On Being Moved
From Mirror Neurons to Empathy

Advances in Consciousness Research

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On Being Moved: From Mirror Neurons to Empathy
Edited by Stein Bråten

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Introduction

Examining the origins, neurosocial support, and therapeutic implications of (pre)verbal intersubjectivity, and with a focus on implications of the discovery of mirror neurons, this collective volume brings together lines of research that jointly hold the promise of a paradigmatic revolution. Pertinent new findings and results are presented on these topics:

i. The matrix and multiple layers of intersubjectivity and empathy
ii. The mirror neurons discovery, and origins and neuro-social support of intersubjectivity and other-centred participation
iii. From preverbal sharing and speech perception to meaning acquisition and verbal intersubjectivity
iv. Implications and applications of the intersubjective matrix in therapy, intervention, and music.

Serving as proceedings of the Theory Forum Symposium on "Foundations of (pre)verbal intersubjectivity in light of new findings", The Norwegian Academy of Science and Letters, October 3–5 2004, the present volume may be seen to be a sequel to at least three previous publications.

First, it follows up the proceedings of the first Theory Forum symposium in the Academy ten years earlier. This resulted in the collective volume *Intersubjective Communication and Emotion in Early Ontogeny* (ed. by Stein Bråten 1998, and now re-issued by Cambridge University Press as a paperback (2006)). Here were brought together for the first time seminal authors whose findings had challenged psychological theories of child development and pertinent comparative distinctions in psychopathology, primatology, and neuroethology.

Second, it has links to a symposium on implications of the mirror neurons discovery, held at the Hanse Institute for Advanced Study, Delmenhorst July 5–8 2000, which resulted in the John Benjamins proceedings *Mirror Neurons and the Evolution of Brain and Language* (ed. by Maxim Stamenov & Vittorio Gallese 2002). Here, in addition to evolutionary, communicative and language implications, functional interpretations and learning contexts applications were examined, including models of perception and learning by imitation.

Third, earlier in the same year that the Theory Forum symposium underlying the present volume took place, Daniel Stern (2004) published his book on *The*

Present Moment in Psychotherapy and Everyday Life in which he lays out in Chapter 5 what he terms 'The intersubjective matrix' with reference to recent developmental and neuroscience findings that invite a revolution in our understanding of the roots, nature, and implications of intersubjectivity.

A paradigmatic revolution

The intersubjective matrix entails *inter alia* two radical turnabouts. First, no longer can be upheld as valid Cartesian and Leibnizian assumptions about monadic subjects and disembodied and self-centred minds without windows to each other except as mediated by constructed or symbolic representations. Modes of participant perception have been identified entailing co-movements with others in felt immediacy, supplementing perception of others in re-presentational mediacy. Second, no longer can be retained the Piagetian attribution of infant egocentricity as a point of departure for children's language acquisition and cognitive development. In the last decades some of the story of human infancy has been re-written, as it were, replacing earlier theoretical views of infants as a-social and ego-centric with a new understanding of infant capacity from the outset for interpersonal communion and learning by altercentric participation.

The first turnabout is partly consistent with what G. H. Mead (1934) emphasized when he refused to the take as a point of departure the monad locked in a cell, and insisted on the priority of the interpersonal. In his posthumous book on *Mind, Self, and Society*, he offers a seminal account of the emergence of preverbal and symbolic intersubjectivity albeit, like J. M. Baldwin (1891) before him, he was not open to the possibility of imitation in the first months of life. The second radical turn was announced 45 years later, when Colwyn Trevarthen (1979) puts forward a description of 'primary intersubjectivity' in human infants, which at first was ignored or contested. Later, pointing out that the human infant's anticipatory cerebral system is prepared for direct perception of the variety of sounds, gestures, and movements that humans afford, he defined 'alteroception', in analogue to proprioception, as direct perception of the other's motivated act (Trevarthen 1986). By now, in line with his definitions, replacing the previous attribution of egocentricity made in Piagetian theories of child development and acquisition of language, infant altercentricity or other-centred participation has been identified (Bråten 1998; Stern 2000/2003: xi–xxxix, 2004; Trevarthen et al. 1998). Already in 1985, in his seminal *The Interpersonal World of the Infant,* Daniel Stern had emphasized the infant in interpersonal communion, and introduced his radical multi-layer model of the four senses of self (and other). This he modifies in an even more radical direction in the new introduction to the paperback version in the light of new findings:

> evidence for the presence of mirror neurons and adaptive oscillators along with the deepening literature on early imitation suggest that probably from the beginning of life, infants have the capacity for what Bråten (1998) terms altero-centric participation or what Trevarthen (1979) has long called primary intersubjectivity. (Stern 2000: xx)

The above are some of the keywords for findings and capacities subsumed in terms of 'the Intersubjectivity Matrix' implying a paradigmatic revolution.

On Part I: Introducing the matrix and multiple layers of intersubjectivity

Thus, as stressed also in the beginning of the prologue to this volume, the story of human infancy has been rewritten in the last decades, replacing earlier theoretical views of the infant as a-social and ego-centric with a new understanding of infant capacities for interpersonal communion and altercentricity. In their prologue, Bråten and Trevarthen (this volume (1)) distinguish these three layers of intersubjectivity remaining operative throughout normal life (Figure 1).

> (III) *Tertiary intersubjectivity* (achieved between 2 and 6 years): symbolic conversation with actual and virtual companions, linked to skills for identifying and using ideas of objects and events, and leading to 2nd order abilities for mental simulation of the mind of conversational companions . . .
>
> (II) *Secondary intersubjectivity* (from about 9 months): objects of joint attention and emotional referencing are brought into play within trusting relations of companionship sometimes inviting object-oriented imitative learning by other-centred participation . . .
>
> (I) *Primary intersubjectivity* (from the first months): direct sympathy with actual others' expressions of feelings in intimate reciprocal subject-subject contact entailing dance-like proto-conversation . . .

