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Embodied Human Intersubjectivity: Imaginative Agency, To Share Meaning

Human beings move coherently as individual selves, body and mind adapted to perform complex activities with imagination, knowledge, and skill; perceiving the environment by engaging it with discrimination and care. Human beings live intersubjectively in communities each with the rituals, beliefs, and language of a culture, along with a history of affective relationships and agreed habits for acting in cooperation. These attachments and cultural habits depend upon an ability to sense the intentions, interests, and feelings of other human selves through sympathetic response to motives and emotions as displayed in the shapes and rhythms of body movement: an ability that infants possess from birth. No brain theory explains this 'felt immediacy' of others' life experience, which philosophers of the Scottish Enlightenment accepted as proof that human beings are 'innately sympathetic'. An innate time sense, capacity to 'attune' to the dynamics of body movement, and ability to recognise serial ordering in 'stories' all appear essential. A theory of 'communicative musicality' employs key parameters of *pulse*, *quality* of movement, and *narrative*, applying them to poetry, music, dance, the prosody and rhetoric of language, and the regulation of skillful practices of all kinds. These elements – present in foetal movements and engaged in through joyful intersubjective 'story-telling' from birth – give direct information on how the human brain orchestrates reflex functions to move the body with sensations of grace and efficiency. Their age-related development leads to mastery of language and cultural rituals. They conduct all cognitive functions and all meaning making.

Keywords: movement, self-awareness, sympathy, imagination, cultural meaning.

MOVEMENT: ITS AWARENESS OF THE WORLD, AND ITS RESPONSIBILITIES IN COMMUNITY

One moves with a body and mind adapted to perform many complex activities with knowledge and skill, engaging energetically and sensitively with the environment. At the same time, people also live in communities, each of which has a culture with rituals, beliefs, and language: a history of habits for acting in cooperation, of 'acts of meaning' (Bruner 1990). These cultural habits change one's awareness of the world and of one another's intentions and perceptions. No other species has such powers of mobility, creativity, communication, and cooperation. But these do not mean that human

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beings are the best adapted for a secure way of life in the future. Acting together, people also transform their environment. As Alfred North Whitehead observed long ago, humans' intelligent creativity and cooperation may threaten their relationship with nature. Writing about how organisms exist, he said:

On the one side there is a given environment with organisms adapting themselves to it.... The other side of the evolutionary machinery, the neglected side, is expressed by the word creativeness. The organisms can create their own environment. For this purpose the single organism is almost helpless. The adequate forces require societies of cooperating organisms. But with such cooperation and in proportion to the effort put forward, the environment has a plasticity which alters the whole ethical aspect of evolution" (Whitehead 1926 p. 138).

Understanding the evolutionary origins of human cultural intelligence – how it is motivated for a special human way of life – may lead to moderating the ethical blunders people may make in fashioning their environment to suit their lives in a highly technical world economy. One may gain a view of human nature that may help one understand what Susan Stuart (2010) calls the 'ethiosphere' of the world's large and powerful societies, empowered by many kinds of machine – including those that pretend to simulate thought but do not possess human motives, with their imaginations and feelings, or the capacity to share them.

I am interested in the innate biology of human creativity: how it develops in individuals from childhood, and how enactive human intersubjectivity and cooperation are motivated and cultivated to generate meaning. I find key evidence from research that studies the sympathy infants and their parents feel for one another's embodied vitality – and for the mental interests, intentions, and emotions expressed by human actions in families, communities, and societies.

A new, more descriptive and less prescriptive, less experimental science of infancy finds evidence from birth of intuitive cooperation in intentions and consciousness. It researches the biology of this shared action and how it develops from conception. The steps by which infants and young children master language and other artefacts of cooperative cultural life – in informal games and formal schooling – give further information on the natural growth of embodied intersubjectivity and how it motivates learning from within the child.

In this article, I will consider the unique adaptations of the human body and its actions for cultural collaboration under these three headings: *SHAPE* is the intricate form of body and mind that determines how the human Self moves in a *behaviour space* of the mind's awareness; *RHYTHM* is how the restless human body acts in an imagined *life time* of its self-created prospects of moving; and *SYMPATHY* is that most mysterious innate ability for sharing one another's acting – in present space and time and through history – in a *cooperative cultural community*. It is how one perceives both intentions and feelings in the shapes and rhythms of self-generated body activity of other persons, how one knows their engagement with their world, and with one's own person, how one builds a fictional world of past achievements and understandings and an imagined future.

First, however, I will recall basic principles of the physiology of any animal's moving with conscious intention.

The physiology of animal agency: Movement with feeling for use in the environment

Every embodied animal-self must be aware of the immediate prospects of acting that will affect its life. The creature must perceive the layout of its surroundings in the changing present of where it is: searching with ‘distance receptors’, taking in knowledge of the affordances for activity of a particular place at a moment of time with the identified objects in it, and testing and tasting the qualities of those objects (von Uexküll 1957, Gibson 1979). Even an earthworm can have a rudimentary self-awareness, with regulation of its ‘liabilities of mobility’ (Merker 2005). As Charles Darwin proved, even the earthworm can show a simple, practical intelligence in taking benefits from particular objects in the world: e.g., cleverly seizing leaves by their pointed ends to draw them underground for food (Darwin 1881).

Animals have a prospective, ‘knowing’-type control of movement: imagining the consequences of actions within their bodies and in engagement with the environment, anticipating sensory consequences, and regulating motor activity with minimal waste of energy (Bernstein 1967, Lee 2005). They have ambitious nervous systems that map their body form and are set to perceive the body-related layout of the world in which they move and with which they maintain integrated behaviour and whole-self well-being in creative, sentient ways: choosing objectives to take nourishment and acting to escape injury or discomfort, as guided by emotions. Prospective regulation of bodily muscle activity is achieved by nerves that provide feedback or *re-afference* to confirm the sensory effects of moving (von Holst 1954): both inside the body, among the vital organs and muscles; and on its surface, in immediate or distal contact with the world.

Such animal intelligence is capable not only of anticipating this experience, in the present moment, for future use; but also of recalling items from the past: modifying motives for action and deploying cognitive and emotional abilities for recognition and appraisal of objects in more adaptive ways. This facility for being ‘imaginatively’ alive through different spaces and times increases with the evolution of more ambitious brains and more mobile and versatile bodies – permitting formulation of a *narrative of events* or of episodes in a remembered lifetime. This story-making in action expands enormously with human intelligence, given its representational semantic memory (Bruner 1990, Tulving 2002, Stern 2004).

