which is expressed in the imprinting of evolving brain circuitry' (Schore, 2000).

The important message is that social interactions among humans shape neural connections, i.e. the fine-tuning of the brain, as well as the mental representation of experiences, and thus the psychological foundation of the individual. The modes how open programs influence and direct behaviour are 'legion' (Mayr, 1988, p. 68; MacDonald, 1988), indicating that these interactions occur at a variety of neurophysiological and behavioural levels and are domain specific (Darwinian algorithms, Cosmides & Tooby, 1987).

Therefore, learning based in open genetic programs cannot be understood as a general mechanism with universal properties: '... the more we have studied learning abilities, the more impressed we have become with their specificity' (Trivers, 1985, p. 102). However, the different

¹ The estimations for the mutation rate in humans varies between 1.6 (Eyre-Walker & Keightley, 1999) and 3 (Crow, 1999) : 80.000.

modes of learning show biases that may reflect selective forces. Thus, learning has to be specified with respect to the content that is to be learned and the timing when it is learned. The interplay of content specificity and timing of learning is regarded as specifying ‘epigenetic rules’ (Wilson, 1975) or ‘central tendencies’ (MacDonald, 1988) that direct attention to specific (environmental) cues at specific times. Such effects may be weaker or stronger, the classical ethological conception of the sensitive period for imprinting being the strongest case. The acquisition of specific information during specific time windows allows ‘to learn easily’ (Boyd & Richerson, 1985; Draper & Harpending, 1988). The specification of content and timing of learning draws on the implicit notion that the genotype needs specific information from the environment in order to develop its phenotypic appearance (evolved co-designs, Rochat, 1997; inborn environment, Bischof, 1996). Because many aspects of development are activity-dependent, a broad range of individual differences results.

Thus, the foundation of interpersonal differentiation with respect to psychobiological functioning is laid down during the very early years of life and continues to exert influences throughout the life history. Yet we agree with Nelson (1999, p. 425) that ‘... the first few years of life are (not) a critical period *in general*; rather, it is perhaps wisest to view these years as a critical period for some functions, a sensitive period for others, and broadly tuned and receptive to modification for the duration of the lifespan for still others.’

In summary, it can be concluded that human infants are predisposed with open genetic programs for the acquisition of environmental information, which is of primordial significance for shaping their neurophysiological and psychological development. Yet, it can be assumed that the complexity of humans nervous systems and the multiple facets of the context and environment do not allow to formulate a single adaptive relation between context and behaviour (cf. Lerner & De Stefanis, 1999; Keller, 2000a,b; Belsky, Steinberg, & Draper, 1991; Keller & Greenfield, 2000; Greenfield & Suzuki, 1998; Rothbaum et al, 2000; Keller et al., 1999; Chisholm, 1992)

Learning Relationships: The Acquisition of a Social Matrix

The first overarching developmental task that an infant has to master all over the world consists of developing relationships with the primary caregiver. Learning relationships can be understood as a developmental process that is guided by epigenetic rules that direct infants’ attention to their

social partners and allow the easy learning of the parameters that define the relationships within a specific context and with this, the definition of the contextual foundation of the self.

The constituting interpersonal experiences are embedded in caregiving systems that have evolved as adaptive responses to environmental challenges, mainly entailing the regulation of physiological and behavioural functioning (Hofer, 1987), protection from predators (Bowlby, 1969), development of group cohesion (Dunbar, 1996, Keller, 2000b), and the emergence of a sense of self (cf. Keller et al., 1999). It is assumed that the caregiving systems consist of a set of genetically prepared behavioural propensities that can be activated due to the challenges of environmental demands. Since contexts only gradually change, contextual continuity over the generations establishes the prevalent socialization framework. This developmental scenario favours vertical socialization influences where parents prepare their offspring for mastering the same environmental context that they have learned to master. In rapidly changing environments that characterize the (post)modern world, horizontal influences, e.g. from peers and age mates, increase in importance. Yet the receptivity for those influences is based in the experiences with the early family context. Learning relationships thus consists of decoding information from the significant social partners during the early socialization phase with the consequence of the development of an early conception of an internal working model (Bowlby, 1969) where the emerging self is represented, as well as the relationships with the social partners. Thus, relationship learning is part of an intergenerational transmission process (cf. Figure 1).