Figure 1. Layers of intersubjectivity succinctly specified (to be elaborated in the prologue)

In contrast to the stages in Piagetian theories of cognitive and moral development, in which earlier stages recede and are replaced by higher-order stages, the above tripartite distinction implies that the layers of primary and secondary intersubjectivity continue throughout life to support higher-order layers of intersubjectivity. This conforms to the multi-layer logic of the developmental model of senses of self (and other) proposed by Daniel Stern (1985/2000), who has specified how the earlier self-other senses continue to prevail and support higher order senses of self and other.

In his keynote contribution, Stern (this volume (2)) refers to recent neuroscientific findings that suggest mechanisms for intersubjective phenomena, and to

developmental accounts of such capacities subsumed in terms of the intersubjective matrix. Stern reviews developmental and infancy research findings attesting to the early foundations of primary intersubjectivity – revealed in neonatal imitation and reciprocal engagement in early infant-adult interplay, and supporting the kind of joint attention and object-oriented learning by imitation that follows around nine months, entailing mutual affect attunement and action- and object-oriented participation, which in turn come to support senses of verbal and narrative self and others. Stern points out how developmental and neuroscience findings on other-centred participation have bearings for understanding of processes of change in psychotherapy. He offers insight into the nature and contents of certain moments in psychotherapy and everyday life: critical "*now moments*" entail mini-crisis that may come to be resolved in what he terms "*moments of meeting*", entailing a qualitative leap in the relationship, and with mutual participant perception as one of the characteristics. Such implications and applications are returned to in Part IV of the present volume.

In his key note contribution, Frans de Waal (this volume (3)) reviews expressions of empathy in animals, especially nonhuman primates, and presents a tripartite model of how animals perceive others. It ranges from a core mechanism of emotional linkage arising from a direct mapping of another's behavioural state onto the subject's representations. This Perception-Action mechanism (cf. Preston & de Waal 2002) provides the basis for higher layers in which the other is recognized as the source of felt emotions (Cognitive Empathy). This permits responses to be geared more specifically to the other's situation, thus increasing the effectiveness of sympathetic support, care, or reassurance. Such responses have great survival value in cooperative animals, de Waal argues. At the highest layer, the other's perspective, situation, and intentions are fully appreciated. As in a Russian doll, each earlier layer plays a role in the higher layers, so that even a fully developed empathic layer of attribution and perspective-taking (layer 3) includes and builds upon unconscious emotional reactions (layer 1). Thus, there is here some affinity and consistency with the three layers or modes of intersubjectivity laid out in the prologue (this volume (1)). The inner core of de Waal's 'Russian Doll' model, entailing motor mimicry and emotional contagion, partly corresponds to the first layer or mode of primary intersubjectivity. While the innermost, automatic core of empathy is distinguished by de Waal in terms of affective resonance in an immediate sense, the higher-order layers entail empathy in a cognitive sense and through intersubjective perspective-taking. In these terms he gives many illustrations of consolations and helping by great apes.

On the front cover of the symposium pre-proceedings was used, as the middle part of three illustration, another illustration, a drawing of a chimpanzee holding out a sugar cane for a youngster to lick (Fig. 2 (middle)), based on de Waal's (1996) photo record in his book on *Good Nature*.

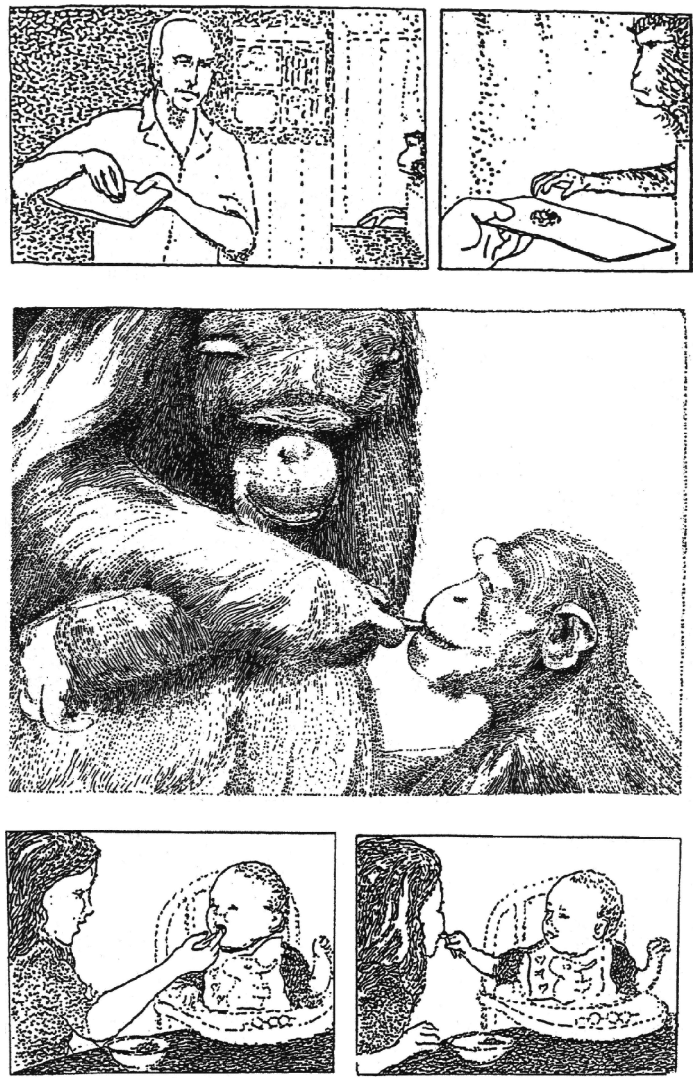

Figure 2. Illustrations of (in)take of food inviting participant perception

Perception of another's grasping or taking in food invites in the observer participant perception as if the observer were a virtual co-author, simulating the other's grasping or intake of food.