Over a hundred years ago, Charles Sherrington described his discoveries about *The Integrated Action of the Nervous System* (1906). He showed that a mammal’s experience depends on three different physiological systems for prospectively self-sensing the body in action (Sherrington 1906, Lecture IX):

Proprioception: dynamic awareness of the physical forces in the body itself. (Sherrington called this the *material me* in movement.)

Exteroception: an activity that detects and discriminates goals for adaptive action at a distance from the body by means of *projicience*. Projicience, in turn, is the imaginative function of object

identification, which expects confirmation of benefits or risks by the "affective appraisal" of "consummatory reactions" when the object is brought in contact with the body or taken into it.

Visceroception: awareness within an autonomic nervous system that regulates and protects inner energy resources, integrating the maintenance of vital physiological functions with assertive acts against the environment while appreciating their beneficial or damaging effects.

Understanding of all this has expanded with research into the functions of autonomic and limbic systems (Hess 1954, MacLean 1990) and the *affective nervous system* at the core of the brain, which defines emotional tendencies through all levels (Panksepp 1998a).

Animals are constituted by their development as embodied and motivated *agents*. They are prepared to act intelligently, with affective evaluation of what they are doing and what they may do. They move under prospective emotional control in an awareness of space and time that is created, in their brains, for integrating use of their limbs and senses. This *life world* (von Uexküll 1957) can be elaborated by learning – but it cannot be created by it.

Like many seeking a natural science of consciousness have argued (James 1890, Sherrington 1906, Lashley 1951, Sperry 1952, von Uexküll 1957, von Holst & von Saint-Paul 1961, Gibson 1966, Bernstein 1967), an evolutionary biologist sees the brain as the generator of a singular, intentional, and feeling-rich consciousness -- that 'knows', in a general way, what any of its body's movement will do or lead to; that 'expects' the effects of stimuli in a body-centred world; and that can 'project' or associate internal, autonomic regulation of vital states onto items of experience, to give situations and objects qualities of affect or feeling. The evidence from embryogenesis is that the integrative neural mechanism is mapped in such a way as to generate prospective movement in a *field of behaviour*: one fitting the form and functions of the body, with its appropriate effectors and receptors and internally felt needs (Trevvarthen 1968a). In this behavioural field, different innate adaptive *modes of activity and awareness* guide complementary functions, enacted by moving bodies: sustaining physiological well-being, guiding locomotion through the media of the surrounding world, performing selective attention to local objects that may be identified for their life-giving or dangerous potential, and eliciting cooperation from social partners in vital activities (Trevvarthen 1978). (Figure 1).

Figure 1 -- Left: The behavioural field of a frog, and its map in the frog's brain. Potential food is perceived in the right, peripheral field of vision and is subject to estimation of its nature via *projicience*: the frog orients to bring the food to the centre of awareness, where it can be confidently identified; then it swallows the fly and makes *affective appraisal* by taste. Right: The muscles that regulate – and are regulated by – vision in a human being. Visual experience is transformed by (1) locomotion, (2) changes of posture, (3) head movements, (4) conjugate rotations of the two eyes, (5) accommodation of the lens, (6) dilation or constriction of the pupil, and (7) hand movements under visual attention or movements of an object manipulated by the hand.

The psychobiology of shared feelings of agency and social cooperation

Cooperation toward various life-supporting tasks within a community of animals – e.g., toward reproduction, collective actions of foraging or hunting, or defence against predators or rival groups – has, with the increasingly clever agency of individuals, evolved new forms: special organs of body form and movement that communicate and coordinate motives, intentions, and feelings. In this way, communities of animals with an intuitive or constitutional will to imitate can become larger intentional organisms, while knowledge of the environment is increased as a collective experience: a 'social mind'.

The cerebral processes of collective agency, *shared projicience* for object perception, and *sympathetic affective appraisal* for sharing emotions eluded Sherrington's physiology. They remain challenging to our neuropsychology and functional brain science, in spite of the spectacular advances of the past decade or two.

I do not need to cite the many hundreds of articles – or the scores of books – that apply the discovery of ‘mirror neurons’ to identify and ‘locate’ a great range of mind states in the human brain – albeit in highly artificial test environments. It is clear that one needs to make sense first of what the brain of a freely active person does to communicate – of how motives, feelings, and inner regulations are generated in the body and, in time, in forms that may pass to other brains. A new, dynamic biology of intentions and emotions is required: one which does not assume that the cause of behaviour lies in the nature of the physical stimuli impinging on the sensory equipment of the recipient subject (i.e., on information *coming in*). One must allow that intrinsic motives cause perceptions, intelligent actions, and emotional adjustments of vital states, by setting purposes *from within*: i.e., imaginatively, in space and time. One needs as well a theory of how such intentions, interests, and affect appraisals pass between brains, and how they may be detected in one brain from the purposes and emotions made explicit in others' movements. The evidence is accumulating rapidly and needs explaining.

Intersubjective motor control

One important conclusion from the science of animal actions is that any cooperation between animals – any social coordination of intentional behaviours to achieve more than a single self can do – must have evolved to make the intentions, interests, and states of internal vitality in single selves available to others. This requires transmission of evidence through behaviour, as 'symptoms' of the special generative properties of *movements in congruent body forms*. I have called this transmission of motives 'intersubjective motor control' and described the essential dimensions of communication as *kinematic* (concerned with the rhythmic movement dynamics), *energetic* (concerned with variations in the intensity, force or power of actions), and *physiognomic* (concerned with changes in the shape of the body: organising postural, gestural, facial, or vocal settings into distinct categories related to the subject's changing interests and purposes) (Trevvarthen 1986a). All three parameters give information on intrinsic autonomic/emotional states.

These three complementary dimensions of expressive movement form a primary level of organisation that is largely innate. They are united by processes that control serial ordering and strategic patterning of movements in adaptive sequences. The development of the latter, higher order, organisation of communication is more dependent on experience and learning" (Trevvarthen 1986a, p. 209).

Below I present evidence that these movement dimensions are innate in a newborn infant and that they motivate learning in a human community.