[Insert Figure 1 here](#)

Figure 1 visualizes the individual developmental life history which is roughly differentiated into childhood, adolescence and adulthood (for a more detailed discussion of the life span from an evolutionary perspective see Keller, in press), as being informed by fixed and open genetic programs, thus covering genetic as well as cultural transmission between generations. During the adult phase, individuals create socialization contexts for their offspring, which are contingent upon their own biographical history and their eco-cultural present. Infants actively acquire their social matrix and learn specific modes of relationships within these contexts. Together with horizontal experiences in their eco-cultural environments they proceed through the biographical cycle facing the same developmental tasks.

In our understanding, relationship learning is situated mainly in the earliest developmental period covering about the very first months of life. At about three months of age, a developmental transition is postulated in very different cultures. In the Western literature it demarcates the first bio(social) behavioural shift (Emde, 1984; Cole & Cole, 1989), with a first developmental result in the processes of relationship formation (Keller, 1992) when a sense of an emergent self is formed (Stern, 1985). In India, there are ceremonies at about the same time where the infant is exposed for the first time to the sun and the moon (Saraswathi & Pai, 1997, p. 75), thus also opening new developmental contexts. The first three months form the first stage of the reception phase of development (Keller & Eckensberger, 1998; Keller, 1998). This phase extends over the first two to three years with the result that the biosocial infant has developed into a cultural child who is recognizable as a member of a distinct culture in terms of appearance and behaviour. The following considerations therefore address specifically the first few months of life.

Infants and Caregivers: Biological Preparedness for Relationship Formation

Infants are equipped from birth on and even before with specific predispositions (epigenetic rules, central tendencies; cf. Keller, 2000b) to support their own growth and development.

They attract their caregivers' attention, with a repertoire of infant characteristics like the 'Kindchenschema' ('babyiness', Lorenz, 1943), and by retaining juvenile characteristics, which may stimulate surveillance and protection, also from non-family members ('neotony', Mayr, 1982), particularly in cultures where infants are the property of the community, like among the Cameroonian Nso (Yovsi, 2001). Because of their social nature, infants prefer the human face over other perceptual displays (e.g., Fantz, 1963) and behave differently towards persons as compared with objects (Brazelton, Koslowski, & Main, 1974). They expect responsiveness from their social environment as still-face studies clearly demonstrate (cf. Weinberg & Tronick, 1996). They detect event as well as person based contingencies (Keller et al., 1999) and process meaningful language units (phonemes) from their linguistic environment (Keller, 2000c). They are sensitive to stimulation and experience relief from comfort. However, infants are not passive recipients of parental treatment, but participate actively in the acquisition of the relevant information for the construction of the early social matrix (Keller & Eckensberger, 1998; Keller & Greenfield, 2000).

Due to the ‘physiological preterm birth’ (Prechtl, 1984) which needs not only to be seen as caused by hominid brain growth, but constitutes an adaptational pattern in itself, allowing to invest all resources into growth and development (Keller, in press), newborn infants are highly altricial in many respects. Although they can see, vision is still imperfect, since convergence and acuity are not yet mastered (Kaufmann-Hayoz & Van Leeuwen, 1997), vision and movement are not yet coordinated, and the memory span covers only about one second. Therefore, they need a special co-designed (‘fitting’) caregiving environment, which can compensate and complement their behavioural inflexibility and shape the behavioural repertoire that is appropriate for the respective eco-cultural environment. For this purpose also caregivers are endowed with behavioural predispositions to care for and interact with babies.

Humans from about two to three years on display parenting skills which enable them to perceive and process the communicative cues from babies and react in an appropriate manner. We adopt the ethological conception of behavioural systems as relatively independent functional units that comprise behaviours that are coordinated to achieve specific goals, which regulate the interaction intentionally and/or intuitively (Bowlby, 1969; Hinde, 1982). They are activated and terminated by endogenous and environmental cues. Our conceptualising of parenting systems is more comprehensive than the caregiving system as defined in attachment theory as the subset of parental behaviours, which promote proximity and comfort when the child is in real or potential danger (Cassidy, 1999). It also cuts across descriptive systems like maternal and paternal system (cf. Harlow, Harlow, & Hansen, 1963) or the systems of teaching, feeding, and playing (e.g. Cassidy, 1999). We assume that parenting is organized as a pervasive style that is composed from different systems pertaining the whole of interactional experiences with all caregivers.