(*Top*) The original mirror neurons experiment: When the macaque monkey observes the grasping of a piece of food and when grasping the food by itself, there is a grasp-specific pre-motor neurons discharge in both cases involving the activation of mirror neurons. Now, Ferrari et al. (2003) report the findings of mouth mirror neurons in the monkey ventral pre-motor cortex, referred to in Part II of the present volume.

(*Middle*) Adult female chimpanzee feeds a piece of a sugar cane to an unrelated juvenile at the Yerkes field station, based on photo by Frans de Waal (*Good Natured,* Harvard U Press 1996: 136f.) who presents his 'Russian Doll' model of empathy in this volume (3).

(*Bottom*) As his big sister takes in the spoon with food offered by her baby brother (11 3/4 month) he reveals by his opening his own mouth his other-centred participation in her food-intake (as recorded by Stein Bråten 1996). Drawings, similar to the top and bottom illustrations also appeared in S. Bråten (Ed., 1998: 108, 122), and in Stamenov and Gallese (Eds., 2002: 281), and are returned to in this volume (7).

In Figure 2 we see various illustrations of (in)take of food inviting participant perception, including the original macaque monkey experiment in which single premotor neurons firings were recorded (Fig. 2 (top) drawing adapted from di Pellegrino et al. 1992; Bråten 1998: 122), entailing the discovery of what later aptly were labelled "mirror neurons". We also see demonstrated by the chimpanzee (Fig. 2 (middle)) rudiments of the capacity to hand out or give (which the monkey would be lacking). In turn, the younger chimpanzee's licking may very well have elicited empathy and invited participant perception in the older provider, albeit not in the nature of manifesting by mouth movements other-centred participation, such as exhibited by the 11-month old infants (Fig. 2 (bottom right)).

On Part II: Relating intersubjectivity in humans to the discovery of mirror neurons

The same year that the proceedings of the first Theory Forum symposium were published, portraying the original macaque experiment (Bråten (Ed.) 1998: 122, similar to the top illustration in Fig. 2), Rizzolatti and Arbib (1998) published their seminal paper "Language within our grasp", identifying indirect evidence of a mirror neuron system in the human brain and relating inter alia to Liberman's motor theory of speech perception. That had been partly anticipated (in a Centre of Advanced Study lecture in the Norwegian Academy the preceding year) by this prediction:

> . . . if by way of experimental procedures the neural basis supporting egocentric perception and the neural basis sensitized to support allocentric perception are uncovered in humans, then I would expect that neural systems, perhaps even neurons, sensitized to realize altercentric perception will be uncovered in experiments designed to test and disconfirm this expectation. (Bråten 1997, 1998: 122–123)

Now, while no studies entailing recording of single neurons, can or have been done on humans, all the indirect neurophysiological evidence afforded (reported and examined inter alia by Rizzolatti et al. 2002: 37–59; cf. also contributions by Ferrari and Gallese, by Hari, and by Fadiga and Craighero (this volume (4–6)), indicates that an adapted and sensitized mirror neuron system is the most likely candidate for partial neurosocial support of intersubjective attunement in humans, including participant perception.

Ferrari and Gallese (this volume (4)) present monkey data on grasping and holding neurons, lip-smacking neurons, and lips protrusion neurons. Examining the potential of the mirror neuron system for actions in humans, they compare behavioural studies on synchrony and imitation in human and nonhuman primates, and addresses questions concerning primary and secondary intersubjectivity re-

lated to the mirror neuron system. Their pointed question concerns which neural mechanisms that may underpin our capacity to capture others' living experiences just by watching them, a construction built up in order to respond and re-act very early in life, such as attested by documentation of infant intersubjectivity and alter-centred participation. Ferrari and Gallese posit that the mirror neuron system, together with other mirroring neural clusters outside the motor domain, constitute the functional mechanism at the basis of intersubjectivity, and which they consider to entail embodied simulation. By that they mean an automatic, unwitting and pre-reflective functional mechanism, the function of which is to model objects, agents, and events. By means of such embodied simulation we are intentionally attuned to others.

The phylogenetic gap between advanced tertiary intersubjective capacities for simulation of mind and the mirror neurons discharge in macaques is of course huge, even though a partial basis for participant perception are afforded by the impressive capacity for mirror neurons discharge in the macaque upon sight of another's grasping act and upon own execution of a similar grasping act (Fig. 2 (top)). In the ventral premotor cortex of the monkey (area F5) there are neurons that discharge both when the monkey performs a specific hand action and when it observes an individual making a similar action. The strength of mirror neurons discharge even varies with the action context in which the perceived grasp act is embedded; there is a stronger discharge when the food is seen to be grasped and put in the mouth, than when it is seen to be grasped and put in a bucket (Fogassi et al. 2005: 662). And then, in connection with a seminar of mine at the Human Physiology Institute in Parma, Vittorio Gallese showed me the design with a screen which hides from the sight of the monkey the endpoint of the experimenter's hand grasping the object, allowing only the beginning of the reaching and grasping act to be visible. And yet, even that evokes mirror neurons discharge. This supports the point made by Ferrari and Gallese on embodied simulation. Is is not only a demonstration of the activation of mirror neurons upon observation of parts of another's partly hidden act, but an indication of the macaque's being able to rudimentary simulate the completion of that partly hidden target-oriented act. This may be seen to resemble the kind of simulated completion, albeit at a higher layer of intersubjectivity, that the 18-month old toddlers are doing when exposed to the experimenter who fails to pull the dumbbell apart in Meltzoff's behavioural re-enactment design (cf. Meltzoff & Brooks this volume (9)).