The *kinematics* of animal agency are fundamental: all animal movements are regulated sequentially in pulses of time caused by internally generated ‘clocks’ or oscillators (Lashley 1951, von Holst 1954). Their actions prescribe rhythms and *self-synchrony* between movements of body parts. Animals move as intelligent, purposeful agents ‘making the time of their life’.

The *physiognomics* or forms of activity also provide crucial information. Directed movements of organs, carrying special senses, are deployed in ways that correlate with the animal's adaptive

initiatives and preferences. They reveal shifting interests and feelings. Communication between similarly motivated and similarly formed subjects, with the same kind of brain and the same rhythms and forms of attending, evidently has evolved by brains taking up and engaging with – or resonating to – the *timing*, *aim*, and *style* of these intentional and sense-directed activities generated in other brains.

Finally, the self-sensing *emotional economy* of the body's energy gives information on the actor's internal state of efficiency and well-being. The animal body shows emotions as expressions of the vital values of action felt within changing experience (Darwin 1872). It displays appetites, fears, satisfactions, excitements, pains, and pleasures.

Principles of Biosemiosis, The Signalling of Interests and Feelings

This coupling, between individuals, of motive impulses and emotions is vividly evident in the complexity of human conversational behaviour, in which movements of speech, gesture, and body parts are coordinated – demonstrating an *inter-synchrony* of rhythms with contingent imitation of the form and style of moving (Condon & Ogston 1966, Kendon 1980, Key 1980). As Daniel Stern (2010) has eloquently explained, the intimate communication to one another of states of mind, interests, and attitudes depends first on an exquisite and immediate sense of the *vitality dynamics* of movement, and second upon the capacity for 'attunement' between one another's expressive states of emotion (Stern 2010). These special human abilities for shared agency have evolved from the rich social adaptations of animal agency.

Animal and human communication derives from the way motives, intentions, and feelings are generated and mediated in movements of integrated selves; from the way that the power of activity is distributed efficiently between body parts in one time, rhythmically; and, especially, from the way that inquisitive orienting or seeking movements of head, eyes, ears, and limbs anticipate a future selective contact with items in the world: seeing, hearing, touching, smelling, and tasting. Movements of bodies and body parts have evolved to "advertise" signals that move other selves with with bodies, employing "biosemiosis" according to semiotic principles as defined by the brilliant and eccentric logician Charles Saunders Peirce (Buchler 1940; Sebeok & Umiker-Sebeok 1992; Trevarthen 1990a, 1994).

The instantaneous efficiency of collective action and joint attention, involving *inter-synchrony* between the motives of individuals, is clearly evident in swarms of insects, schools of fish, flocks of birds, and herds of mammals. Looking, listening, reaching, sniffing, or tasting movements show how objects are being selected; these self-serving actions may become signals in "ritualised" encounters for both many innate and learned kinds of social cooperation. Animal signalling commonly involves accentuation of expectant orienting movements of the ears, head, or limbs, and postural adjustments of head or tail that indicate impending directions of movement. These body part adjustments, and their emotional significance as indicated by the rapidity or frequency of their movements, are often made more visible or audible by adornments: colour patterns of plumage or pelage, or sound-making organs

(Darwin 1872, Hingston 1933, Tinbergen 1951, Lorenz 1966, Coppinger & Coppinger 2001, Quaranta *et al.* 2007).

All dynamic forms of communicative animal gestures that transmit purposes and feelings between individuals "musically" (Wallin, Merker & Brown 2000) – e.g., the head bobbing and hand waving of lizards, the singing of whales or nightingales, the cries of migrating geese or their confidential honks in a flock as they "comment" on an approaching person, the "laughter" or squeaking of mice (Panksepp & Burgdorf 2003), and the status-setting grunts of baboons (Cheney *et al.* 1995) – are derivative of movements that are *self-regulatory* (i.e., felt within the body or guided by subjective attention to objects and events in the world), and specially transformed for acting intersubjectively in social communication (Darwin 1872; MacLean 1990; Porges 2003; Rodriguez & Palacios 2007; Panksepp 1998b, 2000; Panksepp & Trevarthen 2009). They manifest intentions *with feelings*, in forms that can be sensed by other individuals, symptomatic of the motives and self-regulating processes that generate them. They exhibit the dynamic narrative features by which one can define *communicative musicality* (Malloch & Trevarthen 2009; see below).

THE SPECIAL THEORY OF HUMAN AGENCY AND THE CULTURAL ELABORATION OF ITS INTENTIONS

We possess... the ability to pursue our goals with great tenacity. This tenacity has a number of sources, but prominent among them is the fact that our purposes are apt to be accompanied by very powerful feelings.... In spite of these facts of experience and observation, a number of serious attempts have been made to account for human behaviour without having recourse to the notion of intention or purpose at all. The notion, however, is one that tends to reappear in some guise or other within psychology, no matter how hard one tries to keep it out. And it is ironic that the attempt to keep it out is generally itself sustained by a passionate aim: the aim of being 'scientific' in a manner modelled upon the activity of the physicists.

The devising of novel purposes comes readily to us because we have brains that are good at thinking of possible future states - at considering not merely what is but what might be. We exist in a world of 'hard fact', but we can imagine it as changed; and from a very early age we know that, within certain limits, we are able to change it.... In this context 'the world' includes other people as a most important component. And, if we have any wisdom, it also includes ourselves (Margaret Donaldson, *Human Minds*, 1992).

My research on the intentional talents innate in human infants began in 1967 at the Harvard Center for Cognitive Studies in Jerome Bruner's laboratory for infant cognition. Bruner sought new methods to test how infants could modify freely chosen movements and selective engagements with objects, to 'categorize' and regulate their accumulating knowledge (Bruner 1968).

It soon became clear to some of us that the *cognitive revolution*, propelled by computer engineering, information processing, and theories about reactive control systems (Miller, Galanter & Pribram 1960, Miller 2003) – and of which Bruner had been one of the initiators a few years earlier – undervalued the adaptive anticipations of innate motives, imagination, and emotions, both in animals and humans. The individualistic, physical-information-processing cognitive approach disregarded how all consciousness and all communication – including the 'digital' codes of language – depend on creative and adaptive purposes of movement in whole living subjects; as well as how those purposes, regulated by emotion, may be shared socially by metaphorically detecting the analogic patterns of

controlled vitality evident in sequences of movement. Language – including the logic of its grammar and productivity – must surely be more than the referential information it contains in the inert product of text. Its learning and deciphering depend on shared story making by mutually aware persons – alive, moving together in shared time and feeling – and on intersubjectivity (Ryan 1974; Bruner 1983, 1996).