These behavioural regulations are mainly performed intuitively and non-intentionally and not based on an understanding of why they are performed (e.g., Papoušek & Papoušek, 1991; Heyes & Dickinson, 1993; Keller et al., 1999). Individuals seem to allocate parental investment differentially into their offspring depending on an intuitive calculation of fertility and mortality rates (Dienes, Altman, Kwan, & Goode, 1995; Hasher & Zacks, 1984; Hill & Hurtado, 1996). Also, biological marker variables like sex, age and birth order influence caregiving and psychological parenting on an implicit basis (Trivers & Willard, 1973; Sulloway, 1996; Keller & Zach, in press). However, parenting constitutes also a culturally shared activity with explicit scripts about what is considered good or bad for infants. Motor handling in order to increase the speed of development is an example of an explicit parenting strategy in many African societies (Keller, Völker, & Yovsi, in prep a; Keller, Yovsi, & Völker, in prep. b).

Generally parenting comprises the motivation to care for the infant by nursing, consoling and comforting when distressed, responding to the communicative signals and stimulating growth and development. Mainly family and close kin are involved in early child care with the mother being the primary caregiver during the early months virtually all cultures, even if allomothering or multiple caregiving arrangements are prevalent, like in the Central African Efe (Morelli & Tronick, 1991; Tronick, Morelli, & Ivey, 1992) or in contexts with extensive paternal care like the Aka, also in Central Africa (Hewlett, 1991; Munroe & Munroe, 1997). Nevertheless, fathers' absence has detrimental effects on e.g. child mortality (Hurtado & Hill, 1991). The interplay between the infant, the caregiving persons and the caregiving environment form individually unique socialization contexts, which represent intuitive regulations and are defined in terms of cultural scripts.

Component Model of Parenting

So far a general conception of parent-infant interaction has been presented. In the following paragraphs, this conception will be differentiated into functional units. We propose to understand caregiving and psychological parenting as occurring within behavioural systems that are considered to have evolved to answer adaptive problems of our ancestors, which arose during different stages of the evolutionary past. We adopt the ethological conception of behavioural systems as relatively independent functional units that comprise behaviours that are coordinated to achieve specific goals, which regulate the interaction intentionally and/or intuitively (Bowlby, 1969; Hinde, 1982). They are activated and terminated by endogenous and environmental cues. Our conceptualisation of parenting systems is more comprehensive than the caretaking systems as defined in attachment theory as a subset of parental behaviours, which promote proximity and comfort when the child is in real or potential danger (Cassidy, 1999). It also cuts across descriptive systems like maternal and paternal systems (see Harlow et al., 1963) or the systems of teaching, feeding, and playing (e.g., Cassidy, 1999). We assume that parenting is organized as a pervasive style that is composed from different systems pertaining to the whole of interactional experiences with all caretakers. Parenting systems are thus sets of behaviours that can principally be executed by anybody. We differentiate the parenting systems 'primary care', 'body contact', 'body stimulation', 'object stimulation', and 'face-to-face exchange' as exhaustively describing the experiential array of infants during the first months of life. The psychological processes and consequences that are initiated within the behavioural framework of the systems are modulated

by caregivers' characteristics that fine grain the interactional style. We define these characteristics, basically the mode of attention (exclusive or shared), sensitivity more towards positive and/or more to negative infant signals, contingency in terms of prompt reactivity, and emotional warmth as constituting interactional mechanisms. All mechanisms can be effective within all systems of parenting. This does not exclude that the various systems promote specific mechanisms differently. Systems and mechanisms are considered as universal components of parenting, which are triggered, in different compositions due to different environmental demands. The parenting systems constitute mainly explicitly shared cultural conceptions, the interactional mechanisms may operate more on an intuitive basis. The parenting systems together with the interactional mechanisms represent parental investment contexts differing with respect to energy, time, attention, and emotional tone that are directed to the infant. As such the abundance or scarcity of resources and the 'reproductive value' of the respective child in terms of gender, birth rank and parental age inform intuitive cost-benefit calculations (cf. Keller & Zach, in press). Thus, the flexible organization of parenting allows adaptations to a given situation on a universal scale (cf. Rothbaum et al., 2000; Keller et al., 1999; Keller, 2000a).