In the proceedings of the Hanse Institute symposium, Stamenov (2002: 249–271), with a view upon prerequisites for linguistic competence, questions attempts to account for "higher cognitive capacities of humans" with reference to the mirror neuron discovery (cf. also Stamenov & Gallese 2002: 7) because even though they have access to mirror neurons, macaques cannot engage in language, or simulate another's mind. True, not only are such higher-order modes of intersubjectivity

beyond their capacities; there are limitations even in bodily capacities for reciprocal resonance and co-movements in the mutual sense of primary intersubjective attunement. While the macaque is able to resonate with grasping (like in Fig. 2 (top)), it is likely to be unable to resonate with an act of giving, since it cannot do what is done by the chimpanzee (Fig. 2 (middle)), who in turn is unable to participate in the kind of face-to-face exchange that is demonstrated by the 11-month old in Fig. 2 (bottom), because that would have required a frame of reference shift in such a face-to-face situation (cf. the contributions by Bråten, and by Billard & Arbib in Stamenov & Gallese (Eds.) 2002: 273–294, 343–352). Such a mirror reversal is returned to by Bråten, this volume (7). Still, we may say that exposure to a manual reaching act, or even to mouth grasping act, such as reported by Ferrari and Gallese, evokes in the macaque a unilateral mode of internal resonance that partly matches that target-oriented act, manifested by the discharge of the same pre-motor neurons that are activated upon own execution of that unilateral target act. And then, when an object is grasped and then eaten, there is a stronger discharge than when an object is grasped and then thrown in a bucket. Even though this is an unilateral target oriented acts, not embedded in bilateral give-and-take interactions (such as specified for human by Bråten 2002: 290n.), such experiments demonstrate a primate basis for the kind of phylogenetic adaptation of mirror neurons systems that may afford part of the neurosocial support of participant perception in human, even infants (cf. also Bråten & Gallese 2004).

Reporting from her experimental studies with her co-workers on human mirroring systems related to the mirror neurons discovery, Riitta Hari (this volume (5)) raises questions inter alia about the potential support of predictions and attribution of goals in social interaction, such as predicting another's doing or saying – predicting the opponent's move in sport, or completing the speaker who has difficulties in finding the right words, neither of which deserves the term 'true imitation'. (Detailed examples of such participant predictions are given in Chapter 7 (this volume) in terms of other-centred participation). While pointing out that true imitation is likely to require action understanding and to entail learning of new motor actions, Hari distinguishes true imitation from mere release of stereotypic motor patterns, and from facilitation of actions that are already in the observer's motor repertoire, e.g. in spectators watching an athletic performance. For mirroring systems studies of the brain basis for social cognition and dynamic interaction, Hari emphasizes the combination of the temporal accuracy of magnetoencephalographic (MEG) recordings with the fine resolution of magnetic resonance imaging (fMRI). One of the MEG studies reported from was applied to hand movements; when the subject stretched the right arm and hand towards a manipulandum, ending the movement with a pinch of the tip, and when an on-line similar movement was observed, both Broca's region and the primary mo-

tor cortex were activated during both hand movement execution and observation, satisfying one of the criteria for motor mirror neurons being involved.

Broca's area also relates to speech activation. As for the key question about how the mirror neurons discovery may relate to our understanding of the emergence and acquisition of language, Fadiga and Craighero (this volume (6)) afford cues to the origin of language based on electrophysiological data on mirror neurons and motor representations. They inter alia report Transcranial Magnetic Stimulation (TMS) data on how a system in humans motorically 'resonates' when they listen to speech. Their current research is aimed at investigating if and how, during speech listening, tongue motor representations are activated in the listener as expression of an acoustically evoked motor resonance, and as to whether such activation has a role in the perception of speech. According to Liberman's motor theory of speech perception, speech is perceived by matching articulatory gestures, embedded in listened words, on the listener's motor repertoire, entailing that perception and production of speech use a common repertoire of motor primitives represented in the brain as invariant motor commands. Recently this theory has been indirectly supported by a series of neurophysiological data. Brain imaging studies and electrophysiological investigations of motor cortex excitability show that in humans the observation of motor actions activates the motor circuits involved in the generation of the seen movements. Among active areas, the presence of Broca's region suggests a possible evolutionary pathway linking hand action related mirror system to the birth of spoken language. Fadiga and Craighero point to the homology between this newly discovered visuo-motor mechanism and the acoustic/motor matching postulated by the motor theory of speech perception, opening fruitful windows.

The issue of the phylogenetic origin, as well as manifestations in ontogeny of participant perception by infant learners and adult listeners, is pursued by Bråten (this volume (7)). He offers a number of illustrations of how other-centred participation is manifested by preverbal infants and verbal children and adults alike. Like adult feeders, for example, who open their mouth when offering the food to the mouth of the infant or patient their are feeding, when infants reciprocate spoon-feeding, which they can do in the 11th month of their life, they manifest with their mouth movements their participation in the other's intake of the food as if they were taking part in the eating from the other's centre, as it were. In contrast to the Piagetian attribution of an *egocentric* point of departure for children's development of language, requiring decentration in ontogeny as the child matures, Bråten advances the hypothesis that the mirror neuron system has been decentred in hominin phylogeny to allow for infant listening and learning by (m)other-centred participation to cope and take care. In ontogeny, this altercentric capacity for preverbal learning by virtual other participation announces verbal conversation to come with its reciprocal, participant, and simulational characteristics.

As for the phylogenetic support of speech articulation, pertinent findings on the inherited speech disorders in the KE family are presented by Faraneh Vargha-Khadem and Frédérique Liégeois (this volume (8)). They point to a gene mutation and associated language articulation abnormalities found in half the members of the three-generational KE family present with a dominantly inherited verbal and orofacial dyspraxia caused by a point mutation in the FOXP2 gene. The mutation is associated with bilateral morphometric brain abnormalities in cortical and subcortical regions involved in language and speech motor planning, including the inferior frontal gyrus (part of Broca's area), the planum temporale, the putamen, the head of the caudate nucleus, and the cerebellum. More recently, functional Magnetic Resonance Imaging (fMRI) was used to determine the pattern of brain activation associated with the FOXP2 mutation when performing language tasks. They report on the distribution of brain regions involved during covert verb generation, overt verb generation, and overt word repetition. FOXP2 mutation results in abnormal functioning of a cortico-striatal network involved in both covert and overt language processing. Altogether, these results are consistent with the notion that the FOXP2 gene plays an important role in the development of brain circuits that are crucial to the normal acquisition of speech and language.