This sharing of experience in the time of its making is anticipated in the special adaptations of the human body and mind for complex combining and sequencing of movements with awareness – and for giving affective appraisal to rhythmic plans for action; the prosody of intonation; and sequential, 'phrased', or 'discursive' perception of the environment (Lashley 1951, Turner & Pöppel 1999, Fonagy 2001, Miall & Dissanayake 2003, Brandt 2009). Three books published in the '70s (Schaffer 1977, Lock 1978, Bullowa 1979) investigated new evidence from the study of natural encounters to demonstrate that infants are particularly attracted to stimuli arising from human movement – catching and engaging with the motives in them from birth.

These adaptations of the infant body and mind for a cultural/ritual way of life seemed to have escaped scientific attention at the time, in 1967, that I began my research with Martin Richards and Berry Brazelton in Bruner's laboratory. We wondered: could young infants be expecting – in the ways they seek engagement and build trust in shared games – a cultural life of fictive evaluations in activity and story-making talk with other human beings? Could symbols be symptoms of – or metaphors of sympathy in – intentional behaviour requiring an imaginative sense of being in a community of embodied minds? Answers to these questions became clearer through the '70s, from several sources (Beebe *et al.* 1979; Brazelton 1979; Condon & Sander 1974; Donaldson 1978; Halliday 1975, 1979; Hubley & Trevarthen 1979; Papoušek & Papoušek 1977; Richards 1973; Stern 1974; Stern *et al.* 1977; Trevarthen 1977, 1979; Trevarthen & Hubley 1978).

Three mysterious powers – active in young infants – challenged the rational, reductive assumptions of cognitive science. They have important implications for the education and care of children, as well as for the promotion of a healthy and creative way of life for human beings of all ages in all societies. As Donaldson has commented, they call into question some of the central assumptions of the scientific method itself; and they expose certain restrictive habits in the language of science (Whitehead 1926, Halliday 2006) – leading to a different appreciation for the function of the imaginative arts in sustaining human companionship and thought. They require neuroscientists to pay more attention to the motivating/affective core of the brain. They require more attention as well to the regulatory influence these intrinsic motive "formations" and their associated emotions have over the development and functioning of the environment-related intelligence that our ever-curious experience builds into the vast array of neocortical circuits (Trevarthen & Aitken 1994, Panksepp 2003, Gallagher 2008, Panksepp & Trevarthen 2009).

Research shows that infants are born intentional creatures with coherent self-awareness. They move and experience with a sense of time corresponding to that which governs the agency and awareness of adults. They immediately seek intimate synchrony and interaction with the expressions

of agency and emotion in a parent: responding and taking initiative in playful ways that go beyond their needs for protection and care of vital functions. They are active, feeling-full, intersubjective *persons* from the start (Trevvarthen 2010).

Knowledge of conventional meaning, the skills of manipulative and manufacturing intelligence, and the pragmatics of language in society – which an infant clearly has yet to gain – all require reinterpretation in light of the evidence that now exists of infant consciousness and its special awareness of interpersonal phenomena and their associated emotional values. With this comes the realisation that the intuitive ‘romantic’ and ‘trusting’ foundations of education and responsible social functioning are not displaced as more disciplined ways of thought, understanding, and behaviour are acquired (Whitehead 1929; Erickson 1950; Bruner 1960; Donaldson 1978, 1992). One’s cognitive apprehensions are judged to be important and acceptable – or irrelevant and undesirable – via *aesthetic* sensibilities (feelings that things are made or done well) and *moral* criteria (perceptions of relationship to others’ interests, needs, and feelings). A child is sensitive to these things before acquiring the necessary language to describe, justify, or elaborate what they believe to be true (Reddy 2008, Trevvarthen 2009a, Frank & Trevvarthen 2012).

I will next summarise the conclusive findings from infancy research on the intersubjective psychobiology of human intentions: their innate reaching out for participation in a community of action and awareness. Three key words define the essential powers of the unschooled human mind and its evaluation of meaning shared with others: SELF, RHYTHM, and SYMPATHY.

SELF: BEING A SINGLE, WILLFUL, CONSCIOUS AGENT MOVING WITH ITS BODY IN THE WORLD

Since a great number of reflexes can be elicited in the young infant while ‘higher’ brain activity cannot yet be observed, the conclusion has been drawn that the infant’s brain activity consists only of reflexes. This opinion does not at all do justice to the facts. At each stage of development there exist functions that occur without external stimulation.... During their inactivity the centers have been charged and finally press for a discharge ‘by themselves’, i.e., without external stimulation (Peiper 1963: 248).

From a psychobiological perspective, the Self is a well-governed, intentional – i.e., activity-creating – entity from conception. It develops ever more powerful anticipatory intelligence from this initial simple state of the vitality and sensibility of a multicellular system, greatly expanding its prospects of moving with feeling.

The development of the animal mind depends on the formation of an integrative central nervous system, originating in the embryo as a portion of the ectodermal interface of the body with the environment, the cells of which become neurons specialized for communicating their states of excitation. This ‘neuro-ectoderm’ becomes folded into the body to function as an intricately woven inter-neuronal net: the generative and sensitive regulator of the body’s activities (Sperry 1965). It develops into a system for making and feeling an integrity of movements.

Building on Sherrington's discovery of the neural mechanisms of proprioception along with his theory for explaining how the reflex actions of many body parts are integrated by the brain into movements of a single coherent actor, Russian physiologist Nikolai Bernstein (1967) made a brilliant analysis, using film to do a refined cinematography of the cyclic dynamics of various actions in locomotion and tool use to determine how human movements are imagined in the brain (Figure 2). His six laws of the *biodynamic structures* that cause and guide adaptive movements explain how excitations of muscular activity are controlled to produce highly efficient rhythmic actions of one unitary Self with a heavy body of many parts and many biomechanical 'degrees of freedom'; they explain as well how these centrally generated actions are adapted to work in collaboration with peripheral circumstances (Trevarthen 1984).

Figure 2 – The regulation of actions in a human body by *motor images* that employ or 'assimilate' peripheral forces, modulating them by excitation of muscle activity that makes prospective adjustments to sensory information. The graph on the left, after Bernstein (1967), shows how the resultant motor output is both rhythmic and highly efficient. Bernstein named the biomechanical adjustments in the body – and between the body and the material of the external world – the 'external synapse'. Neural excitations of muscles meet sensory input at the 'internal synapse' in the brain.