Parenting System 1: Primary Care

Providing primary care for infants in terms of food, shelter and hygiene characterizes any parenting effort and represents certainly the phylogenetically oldest part of the parenting systems. Feeding rates in birds (Borgerhoff Mulder, 1990), caloric consumption with nursing in primates (Paul & Volland, 1997) and other measures of parental energy are assessed as descriptors of parental investment, also in other species than humans. The expenditures into primary care, however, may vary tremendously. Under extreme circumstances of poverty and environmental stress nursing may form the main maternal investment that a woman can offer. Hitchcock and Minturn (1963) described the rearing environment of Indian Rajput babies as if adults would not pay much attention to them. They were nursed, only when they cried in some cases with remarkable time delays (cf. also De Vries, 1984, for Masai babies).

The psychological function of the parenting effort as expressed in the primary care system would consist of reducing distress (Hitchcock & Minturn, 1963), rather than initiating positive behavioural states or sharing enjoyable moments. With the promptness that an infant receives primary care and, thus, experiences relief from pain and distress, security and trust into protection (in the availability and reliability of others) are developed as a primary dimension of the

emerging self (Bowlby, 1969; Bischof, 1985; Erikson, 1950). In some cultural environments where health and survival are the utmost socialization goals, anticipatory responses to infant distress further promote closeness and interpersonal fusion (Yovsi, 2001; Rothbaum et al., 2000; Keller et al., in prep. c).

Cultural practices are matched by systems of beliefs and attitudes (Keller, 1996), when for example the Rajput mother insists ‘... that all children are alike’ (Hitchcock & Minturn, 1963, p. 317), thus explaining that no special attention has to be paid to infants beyond their physical needs. Equally Ochs and Schieffelin (1984) reported that the Kaluli of Papua New Guinea see their babies as creatures who have ‘no understanding’, thus explaining why they do not talk to them. Parenting consisting solely of providing primary care for the infant, may be characteristic for circumstances that are characterized through extreme mortality, especially high infant mortality. The psychological costs of individual bonding, the disappointment to the mother if the child dies (Cormack, 1974, p. 3), and the grief over the loss would hamper sustaining the functioning of life.

Parenting System 2: Body Contact

A second system of parenting can be defined by body contact and extensive carrying. In many different eco-cultural contexts, infants are carried on the bodies of their mothers for a substantial part of the day, mainly tied to the back or astride the mother’s hip with her arm around them (for example the Aka Pygmy mothers carry their infants for about 8 hours a day, Hewlett, 1991; cf. also !Kung, Barr et al., 1991; or the South American Ache infants spend about 93% of their daylight time in tactile contact with mainly the mother, Hill & Hurtado, 1996; ‘back and hip cultures’, LeVine, 1990).

Carrying a baby prevents him or her from exposure to dangers that threaten life like fire and/or poisonous animals on the ground. Body contact in terms of carrying, clinging and grooming in primates supports bonding between mother and infant as well as group coherence (Harlow & Harlow, 1962; Dunbar, 1996). Hofer (1987) describes bodily regulation even in rodents as a phylogenetically old attachment system. The psychological function of body contact mainly consists of the experience of emotional warmth. The permanent close vicinity of the mother and other significant caregivers and the resulting body stimulation seem to foster an emotional bond that establishes a major transmission mechanism for the development of feelings of relatedness and belongingness.

These feelings seem to be associated with the acceptance of norms and values from the previous generation, preparing the individual for a life which is based in harmony and hierarchy among family members or the primary social group (cf. Keller et al., 1999). Yet, parental investment in terms of body contact allows to continue to participate in subsistence labour, e.g. through farming, fetching water, cooking etc., although carrying a child might compete for a mother's time with other resource-producing activities (Hill & Hurtado, 1996).

Although the primary care system and the body contact system have definite psychological consequences, they are obviously not uniquely human, since they can be observed in many other species as well. The following three systems --two stimulation systems and the face-to-face system-- are not found in other species as humans.

Parenting System 3: Body Stimulation

The third system of parenting is also based in body communication, but as an exclusive dyadic activity. Mothers, but also fathers (like the South American Yanomani, Keller, Schölmerich, & Eibl-Eibesfeldt, 1988) stimulate their infants by providing them with motorically challenging experiences through touch and movement, observe the reactions and modulate their own behaviour accordingly. Parental care in terms of body stimulation is an individual response to an individual child.