On Part III: From preverbal to verbal intersubjectivity in child development

Early speech perception and meaning acquisition, windows to intersubjectivity from preverbal sharing, and conversations with invisible companions, are amongst the topics of the contributions in Part III.

Drawing upon research in the Seattle's laboratory on learning and brain science, Andrew Meltzoff and Rechele Brooks (this volume (9)) examine phenomena illuminating the nature of preverbal intersubjectivity, entailing these three windows on preverbal sharing: (a) action imitation, (b) joint visual attention, and (c) sensitivity to intentions related to action or attempted action. The latter involves 18-month old toddlers exposed to the dumbbell experiment in Meltzoff's behavioural re-enactment design. They see the experimenter's failed effort to pull the dumbbell apart and, then, when handed the dumbbell, pulls it apart, demonstrating (with a triumphant smile) to have "read the experimenter's intention". They also report from experiments with 12-month-olds who had experienced being blind-folded. When exposed to a blind-folded adult, they did not turn to follow the gaze of the adult, unlike the control group in which the infants had had no experience with loss of vision and turned to follow the gaze of the blind-folded adult. As Meltzoff and Brooks point out, this experiment affords a nice demonstration of a 'like me / like you' interpersonal mechanism at work. Towards the end of their chapter, they touch upon the question of whether a subserving mirror neuron sys-

tem is brought to experience, or is a result of experience – a question which is also pursued in terms of phylogenetic adaptation and ontogenetic sensitizing nurture by Bråten (this volume (7)).

In her studies of early speech perception, Patricia Kuhl (1998) has shown that the infant's perceptual space is beginning to get closed to sound distinctions that do not make sense in the ambient language. In her contribution with Barbara Conboy (this volume (10)) on the development of a culturally specific way of listening through social interaction, studies are described oriented towards overcoming such early native language closure. Infants acquire language with remarkable speed, although little is known about the mechanisms that underlie the acquisition process. Studies of the phonetic units of language have shown that early in life, infants are capable of discerning differences among the phonetic units of languages, including native- and foreign-language sounds. Between 6 and 12 months of age, the ability to discriminate foreign-language phonetic units sharply declines. In two studies are investigated the necessary and sufficient conditions for reversing this decline in foreign-language phonetic perception. In one experiment, 9 month-old American infants were exposed to native Mandarin Chinese speakers in 12 laboratory sessions, and compared to a control group exposed only to English in the same number of language sessions. Subsequent test of Mandarin speech perception demonstrated that exposure to Mandarin reversed the decline seen in the English control group. In another experiment, infants were exposed to the same foreign-language speakers and materials via audiovisual or audio-only recordings, without any interpersonal interaction, and which turned out to have no effect. Thus, exposure to live interactive speech in another language makes a difference, but not upon video or media exposure to the same speech.

Ivar Frönes (this volume (11)) portrays earlier approaches in sociology and psychology to processes of socialization of the child, as well as views upon (pre)verbal meaning acquisitions that imply that it resists attempts of enculturation and socialization, like Freud's point about the unpleasantness of culture. Some theories conceive of the cultivated individual as under-socialized, while other theories invite the conception of the socialized individual as over-socialized. Emphasizing the dialogical conception, Frönes returns to G. H. Mead and, before him, to Peirce's understanding of communication in the sense that "language has strong idiosyncratic, local, and situation-anchored dimensions." Pertaining to the latter's pragmatics, Frönes' chapter, which also relates to the tripartite distinction of intersubjectivity as primary, secondary, and tertiary, invites this reflection: There is a certain degree of affinity between this distinction and Peirce's distinction between 'Firstness', 'Secondness', and 'Thirdness', which albeit definitions varied concerned, respectively, (i) immediate quality of feeling, (ii) reaction or relating to objects, and (iii) sign mediation and representation. Now, against this background of history of ideas, and given the recent findings, including his own seminal stud-

ies of peer interaction, Frönes offers a re-definition of socialization and meaning acquisition in light of the intersubjective matrix, defined by Stern (2004 this volume (2)), with reference also to Bråten's (1988) postulate about an innate 'virtual other' and distinction of the mode of felt immediacy.

Related to Stern's (1985) 'evoked companion', the child's virtual other may be seen to pertain to the phenomenon of children's invisible companions. This topic is examined by Stathis Papastathopoulos and Giannis Kugiumutzakis (this volume (12)) through their reported studies of five-year old preschool girls. Sixteen preschool girls were interviewed and observed in dyadic play interactions, at the nursery schools. The girls having imaginary companions attribute to them primarily the functional roles of playmate and interlocutor and secondarily the role of a companion in everyday activities. During the dyadic play interactions, the 8 girls with imaginary companions used significantly more of their speech to communicate, than the 8 girls without imaginary companions, and also engaged significantly more often in pretend play and in negotiations about it. During their play with dolls, girls with imaginary companions used them significantly more often as active agents and attributed to them psychological and relational characteristics while acknowledging that they do not really exist. The authors see imaginary companions to emerge naturally because of the inherently dialogical structure of mind and the intersubjective nature of human development. Their findings may leave substance to the assumption that – contrary to what has been surmised from Piaget's line of enquiry and psychoanalytic thinking – a child who overtly engages with her virtual other may turn out to be more socially and emotionally sensitive and competent also in relation to actual others.