Bernstein's theory of a complex, 'imaginative', and dynamic organization of excitation in motor centres – exploiting peripheral mechanisms prospectively and responding to their signals – is incorporated into the contemporary theory of *embodied cognition* (Varela, Thompson & Rosch 1991; Clark 1997, 1999; Lakoff & Johnson 1999) and a neuroscience of awareness of body activities (Damasio 1999, Gallese 2005). It assists in understanding emotions that evaluate actions (Panksepp 1998b, 2000) and explaining how they are communicated socially (Porges 2001, Adolphs 2003).

A theory of internal, 'intuitive', and rhythmic processes that generate movement and experience is supported by physiological research, which has discovered the *Bereitschaftspotential*: a specific brain activity in advance of movement (Kornhuber and Deecke 1965). It shows as well how neural activity preparatory to action – or imaginative experience of action – invades widespread structures, including those structured to receive, identify, and recall the effects of stimulation, both by proprioceptors and exteroceptors (Jeannerod 1994). The coherence of action requires coherence in time of the many sources of rhythmic activity throughout the brain (Buzsaki 2006): a productive, temporal integrity of coordinated rhythms that may be called "musical", given that it shows strong motoric and emotional response to music (Sacks 2007, Panksepp & Trevarthen 2009, Turner & Ioannides 2009, Trevarthen 2009c).

A human being, moving as one agent, strives to maintain a single focus of interest and a single sense of passing time, while perceiving in several modalities. One sees with two separate optical systems, but from one locus coincident with the centre of rotation of the head. Saccadic eye movements couple the two eyes, directing gaze to points of interest for focal discrimination in extra-corporal space, without any sense that orientation of the self has changed; the ambient field of interest is likewise stable (Trevarthen 1968b). Each head rotation, stimulating proprioception in muscles and their attachments – along with vestibular sense and 'exproprioception' (Lee 1978) by audition and vision – changes self-orientation. Attention movements of the eyes integrate with reaching, touching, and manipulation movements of the hands, which act with their own foci of interest in intentional coordination with the posture of the whole body. One makes skillful, precise finger movements directed by high-resolution foveal vision as well as by touch – the stereoscopic disparity between the eyes serving accurately to control the distance from the body of the locus of digital contact. Walking on an irregular surface, one monitors one's movements with gaze cast ahead to fix each place where the next step will fall.

When speaking, one accompanies the thoughts to be expressed with gestures that may anticipate the utterances. In conversation, the listener's gaze, head movements, gestures, and speech – as well as changes of emotional expression in face and voice – are perceived as a single sequence of messages. Perception of another person's interests and feelings – and the direction of their intended movements – can be perceived by all the senses together or by any one of them separately. One experiences the senses as 'owning' a single intelligence, transmitted by how they make sounds, show expressive appearances, and embrace or otherwise touch one's body.

All these manifestations, in movement, of the intentions of an integrated conscious Self entail prospective monitoring of what Björn Merker (2005) calls 'the liabilities of mobility'. For this task, human beings possess a large brain with comprehensive proprioceptive sense for the position and displacement of trunk, head and limbs: actively sensing forces generated in muscles and tendons, rotations of joints, and accelerations of the head, with additional guidance from the exteroceptive senses of sight, hearing, and touch. This poly-rhythmic, poly-sensory brain monitors the internal well-

being and safety of the body via a visceral nervous system, components of which have evolved into semiotic organs serving as mediators of one's intimate cooperations, linking the intentional and life-regulating processes of separate selves (Porges 2001).

Figure 3 – **A:** Motor organs and senses of a human foetus at 60 days' gestation: eye, inner ear, mouth, tongue, and hand are already adapted for communication. **B:** An infant's face is motivated to receive messages and respond in kind. **C:** The 'special' visceral nuclei of the brain that move eyes, inner ear muscles, face, and mouth, while receiving sensory input from proprioception, smell, taste, vision, and hearing, are formed by 50 days' gestation. They are being innervated by integrative emotional systems before the cerebral cortex has developed. The numbered nuclei and nerves are as follows: 1, *olfactory*; 2, *optic*; 3, *oculomotor*; 4, *trochlear* (eye muscles); 5 *trigeminal* (facial feelings); 6, *abducent* (eye muscles); 7, *facial* (taste: mouth and tongue); 8, *auditory* (hearing and balance); 9, *glossopharyngeal* (taste); 10, *vagus* (taste, heart, lungs, and gut); 11, *accessory* (head and shoulder movements, swallowing); 12, *hypoglossal* (vocalising, speaking, licking, sucking, kissing). **D:** All these sensory and motor organs are active in a proto-conversation between a young infant and her mother.

Human Face, Eyes and Voice Serve a Lively Spirit Seeking Cooperative Intelligence

In socially intelligent higher vertebrates, the organs of the head – along with the autonomic system – have become the expressive/receptive systems of the face, throat, eyes, and ears (Porges 1997, Trevarthen 2001). The communication, between subjects, of psychological expectations via expressive movements integrates internal visceral regulations with environment-directed somatic ones (Trevarthen 1989b, Trevarthen *et al.* 2006). In reptiles, birds, and mammals, ancient mechanisms –

evolved to signal bodily needs and attract parental care – have been transformed to add mechanisms of sympathetic mind engagement, both for expression of emotion and interest, and for vocal communication of purposes, needs, and desires (MacLean 1990, Porges 1997, Panksepp 1998b) – culminating in articulate speech and language (Fonagy 2001) (see Fig. 3).

Systems that emerge in the human embryonic brain as regulators of morphogenesis in cognitive systems become the core regulatory systems of interneurons in the brainstem, directing orientations of attention, coordinating purposeful movements of the body and its parts, and mediating equilibria between autonomic and exploratory or executive states (Hess 1954, MacLean 1990, Nauta & Domesick 1982, Trevarthen 2001, Trevarthen *et al.* 2006). An important output from this *intrinsic motive formation* (IMF: Trevarthen & Aitken 1994) controls the 'sensory-accessory motor systems' of the special receptors of the head and hands. The eyes, ears and cochlea, lips and tongue, and palms and fingers are separately aimable and tunable. Their movements rhythmically aim and either 'choose' or 'censor' the uptake of perceptual information in different modalities of high sensitivity and resolution. These motor adjustments occur in the exploratory and focusing phases of attending to the outside world, before the final commitment of any 'consummatory' act. They exhibit advance information to an observer about emerging impulses of the subject: signalling awareness and intentions (Trevarthen 1978). All the organs of human linguistic expression are recruited from this accessory motor set (Trevarthen 2001, Porges 2001).