Body stimulation, which is usually not of long temporal extension, can be functionally related to motor development. The motor precocity of the African infant (Super, 1976; Geber & Dean, 1959) has been interpreted as a consequence of early stimulation patterns (Bril, 1989). The specific African body stimulation pattern is based in ethnotheories, like the Nigerian Yoruba concept of mobility and the Nso concept of proper developmental stimulation (Keller et al., in prep. a), expressing an appreciation for increasing the speed of development, since children who walk early can start training household responsibilities early, like running errands (Ogunnaike, 1997). Also, Indian baby bathing and massaging have been demonstrated as accelerating developmental progress (Walsh Escarce, 1989; Landers, 1989).

The psychological function of body stimulation might generally consist of intensifying body perception and, thus, the discovery of the own body effectiveness in relation to resources of the environment. The body is experienced as 'agent' situated in the environment (Rochat, 1997, p. 99) and, thus, the emergence of a body self is promoted. This might be especially adaptive in environments where early motor development like walking helps controlling environmental

hazards, and where body capabilities necessary for subsistence and survival are essential, like in foraging societies. Body stimulation might further enhance somatic development, for example, in order to prepare an organism for early reproduction and prepare children for social training.

Parenting System 4: Object Stimulation

The object stimulation system is aimed at linking the infant to the non-personal world of objects and the physical environment in general. Early object stimulation is pervasive in Western industrialized societies where the objects may replace the caregiving person (Keller & Greenfield, 2000). Object stimulation is also popular in urban contexts of non-Western societies and is more and more recognized also in traditional communities with the explicit expectation of fostering cognitive growth (Keller et al., in prep. b; Yovsi, 2001). It focuses on shared extradyadic attentional processes and thus initiates and supports metacognitive conceptions. Object stimulation is closely related to exploratory activities (Keller, 1992). However, not all parents over the world value exploration as much as Western parents do during this early life span. For example, Rothbaum and colleagues (2000) proposed to replace exploration by accommodation as related to attachment for Japanese developmental trajectories. The psychological function of early object stimulation consists in nurturing the cognitive system and disengaging the infant from the dependency of social relationships at the same time.

Parenting System 5: Face-to-Face

The fifth parenting system consists of face-to-face exchange, which is especially characterized through mutual eye contact and the frequent use of language (Keller, in press). The evolution of language has accordingly been interpreted as an attachment mechanism, which allows group coherence in larger social units. Dunbar (1996) regards the function of language development during human evolutionary history as ‘acoustical grooming’. The parental investment into the face-to-face system consists mainly in the exclusive devotion of time and attention into dyadic behavioural exchange. Face-to-face episodes cover only small parts of infants’ daily experiences. In a study to assess the social experiences in first- and later-born German three months old infants, we found 75 minutes (firstborns) and 66 minutes (laterborns) of situations allowing face-to-face contact with all available caregiving persons over a twelve hour observation period. The

episodes were spersed over the day and might interrupt other activities, like diaper changing (Keller & Zach, in press). Face-to-face exchange follows the rules of pseudo dialogues providing the infant with the experience of contingency perception. Through the prompt answers towards communicative signals, the infant can perceive him- or herself as the cause of the parental action. Thus the infant is informed about his or her uniqueness and self-efficacy (Keller, 1998; Keller, 2001). Warmth in face-to-face situations constitutes an independent mechanism (Keller et al., 1999; Lohaus et al., submitted) and is mainly experienced through sharing (positive) emotions, which may prompt feelings of relatedness. The prevalence of the face-to-face parenting system is especially salient in contexts where competition defines the social structure. Especially Western industrialized societies as well as middle and upper middle classes in traditional societies favour parenting practices which are dialogic in nature. In accordance with these practices, cultural beliefs stress the importance of individuality and early independence.

Interactional Mechanisms

As has been argued, interactional mechanisms are considered to modulate psychological consequences within the parenting systems. They are conceived of as basically independent of the parenting system and from each other. Yet there are different probabilities of co-occurrence of mechanisms and systems, for example the contingent reactions to negative infant signals can be mainly located in the primary care system, or contingent reactions to positive infant cues can be mainly bound to the face-to face system. The interactional mechanisms will be outlined in the following paragraphs.