On Part IV: Applications and therapeutic implications of the intersubjective matrix

The final Part IV is devoted to applications and therapeutic implications of the intersubjective matrix, as introduced, examined and elaborated in the previous parts, and as defined by Stern in Chapter 5 of *The present moment in psychotherapy and everyday life.* Here he makes the point that

> when people move synchronously or in temporal coordination, they are participating in an aspect of the other's experience. They are partially living from the other's center. (Stern 2004: 81)

This is one of the defining characteristics of what Stern (this volume (2)) terms a "*moment of meeting*", contributing to a qualitative leap in a relationship that has suffered a mini-crisis. Such a moment of meeting entails "a moment of mutual other-centred participation in which both partners create and undergo a joint

experience". This is consistent with how altercentric participation is defined in the glossary to his book as "the innate capacity to experience, usually out of awareness, what another is experiencing [. . .] as if your center of orientation and perspective were centered in the other . . ." (Stern 2004: 241–242). In this definition, in line with Bråten (1998), Stern adds that this is the basic intersubjective capacity that makes such phenomena as imitation, empathy, sympathy, emotional contagion, and identification possible.

Empathy, and the way in which it may be obstructed and collapse in the severely pressed caretaker, is a keyword for the contribution by Karsten Hundeide (this volume (13)). He highlights some of the conditions and processes involved in sensitive empathic care on the one hand and neglect and abuse on the other. Drawing upon experiences from the International Child Development Programme, which he is heading, he describes what occurs when empathic care is obstructed in the caretaker who excludes the child from her zone of intimacy. By "zone of intimacy" Hundeide refers to the way in which a child can be included and cared for through empathic identification and sensitive availability of the caregiver to the child's needs. But a child can also be expelled from the zone of intimacy with subsequent blockage of empathic identification in the caretaker, affective withdrawal leading to neglect and possibly abuse. Finally, Hundeide summarizes the conditions facilitating empathic care and relates these to the newly emerging field of "ethics of closeness" and Levinas' ideas of the "appeal of the face".

Reporting from his work with child psychiatric service in Parma, Andrea Cabassi (this volume (14)) describes processes of intergenerational transmission and circular re-enactment of violence across generations in terms of his notion of 'family disseminate archives' concerning the family, its history, its destiny, its memory across generations. Perturbing cycles of circular re-enactments in parent-child relationship, described in such terms of family disseminate archives, constitute a challenge for psychotherapeutic attempts to break such cycles. As expressed also in poems and texts by Baudelaire, Rimbaud, and Proust, memories are reflected by colours, senses of smell and touch, traces of movements that invite cross-modal perception. Cabassi reports from telling case examples. Critical elements are partly described in Stern's terms of amodal perception, affect attunement, and protonarrative envelope, and in Bråten's terms of felt immediacy, e-motional memory, and altercentric participation. They have been seen to afford cues for counselling and psychotherapy in two cases of perturbed infant-parent relationship and circular re-enactment from which Cabassi reports.

Birgit Kirkebaek (this volume (15)) specifies how music give rise to co-movements during interplay between a singer, beating on drums accompanying her singing, and severely disabled or blind deaf children, giving rise to moments of shared experience and movements. With reference to interplay between a musician and the blind and severely hearing impaired boy, Lasse, her contribution

focuses on the pedagogical significance for special education of the new infant paradigm and of a more open biological orientation. This approach is carried out in various Danish projects involving severely disabled and/or deaf blind children, seeking to establish common experience through improvisation between the child and a musician. She emphasizes that the findings, by Colwyn Trevarthen and other researchers, of a connective link between music and communication offers a promise of helping many children with severe disabilities, afforded behaviour-oriented training strategies. This is because an aesthetic approach entails that all expressions be seen and taken seriously.

Thus, Kirkebaek's intervention approach is inter alia influence by the emphasis on musical movements, which Benjaman Schögler pursues with Colwyn Trevarthen (this volume (16), in their contribution on infants' voices and jazz, on singing and dancing together. They are concerned with simple acts of musicality – the expressive movements of music, their perception, and their power to create, communicate and consolidate narratives of meaning in human worlds. They point out how spontaneous musical expression is created and appreciated in mother-infant play, and give several beautiful examples of the inherent musicality in early protoconversation. They further report the results of musical acoustic analysis of vocal records, interpreting the findings in terms of communicative musicality and co-movements. Their basic paradigm for the movement music cycle is illustrated by a concluding illustration of how a gesture or feeling is translated from the score to the mind of the player who brings forth the music and to the body of a dancer. Their leading question is this: There is something measurable in the patterns of communicative flow and expressive behaviour of music and dance that is measurable – what is it and how is it shared and translated between artists? In an experiment set up for singing and gesturing, they report the results in terms of graphs showing the correspondence between recording, with movement in pitch, and corresponding hand movements. Thereby, they examine how improvisations of a single musical narrative, with coherent meaning, may be produced by periodic synchrony of the gestures of jazz players who only hear one another's intentions and emotions in the recorded instrumental sound.

The editor's concluding comments closes the circle to Stern's contribution (this volume (2)) concerning the nature and role of the present moment in psychotherapy, and to de Waal's (this volume (3)) concern with roots of empathy. Here is first offered an account on how occurrences of altruism by toddlers, such as reported by Anna Freud after the second world war, may be rooted in other-centred participation. Then, the question is raised about why abused children may become abusive towards peers and, later, towards younger victims. Finally, certain critical elements in patient-therapist conversations are commented upon and related to Stern's distinctions and to the three layers of intersubjectivity, distin-

guished in the prologue (this volume (1)), and in the chapter concluding the first Theory Forum proceedings (Bråten (Ed.) 1998: 272–382).