Directed attention links brainstem and cortex. Emotions arise as centrally generated states involving all levels of the brain. Two centers have been identified as essential for relating emotions to social experience, developing a reflective (cognitive) understanding, and exercising voluntary control of emotions: the amygdala and temporal mesocortex (Aggleton 1993, Bachevalier 1994, LeDoux 1992, Rolls 1992), and the orbito-frontal cortex (Cummings 1993, Dawson 1994, Goldman-Rakic 1992). The orbito-frontal cortex and the temporal pole cortex develop extensively after birth; they are presumed to modulate the activities of the infant brainstem's emotional system (Schorre 1994). Both regions develop asymmetries (Davidson & Fox 1982, Davidson & Hugdahl 1995).

Left and Right Asymmetries of Gesture and Motive States: Not Just For Language

Cerebral asymmetry was first discovered in relation to language. It has been assumed that the neocortical areas essential for articulating speech and hearing speech, in the left hemisphere, constitute the origin of cultural intelligence and the distinctive features of human consciousness. However, asymmetries in the central nervous system are of ancient origin. Primitive vertebrates have the same asymmetry of emotional systems as do mammals. These systems support many complimentary processes of motivation, emotion, learning, and communication in human beings – from before birth (Trevarthen 1996, Tucker *et al.* 2000).

Neonates show a right-ear preference for speech but a left-ear preference for heartbeat or music. Microanalysis of filmed proto-conversations and photographic records show that, at two months,

proto-conversational utterances of cooing or 'pre-speech' (articulations of lips and tongue) are most often accompanied by raised, right-hand gestures. Extending the hand and pointing with the fingers is frequently synchronized precisely with oral gesture. When distressed and in more reflective and observant phases, infants hold their left hands toward their bodies, sometimes touching or fingering their clothes. They appear to be more 'assertive' with their right hands, more receptive or apprehensive with their left (Trevarthen 1996).

Asymmetries of psychological function and behaviour are elaborated by learning throughout childhood (Trevarthen 1990b, 2004c). Their development is regulated by anatomical and neurochemical asymmetries in systems found at all levels of the human brain, from prenatal stages onward (Cynader *et al.* 1981, Huttenlocher 1994, Trevarthen 1996). Manual preferences observed in thumb sucking in foetuses of 15 weeks' gestation correlate with hand preferences seen in the second year after birth (Hepper 1995). The human neocortex is visibly asymmetric foetally (Rakic 1991). Surface features of the right hemisphere are more advanced than the left from about the 25th week; this bias persists until the left hemisphere shows a post-natal growth spurt, starting in the second year, when language and other articulate skills are acquired (Thatcher, Walker & Giudice 1987). The asymmetric areas – and the differences in motivation that they incorporate – are crucial in all culture-related processes of the adult human brain. Their development is affected by practice of skills and by all *collective representations* (Schlaug *et al.* 2005, Turner & Whitehead 2008, Turner & Ioannides 2009). The telling of stories in any form of art gives the space of narrative an asymmetry in the 'direction' of the plot – related to how one confronts the world and moves in it, sharing feelings and biases of agency with other persons (Trevarthen 1995).

Figure 4 – Infants’ hands serve many functions for regulating the feelings of the body, reaching to grasp and handle objects, and expressing emotions in relation to others’ attentions. A,B: Four- and five-month-old infants look at the lights, try to catch a ball, and join in action songs. C: Seven-month-old infants are eager to catch objects with their hands and study them. D: A six-month-old infant, who proudly shows that she knows “Clap a Handies” at home, is nervous, shows distress, and withdraws from a stranger.

Human Hands Are Sociable Selves and Cooperative Agents of Technical Invention

Human hands are uniquely clever, and their actions are eager to be cultivated (Wilson 1998, Goldin-Meadow and McNeill 1999). The motor-intentional possibilities of human upper limbs – and, therefore, their demands for elaborate cerebral imaginative control – are very great: the jointed lever system of arms, palms, and fingers has many biomechanical ‘degrees of freedom’ (Bernstein 1967), while cerebral programming of the combinations of rotation about the many joints is extremely refined, informed by many sensitive receptors (Trevarthen 1986b, Trevarthen *et al.* 2011). Adult hands can be projected from the body, with high velocity, to transmit large forces; moved with exquisite temporal and spatial precision in an extensive reaching field; and rotated with accuracy in any direction to contact surfaces of objects while responding to light touch and modulating pressure. Fingers are extended or flexed in an infinite number of combinations: palpating, pushing, poking, punching, patting, twisting, tearing, etc. The two hands cooperate, performing complementary tasks of e.g. climbing and manipulating objects, as well as expressive movements that may be cultivated as a language of signs (Goldin-Meadow & McNeill 1999), as dance, and as musical performance (Trevarthen *et al.* 2011).

Many hand actions are **Self**-adjusting, administrating requirements of bodily comfort and well-being: carrying food to the mouth; scratching itches; removing thorns; brushing dirt off; rubbing hot, cold, or sore parts; or pulling clothes on or off. Hands contribute to body-state adjustment through stroking, touching, and holding; transmitting warmth and stimulating autonomic responses; and prompting the release of endorphins. Hands participate in postural balance and locomotion – as forelimbs do in other mammals; but primate hands are particularly adapted to reach out from the body to grasp and manipulate objects. Human hands expand this manipulation power greatly. They are capable of new combinations of movement are directed by greatly increased powers of imagination, memory, and thought-regulated skill (Poizner *et al.* 1987, McNeill 1992). They may show intentions for selecting, exploring, and transforming objects in the environment, while the trunk is active only in providing a dynamic, anti-gravity support.

Human beings gain intimate understanding of the intentions and emotions of one another’s performance by seeing or hearing what the hands are doing (Trevarthen 1986b, Trevarthen *et al.* 2011). In communication with blind-and-deaf persons, touch of hands on hands or on other parts of the body can transmit linguistic messages equivalent to those normally relayed in speech or by visible gesture (Souriau, Rødbroe & Janssen 2006-2009).