Attention

Cultures differ with respect to the attentional patterns that are prevalent in child care. In the Western urban middleclass where most of the interactional studies reported in the literature were conducted, an exclusive dyadic attentional focus of the caregiver, usually the mother, towards the infant is assumed to represent adequate parenting. Attention towards infants' signals is part of the definition of the conception of sensitivity (Ainsworth et al., 1978), which is one of the major assessment tools of interaction quality in empirical research. Yet exclusive attention is a precious resource that caretakers in most of the child rearing contexts cannot afford to allocate extensively. The more popular attentional pattern of caregiving all over the world is constituted by shared

attention (Rogoff et al., 1993), conceptualising caregiving as a co-occurring activity (Saraswathi, 1994). In these cases, the caretaker, also usually the mother, attends to extradyadic activities like daily chores as well as the baby who is in close proximity at the same time. Co-occurring caretaking is considered as the culturally appropriate way in many environments where women's economic contribution to the maintenance of the family is needed and mother-infant separation is considered as inadequate. West Cameroonian Nso women watching videotapes of Nso mother-infant interactions emphasized that the infant should be carried on the left side; carrying the infant on the right arm is not good, because it does not enable the mother to carry out other chores effectively (Keller et al., in prep. b). Co-occurring attention mainly focuses on negative infant signals whereas exclusive dyadic attention is mainly directed at the infant's positive interactional cues.

The pattern of shared attention is perpetuated with older children. In a comparison of attention seeking efforts and caregivers' responses of African foragers (Efe) and European-American middleclass (Salt Lake City) participants, Verhoef and colleagues (in press) report that Efe children rarely made bids for attention and Efe caregivers rarely interrupted their conversation with the interviewer to attend explicitly to their children. They rather tried to simultaneously attend to the needs of their children who were trying to work a difficult object and to the requirements of the ongoing interview. Salt Lake City toddlers on the contrary repeatedly sought to become the caregivers' primary focus of attention by frequent attention seeking bids. Their mothers were likely to interrupt their conversations to attend to children. A similar picture emerges from observations with mothers and toddlers for the Indian Dhol-Ki Patti tribe (cf. Mistry, 1993). The women were embarrassed when asked to explore a toy with their one to two years old children, since playing with a child without an ongoing 'useful' occupation is considered as definitely inappropriate (cf. also Keller & Eckensberger, 1998).

Children experiencing co-occurring attention seldom experience being the centre of attention, but at the same time are never alone since also co-sleeping arrangements support cultural ideals of strong and loyal family bonds where every member accepts the place that is assigned to him or her by cultural customs (Nsamenang & Lamb, 1991, for the Cameroonian Nso; Greenfield, 1994, for Zinacantecan Mayan; Rabinovich, 1998, for Brazilians; Rothbaum et al., 2000, for Japanese). The shared attentional pattern informs the child of being a co-agent in a communicative system. The exclusive attention on the other hand that is awarded to a child has consequences for the development of the concept of self as an individually distinct and unique agent.

Sensitivity towards Positive and Negative Signals

As has been outlined with respect to the attentional patterns, differential awareness towards positive and negative infant cues is involved in exclusive and co-occurring attention. Sensitivity towards negative infant signals, prevalent in traditional communities, is mostly equivalent with immediate breastfeeding, which can even be anticipatory to infants' demands. 'Whenever an infant opens the mouth the nipple has to be put in', is the expression of a Nso mother's attitude towards infants' fussing and crying (Keller et al., in prep. b; cf. Rothbaum et al., 2000, for Japanese mothers; Brazelton, 1977, for Zinacantecan Indians: an infant is never allowed to cry from hunger). This parenting strategy thus can be described as minimizing distress. Western middleclass mothers responses to infant's distress signals are mainly reactive in the sense that the infant has to demonstrate the distress before a reaction is probable to occur. Moreover, mothers' first response is almost never breastfeeding, but changing the body position or trying to distract the infant. Only if these interventions do not work, (breast)feeding is being taken into consideration. Due to their exclusive dyadic orientation, Western middle-class parents try to elicit positive interactional cues like looking, smiling, and (positive) vocalizing. This orientation finds its expression in extended face-to-face episodes. This parenting strategy can therefore be described as maximizing positive emotionality.

Besides cultural differences, also interindividual differences, have to be taken into consideration, since caregivers within cultures differ with respect to their individual orientation towards positive and negative emotionality. As neurophysiological studies and research on personality functioning have demonstrated, sensitivity for positive and for negative emotionality are independent functional systems, which are based in different areas of the brain (Kuhl & Völker, 1998; Völker, 2000).