In that collective volume, after having referred inter alia to Damasio (1994), Di Pellegrino et al. (1992), and Le Doux (1993), Trevarthen makes this declaration:

> The brain mechanisms that represent the human body of the single subject in all its intelligent and emotional activities and states are at the same time very extensive, of ancient linage, and greatly elaborated. The mirror system that enables the expression of other individuals' bodies to play a part in regulating emotion and rational activity and learning intersubjectively, the 'virtual other' mechanism (Bråten 1988a, 1994a, b, this volume) must be similarly extensive. It is interwoven with self-consciousness, and unconscious embodiment of motives, at every level.
> (Trevarthen 1998: 47)

This Trevarthen voiced in an appendix on infant intersubjectivity and the brain. The present volume may be seen to follow that up, opening windows to (pre)verbal intersubjectivity in light of new findings, including implications of the mirror neurons discovery.

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PART I

Introducing the matrix and multiple layers of intersubjectivity and empathy

CHAPTER 1

Prologue

From infant intersubjectivity and participant movements to simulation and conversation in cultural common sense

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In the last few decades the story of human infancy that has been told by philosophers and medical and psychological sciences has been re-written. In place of the idea that infants are a-social and ego-centric there is a new understanding that a baby is born with a lively talent for interpersonal communion. The indulgent opinion of parents has received abundant confirmation from careful observational research. Thus micro-analyses of proto-conversations with two-month-olds have revealed that infants are endowed with a cerebral system that enables direct perception of interests and feelings in an other person and responsive attunement permitting delicate, emotionally regulated engagements. Like the processes of altercentric participation found by Bråten (1998a, 2002) to be exhibited in early cultural learning situations, probably subserved by the mirror system recently discovered by Rizzolatti and his co-workers and identified in the human brain (Rizzolatti & Arbib 1998), these characteristics break radically with the assumptions in Freudian and Piagetian traditions which implied a long developmental period of de-centration before sociality and intersubjectivity could emerge.

Modes of intersubjectivity

Today, based on the empirical findings of the last three decades, we are able to distinguish different layers of intersubjective attunement in human development before language. The innate intersubjectivity defined in the 1970s (Trevarthen 1974, 1979; Bateson 1975, 1979; Stern 1977; Bullowa 1979) helps explain the emergence of the toddler's appetite for speech in the mother tongue and indeed for intent par-

ticipation in the learning of all varieties of cultural habits and manners throughout childhood (cf. Bråten 1988, 1998; Bråten & Trevarthen 1994/2000; Dunn 1998; Harris 1998; Hobson 1998); see also Stern's (2000/2003) new introduction to his 1985-book on *The Interpersonal World of the Infant*,[1] and the literature on cultural learning, especially Bruner 2003; Rogoff 1995). Tracing the growth of communication of purposes and concerns through the first two years has brought a richly nuanced account of how the child uses negotiation with other persons' awareness and intentions in the world to grasp meaning (cf. Halliday and others). The following summarises the key steps that prepare the way for and support the elaboration of higher-order competences in communication and thinking, including conversational speech, creation of narrative explanations and sharing myths, beliefs and scientific ideas afforded by the ambient parental culture:

I. The *primary intersubjective dialogues* of protoconversation and reciprocal sympathetic imitation exhibited in the first weeks of life (Bateson, Trevarthen) lead to more lively *jokes and games* rich in emotions of 'other awareness' (Reddy). Initiatives are tested in a teasing and provocative way. Affectionate attachments are strengthened by this play and build friendships around habitual 'formats' or 'rituals' of baby songs and action games (Stern, Bruner) in which the infants learn to take an active part, for example, by an 11-days-old on the nursing table in a dance-like interplay with her mother (recorded 1990 by Bråten). An exchange of imitations and expressions of emotion may be elicited in the first hours after birth (e.g. as recorded 1983 by Kugiumutzakis), the infant showing initiative as well as copying movements, which reveals that imitation to reproduce a movement made by another is but one element in the innate capacity for mutual engagement in two way expression of sympathetic interest (Nagy and Molnár). The mutual mirroring and turn-taking which we find in mature verbal conversation is clearly foreshadowed in these first bouts of sympathetic mimetic play, and the 'communicative musicality' entailed in dyadic protoconversation allows to be captured in terms of the parameter of musicality such as 'pulse' and 'quality' (cf. Malloch & Trevarthen in press). After a few months an infant may show a wider sociability, being capable of engaging concurrently with more than one other.[2]
II. *Secondary intersubjective attunement* in a *triangular* subject-subject-object format (Trevarthen & Hubley 1978) in which objects of joint attention and emotional referencing are brought into play as occurrences of mutual attention within trusting relations of companionship. The infant displays to others of knowledge and skill learned by sharing intentions and interests are animated by emotions of 'pride' and 'shame'. Others' object-oriented acts elicit participant perception or re-enactment, for example by infants who learn to reciprocate their caregivers' spoon-feeding before their first birthday (e.g. as

recorded by Bråten 1996), and sometimes help-oriented co-movements realizing the other's (failed) intention, as in Trevarthen and Hubley's example of Tracy under 12 months 'helping' her mother move an object aside out of the way. In the final months of the first year the words people use to label people, objects or actions attract attention and invite imitation, then after 14 months or so the gestures and vocalisations of 'protolanguage' give way to clear speech. Toddlers soon begin to combine words to predicate linguistically, e.g. "Doggy Wet"; "Ball Roll" (Akhtar & Tomasello 1998) giving voice to shared topics and meanings found in joint and mutual awareness.

III. *Tertiary intersubjective understanding* (Bråten & Trevarthen 1994/2000) in conversational and narrative speech, entailing predication and a sense of verbal or narrative self and other in first-order modes of symbolic communication, and (from 3 to 6 years) second-order understanding of others' minds and emotion (theory or simulation of mind) opens for perspective-taking and emotional absorption, even in fictional others, for self-other dialoguing in dramas of narrative imagination, for simulation of conversation partners' minds, and for listeners completing the speaker's aborted statements by virtue of other-centred participation (Bråten 2002).