How Motor Intentions Grow to Become Carriers and Receivers of Imitated Meaning

Human infants are born with most of the above capacities for self-regulated movement coordinating limbs and senses. Their hands show elaborate autonomous agency, guided by cerebral processes still under-studied and not well understood (Trevarthen 1986b, 2007; Trevarthen *et al.* 2011). Contrary to the assumptions of Jean Piaget’s constructivist cognitive theory, which sought to explain how concepts

of the body and objects are created by learning, egocentrically, the effects of actions on them (Piaget 1954) – and as Albrecht Peiper (1963) illustrated in his *Cerebral Function In Infancy and Childhood* – human beings at birth are not just organisms of reflex, even though a newborn does indeed have strong reflex systems to coordinate movements with reactions to external stimuli in ways that assist parental carrying or feeding or protect the body.

Human foetuses tentatively touch the placenta, umbilicus, and uterine wall with their hands at 11 weeks. They make jaw movements and swallow amniotic fluid, expressing pleasure or disapproval at the taste by sucking and smiling or grimacing with disgust. Complex movements of trunk, arms, and legs position the body; they may respond to the mother's bodily movements including the contractions of her uterine muscles (Lecanuet, *et al.* 1995, Piontelli 2002, Trevarthen *et al.* 2006). During gestation, sensory inputs are incorporated, or integrated, to guide movement – first by *proprioception*: monitoring displacement of body parts relative to one another or to gravity; then by touch *exteroception* and *ex-proprioception*: sensing immediate bodily surroundings and changes in body displacement. The hand movements that foetuses begin to make at around 20 weeks engage with sensory feedback, 'feeling' newly developed proprioceptive and somaesthetic monitoring systems (Piontelli 2010).

From the beginning of human activity, in the embryo, movements – though lacking awareness of external goals – are coherent, 'sensible' actions. They are made more effective by steps, in development, of feedback of feeling, anticipated by the restless spirit of vitality (Trevarthen & Aitken 1994). Each new form of movement of the limbs is supported by growth of new sensory capacity, so that the consequence of each movement is recorded, confirmed, and adjusted, to sustain and elaborate a self-sensing unity of purpose in the central nervous system (Piontelli 2010).

After 20 weeks' gestation, hand movements explore the foetus' body and surroundings, while eyes turn in coordination with head movements. Twin foetuses touch one another and adjust their confined positions. 'Temperamental' differences between twins – in activity and reactivity, as recorded in ultrasound movies around the gestation midpoint – persist until several years after birth (Piontelli 2002). Foetuses hear from 20 weeks; tests of babies' recognition of their mother's voice immediately after birth prove that a baby can distinguish her speech or singing from that of another woman (DeCasper & Spence 1986, Hepper 1988, Lecanuet 1996). A pregnant woman feels the life of her foetus from the gestation midpoint. This prompts her to imagine the baby she will meet at birth. Sometimes she even talks to the expected one.

Newborn Awareness and Initiative in Dialogue, and How It Grows

Interest in the outside world grows quickly. The sensitive motility developed before birth is capable of orienting to and tracking external objects, perceived by sight, in the first hours after birth. A newborn seeks engagement with intimate and affectionate signals from a parent (Brazelton 1979, Nagy 2010). Evidence that a premature newborn can be conscious comes from observations that an 'aroused' baby

can move in coordinated ways, with selective orientation to events outside its body (Lecanuet *et al.* 1995). The power and grace of these movements signal regulation of the risks and benefits of moving as they are detected by the newborn's *affective consciousness* (Panksepp 2000). They provide important clinical signs of neurological health (Lecanuet *et al.* 1995, Trevarthen & Aitken 2003). A two-month-old premature baby is capable of coordinating simple "coo" vocalizations with a parent, in an intimate dialogue that has the rhythmic timing of the syllables and phrase structure of adult speech (Trevarthen 2008, 2009a).

Paediatric practice has been transformed through demonstrations of the psychological capacities of newborn infants (Brazelton 1973/1984, 1979). A full-term newborn turns to track, and may point to or vocalize about an object moving nearby or the sound of its mother's voice. A touch on the cheek attracts the mouth for suckling. The heart slows with intentful looking or listening. Blinking and conjugate saccades above a few degrees are already well-developed in infancy; newborns can look to a gentle voice in the dark. Initially, vision has low resolution; but acuity develops rapidly in the first few months (Trevarthen & Aitken 2003). There are many so-called *postural reflexes* by which a newborn can compensate for imposed body tilts. These prove that the whole body is capable of adapting the forces of mobility to changes of body position and limb orientation relative to gravity.

Cognitive psychologists propose that infants are born with *core concepts* or strategies for learning, adapted to perceive natural phenomena (Lacerda, von Hofsten & Heimann 2001). As Piaget demonstrated, the exercise and development of these concepts depends on the infant's initiatives in engaging with and investigating phenomena by moving in controlled ways. Donaldson (1992) insists that these concepts are never simply rational, but are coloured by emotions that determine how they will be remembered. Papoušek (1967) writes that infants a few months old, acting as operators in an experiment to test their powers of perceptual prediction of attractive and changing stimuli, express emotions of satisfaction when 'correct' and disappointment when things go 'wrong' and they fail to anticipate the effect of their actions. Piaget (1962) describes as expressions of 'pleasure in mastery' when infants play with effects in this way.

Infants have lively and expressive faces and are acutely sensitive to the feelings expressed in the face of a person addressing them in a friendly way (Fig. 5). This sensitivity has been tested experimentally. In the experiment, the mother is required to interrupt her responses to her baby and remain still, looking at the infant for a short time with an immobile, inexpressive face (Trevarthen 1977, Tronick *et al.* 1978, Murray & Trevarthen 1985). With this loss of communication, infants stop smiling, focus attention with a worried expression then look away, fidget with their hands, and make complaining vocalizations. To test the infant's sensitivity to appropriately sympathetic expressions, a *double television* communication setup is used; this enables replay of the mother's affectionate and responsive talk with her baby in a live dialogue, so that her behaviour – though the same in expressive qualities – is no longer responsive. When a happy minute of the mother's live communication was replayed to an eight-week-old baby girl, the girl became distressed and turned away (Fig. 5), proving

how sensitive she was to her mother's live presence and how apparently indifferent or inattentive behaviour made her unhappy (Murray & Trevarthen 1985; Trevarthen 1993; Nadel, Carchon, *et al.* 1999).