Warmth

Warmth has been recognized as an important ingredient of parenting across many different cultures (Rohner, 1986) since the early parenting style studies during the fifties and sixties of the last century (Becker, 1964; Schaefer, 1959), mainly as opposed to parental control (e.g. Kagitcibasi, 1997). Warmth is described as giving and expressing affection and positive affective exchange (MacDonald, 1992), openness and accessibility (Baumrind, 1971), nurturance, understanding, empathy (Hetherington, & Frankie, 1967). Behavioural expressions like hugging,

kissing or holding are indexed as expressing warmth. MacDonald (1992) conceptualised warmth as an independent parental quality with consequences for the development of early attachment relationships. As contrasted to the conception of security, which is mainly related to negative emotionality, warmth is considered as representing positive emotionality.

Parental warmth during infancy can be expressed in close body proximity. The function of body contact in primates, especially grooming, has been qualified as fostering group coherence. Different primate societies spend up to 30 % of their waking hours with reciprocal grooming, which affects the release of endorphins, helping to soothe the groomed partner and hence allows the development of trust (Dunbar, 1996). Body contact warmth also mediates emotional regulation in the human infant, for example, reducing negative affect (carrying and close proximity are the worldwide most popular responses to distress, cf. Keller & Schölmerich, 1987). Warmth in early parent-infant interactions is also mediated by empathic affect in tonal/vocal parameters of the voice and in the sharing of affective displays in face-to-face exchange.

Warmth generally seems to play an important role for the development of social and emotional competence (Maccoby, & Martin, 1983; Mize & Pettit, 1997); it is considered to be an important condition for the development of altruism and sharing (Radke-Yarrow, Zahn-Waxler, & Chapman, 1983, Staub, 1979). Besides fostering social coherence, warmth seems to relate to the development of social imitation and role taking. Within the context of social learning theory (Bandura, & Huston, 1961), it has been demonstrated that children imitate adult role models more when these display warm and affectionate behaviour (as well as powerful models, Bandura, Ross, & Ross, 1963) as compared with cold and distant behavioural models. Maternal nurturance increases imitation from daughters (Mussen, & Parker, 1965) and parental warmth predicts identification with parents (Hetherington, & Frankie, 1967). Warm and positive affectionate parent-child relationships ‘... are expected to result in the acceptance of adult values by the child, identifying with the parent, and a generally higher level of compliance...’ (MacDonald, 1992, p. 761f).

Contingency

In interactions with babies, parents (as well as caretakers in general) display a propensity for prompt responsiveness to infant cues. Prompt reactivity accordingly is part of different conceptions of parenting, such as the Ainsworth’s sensitivity rating (Ainsworth et al., 1978) or

intuitive parenting (Papoušek & Papoušek, 1991). There are different time spans reported in the literature which are considered as prompt, ranging from two seconds (Millar, 1972) to between five and seven seconds (Perrez et al., 1983), mainly as responses towards distress signals. There is also evidence, that parents in fact respond much faster to a substantial part of infants' non-distress signals within a latency window of 200 to 800 msecs (Papoušek & Papoušek, 1991; Keller et al., 1999; Lohaus et al., 1997). The necessity of the short time span seems to be related to infants restricted memory capacity, since habituation studies have demonstrated that infants do not learn that events belong together if the distance between them exceeds one second (Stang, 1989). The parental contingency matches infants' contingency detection mechanisms, which are present from birth on (Gewirtz, & Pelàez-Nogueras, 1992). The perception of temporal relationships is discussed to constitute a general mechanism of information processing which includes social as well as non-social events (Tarabulsky et al., 1996). With this capacity, infants can relate events to their own actions (cf. Watson, 1967, 1971). Contingency perception does not seem to be dependent upon specific affective displays, although infants enjoy matched affect (Meltzoff, 1990). However, infants' experience of environmental as well as behaviour based contingencies result in positive affect, whereas the violation of contingency expectations -- e.g. during still face situations (Ellsworth, Muir, & Hains, 1993) -- is accompanied by negative affect and distress. Thus, contingency detection seems to be self rewarding.

The function of the contingency experience based on non-distress face-to-face interaction is considered to promote the acquisition of early perceptually based self knowledge (cf. Neisser, 1993), by learning that behaviour has consequences (Lewis, & Goldberg, 1969) and by seeing their actions reflected in others (Bigelow, 1998). Consequently, has been related to the development of beliefs about personal effectiveness (Skinner, 1985) and the predictability of the behaviour of others (Lamb, 1979). The developmental consequence of the contingency experience during early interactions can, thus, be linked to the development of control beliefs which determine a conception of the self as a causal agent (Keller, & Eckensberger, 1998).