We stress the importance of the social-emotional roots and nurture of the development of dialogical competence and consciousness. The emotions supported in affectionate engagements between adult and infants, and soon between peers and with other acquaintances of all ages, are essential to the regulation of normal brain development to the development of the mind's dialogical and creative consciousness, and thus to the common sense of cultural awareness. Emotions are not merely responsible for the natural control of instinctive appetites and aversions that serve immediate survival of the body or give regularity to the baby's feeding and sleep-wake cycles. Emotions that generate the expression in the separate brains of mother and baby can come together in a confluence of affect that develops an organization of its own – an organization moreover that is also reflected in the self-other organization of the developing mind. The shifting between dialogical competence and consciousness manifests itself in intersubjective attunement at various levels – from confluence of affect at the primary level to advanced self-other simulation and constructions at a more advanced level involving internal self-creative and dialogical circles of complementary self-other perspectives.

Thus, a major point here is that such higher-order achievements continue to be supported by capacities and competencies unfolding in the primary and secondary steps or layers, which continue to be operational and supportive throughout life, like the various senses of self distinguished in the multi-layered model by Stern (1985/2000). The kind of mutually fulfilling processes that we have found to be exhibited in early protoconversation and cultural learning situations be-

fore the first year's birthday may be seen to resemble the key characteristics of higher-order speech conversation. For example, teenagers in face-to-face conversation often reflect one another's gestures in much the same way that we observe in early infant-adult interaction, and sometimes complete one another's speech acts akin to patterns manifested also in preverbal object-oriented manual interplay. In dialogue, for example, between speech-competent participants, the "attunement to the attunement of the other" (Rommetveit 1998:360) appears to be prepared for by the mutual, dance-like interplay which we can observe already in the first weeks after birth. That fact that neonates, 45 minutes old or even younger, can imitate facial gestures of the adults to whom they are exposed is evidence of such early readiness for immediate contact with others.

Of course other non-verbal forms of adult human communion share the same vital principles and rhythmic foundations, and these are especially clear in ritual performances, drama, music and dance (see Schögler & Trevarthen this volume (16)).

In the following we offer a succinct characterization of some of the operating characteristics pertaining to the various steps or layers.

(I) *Newborns' imitation and protoconversation in the first weeks and months.* Most parents and caretakers have experienced how their babies in the first months of life complement them in a finely tuned interplay of mutual fulfilling and follow-up of gestures and expressions. Even in the first weeks after birth mother and child can achieve such coordination of expressions and movements in a sort of circular dance of mutually completing and inter-woven bodily motions. There is a primary intersubjective attunement in a reciprocal subject-subject format of protoconversation and interpersonal communion, in which participants attend and attune to one another's emotive expressions and gesture- and sound- producing movements, inviting semblant re-enactment and affect attunement, beginning soon after birth and preparing for and supporting higher-order competencies later in life. For example, pertaining to vocal imitation and speech development, some 45 minutes-olds may attempt to imitate /a/, and 20 weeks-olds /a/, /u/ and /i/). At 6 weeks or earlier infants engage with adults in reciprocal protoconversation. In their early speech perception infants are beginning to 'prune' sounds from their perceptual space that make no sense in the ambient language (Kuhl 1998; Conboy & Kuhl this volume).

In the first weeks after birth infants have been documented by experimental studies to imitate a variety of gestures, such as tongue protrusion, brow motions, and head rotation, finger movements, gestural features used to express surprise, delight and boredom, and vocal (vowel) productions. Most dramatic is perhaps the video documentations by Kugiumutzakis (1983, 1998:74) of how neonates in the first hour after birth attempt to come up with a semblant response, match-

ing his mouth and brow gestures. Inviting even vocal imitation, respectively, of the sounds /*a*/, /*m*/ and /*ang*/, newborns (ranging from 14 to 42 minutes of age) tried to produce a matching /*a*/, while failing with respect to the other invited sounds. Trying hard to emit the sound, accompanied by stretching hand movements and closed eyes, the result was usually an intense explosion of a prolonged and unstructured /*a*/-sound.

Evidence has been obtained of infants' musical listening and natural preference for musical features of the voice. Even a premature newborn baby may actively contribute to the precise rhythmic exchange of vocal songs with a song-like regulation of pitch and timbre (Trevarthen 1993; Malloch 1999). Speech to infants in different languages has universal rhythmic and prosodic features, and rising pitch contours elicit and maintain infant attention more than falling pitch. Unlike the sharply rising pitch contour in maternal vocalization that alerts the infant, the pitch is low and continuous in comforting (Fernald 1992; Papousek 1994). There is a precise regulation of the pitch of a mother's voice and the infants have an innate preference for the range of a happy mother's speech no matter what language she speaks.

(II) *Object-oriented learning by participant participation.* When objects of joint attention and emotional referencing are brought into play, a window is opened around nine months of age for imitative learning of object-manipulation. Bråten (1996) has documented that infants can reciprocate spoon-feeding before their first year's birthday – for instance a baby boy (11 3/4 month), when allowed to take the spoon in his own hand, reciprocates his big sister's spoon-feeding, and even opens his own mouth in the process. When infants reciprocate in this manner they demonstrate that while having been previously spoon-fed they have not just participated by receiving and eating the food, but actually having virtually partaken in the caregiver's spoon-feeding from the caregiver's stance. This entails simulation by altercentric participation in the other's act, similar to what occurs when the caregiver unwittingly opens his or her mouth when the baby opens the mouth to receive the food. Their circular re-enactment of what they have experienced as recipients of spoon-feeding show that they must have been able to participate in the feeder's movements from the feeder's stance – the very reverse of what is seen from an outside, egocentric stance in such face-to-face situations. In order for infants to be able reciprocate the spoon-feeding they must have been able to virtually partake in their caregivers' previous spoon-feeding activity as if they were co-authors of the feeding, even though their caregivers have been the actual authors. This is the defining criteria of learning by altercentric participation (Bråten 1998 this volume (7)).

In almost the same vein we may regard the 18 month old in Meltzoff's behavioral re-enactment design. Watching the model failing to pull the dumbbell apart,