Conclusion

We have proposed to understand parenting within an evolutionary framework. It is assumed that humans are basically equipped with a set of functionally independent parenting systems and interactional mechanisms which can form contextual and culturally informed alliances. The

flexibility of the behavioural organization allows to adapt the socialization environment for small infants and the developmental goals of the respective community. The substantial environmental receptivity of the human brain during the early months of life, and learning based in open genetic programs allow to process the early experiences in order to form a modal conception of the self which balances the relationships between the psychological dimensions security (secure self) nourished from the primary care system and contingency towards distress, relatedness (social self), rooted in the body contact system and warmth, body awareness (body self) as mirroring the stimulation context and individuality and distinctness (mind self) based in the object stimulation and the face-to-face system, with contingency towards positive infants' signals and exclusive attention.

The different components (systems and mechanisms) can be regarded as representing a reaction norm, i.e. the organism's ability to respond 'correctly' under different circumstances. 'A clear understanding of phenotypic plasticity, as produced by reaction norms, has important ramifications for all studies of human social behaviour, since much of what we call culture may simply be the result of evolved reaction norms in varying contexts' (Hill & Hurtado, 1996, p. 14). Thus, existing phenotypes do not represent infinite, randomly composed patterns. Environmental challenges promote a single or a few solutions for specific life history problems. For example, the co-occurrence of the primary care system and the body contact system are conceived of in the literature, as an agrarian or paediatric parenting strategy (e.g., LeVine, 1974, 1994) which is differentiated from urban-industrial or pedagogical parenting, in which the face-to-face system is emphasized more (cf. Keller & Eckensberger, 1998; Keller, 1998). These different types have been related also to different developmental goals. The agrarian pattern, thus, represents a more interrelated life style whereas the pedagogical parenting is more related to individualistic developmental goals. However, the variability in the degree of co-occurrence or overlap as well as the variability in the expression of the two modal types is substantial.

We see at least two lines of evidence to support the view of universal propensity and contextual sensitivity of the parenting systems and interactional mechanisms:

1. All systems and mechanisms can be identified in the diverse cultural environments, although differing substantially with respect to the amount and duration of occurrence. In one study Keller, Schölmerich, and Eibl-Eibesfeldt (1988) have demonstrated that the face-to-face system exists in cultures, as far apart as Germany, Yanomami Indians and Trobriand Islanders, following the same interactional structure with parents framing the gazes of their infants, even though for different amounts of time. Within this system, a preponderance of contingency towards positive interactional signals can be observed across different cultural contexts

(Keller, Chasiotis, Runde, 1992). Also in our recent data base (Keller et al., in prep.

b), we find all systems and all mechanisms in all contexts, although the expressions and the duration seemingly differ.

2. A second line of evidence can be derived from research demonstrating that the experience of formal schooling has an impact on specific forms of parenting. Reports from very different cultural environments have demonstrated that the experience of formal Western style schooling is associated with an increase in face-to-face contact in parenting, the use of language, and object stimulation during interactional situations. Greenfield and Childs (1991) have observed this pattern of change in Zinacanteco Indians, Richman and colleagues (1992) in Mexico, and Nsamenang and Lamb (1991) in Cameroonian Nso people (for a summary see Greenfield & Cocking, 1994). The emergence of previously unpopular styles of parenting cannot be attributed to imitation (there are no role models available) or instruction (parenting is not part of the school curriculum). The emergence of the changed patterns of parenting is contingent upon the changing patterns of life as initiated through formal education.

The conception presented here captures intergenerational continuity as well as change in reaction to economic, social and societal demands. From this viewpoint, cross-cultural as well as interindividual differences are interpreted as psychological adaptations without assuming one normative pattern of relational development, as is still claimed in attachment theory (e.g., Sroufe & Waters, 1997). Our conception prevents us from accentuating cultural differences as deficit parenting when the Western pattern is not met. Also the Western romantic ideas of perceiving traditional parenting as the natural way seems to represent basically a myth. In fact, it is probably impossible to evaluate one parenting style in terms of the cultural standard of another. The proposed component model of parenting allows to discover cultural conceptions of parenting as well as their qualitative and quantitative variations.

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