Figure 5 – A mother talks with her eight-week-old girl through a *double-television* link. At first (**A** and **1**) they are not in contact; the mother is seeking her daughter, who seems not to see her. Then a sharp, loud noise frightens the baby, and she starts to cry (**2**), to which the mother makes a sad face (**B**). The problem is fixed, and they join in a happy chat – even playing a game in which the mother (**F** and **G**) teases the baby and makes her laugh (**7**). At the end of a minute and a half, they are both very happy (**H** and **8**). In the pictures at the bottom, the baby shows confusion, tries unsuccessfully to communicate, then withdraws unhappy, when one minute of the mother's happy talk is replayed to her.

Age-related changes in body and brain transform what the infant is aware of and what the infant attempts or seeks. This is not only a development of powers of action and perception: pleasure in games and emotional relations with companions are also changing (Stern 1985/2000; Trevarthen 1980,1992; Trevarthen & Aitken 2003). Once a child is mobile, her interest in the world becomes a consuming ambition to discover meanings that can be shared with others (Hubley & Trevarthen 1979; Trevarthen & Hubley 1978; Trevarthen 1988, 1989a). Before language is learned, the child is already becoming a thinker and actor in cultural ways. The motivation for this learned transformation in

activities and experience appears to be a direct outgrowth of the integrated mobility, intelligence, and emotions with which the infant is born. One essential principle retained is a human sense of *time*.

RHYTHM: MOVING TO THE PULSE OF THE MIND

All living organisms have rhythms that give measure to the timing of their life: both within the body and through motor engagements with the world. The science of *chronobiology* demonstrates the rhythms of plants and animals adapted to respond and adjust to the diurnal and seasonal cycles of events in their environment – over periods that may extend through years and the phases of a lifetime (Foster & Kreitzman 2004, Osborne 2009a, Trevarthen 2009c).

Animals exhibit a coherence of timing in every movement they make and, therefore, in all they experience. This temporal integrity of an animal's activity requires self-synchrony, coupling pacemakers in the vital organs inside the body. It requires that the centres of the animal's brain that direct somatic movements of limbs and entire body, and that sense the environment, are coupled in rhythmic synchrony. For conscious intelligence, actions of mobile parts and uptake of information by different sense modalities must be orchestrated (Pöppel 1994, Pöppel & Wittmann 1999). Brains at all levels of complexity are rhythm-generating, coordinating systems in dynamic communication with the effectors and sensors of the body (Buzsáki 2006).

The energy-expending efforts of limbs and body acting in adaptive ways in the environment are supported by changes in autonomic activity of internal organs – organs that take sources of energy from the environment to supply the tissues with substances essential to their health as well as defend against stress, injury, and pathogenic infection. The autonomic nervous system has its own rhythms (Delamont *et al.* 1998), which are integrated with somatic rhythms in the affective nervous system (Panksepp & Trevarthen 2009) – the emotions of which regulate the intensity and goals of action and balance exertions against recuperation. What results is a hierarchy of times – a *biochronological spectrum* – by which both intentional actions and vital functions are kept efficient and well (Trevarthen 1999b, 2009c). One's intrinsic body sense of time – or *enkinesthesia* (Stuart 2010) – enables one to describe the elaborate prospects of one's purpose in stories, dramas, and strategies that may capture the interest of others and enable them to feel, imagine, and collaborate. One's narrations are informative about how one's body and mind intend to act and how they sense the pleasures and pains – or benefits and risks – of one's enterprises.

Emergence of Life Times Before Birth

Human embryos have beating hearts from the first month after conception, at which point the body is 5 mm. long. This occurs before any motor nerves exist to activate the muscles (Trevarthen 2004c). From six weeks – before there are any sensory inputs to the spinal cord – the nerves perform rhythmically paced, whole-body movements, bending the spine. Foetuses – once the first core motivating systems of neurons link the motor centres of the brain stem and spinal cord – show, with

increasing frequency from 10 and 14 weeks, periods of differentiated and guided cyclic movements of the now well-developed and clearly *human* eyes, facial muscles, jaws, and hands. These movements, which appear to be directional and self-sensing, are rhythmic..

As the body grows through cycles of differentiation of parts and reintegration of whole, so the coherence of movement changes. Around three months' gestation, one finds many anarchic twitches and startles of body parts, presumably originating in the rapidly developing brain stem. These become integrated again into flowing patterns by eighteen weeks. At twenty weeks, foetuses are active approximately 25% of the time: moving about once every minute. Heart-rate responses to sound appear around this time (Lecanuet *et al.* 1995, Parncutt 2006). From this point until term (forty weeks), fetal heart rate slows appreciably and becomes more variable, due to increasing para-sympathetic maturation. Respiratory movements and amniotic breathing appear several weeks before birth.

Heart-rate changes are coordinated with motor-activity phases from 24 weeks (James, Pillai & Smoleniec 1995). This is indicative of the formation of a prospective control of autonomic state, coupled with readiness for episodes of muscular activity of engaging with the environment: a feature of brain function Jeannerod (1994) has cited as evidence for the formation of cerebral *motor images* underlying conscious awareness and purposeful movement.

Research on the behavior, psychology, and physiology of the foetus indicates that, in the last trimester, functions are established in anticipation of an active post-natal life: especially for assimilating and collaborating with maternal care (Lecanuet *et al.* 1995). Motor coordinations exist that are obviously adapted for visual exploration, reaching, and grasping; walking; and expressive communication by facial expression and gesture (de Vries, Visser & Prechtl 1984; Prechtl 1984).

Narratives of 'Musicality': In Self-Regulation and Self-Awareness, Ready For Communication

The gracefully coupled rhythms of a newborn infant's movement unfold in time like a melody, usually with no detectable practical purpose: no explicit sense. One presumes that is why such movements have been dismissed as not just involuntary but random. The adaptive value of this far-from-random musicality of human body movement – what it is controlled to do – soon becomes apparent in *implicitly appreciated* or *intuitive* communication, when its powers of attracting attentive others to move in counterpoint or synchrony, and to entrain and respond to their separate interests in a emotional narrative of purposes and experiences, become obvious (Trevvarthen *et al.* 2011). *Communicative musicality* is an elaboration of the poly-rhythmic harmony of movement of a human body, capable of acting with versatile grace to negotiate the spaces of a complex world. It is an evolutionary elaboration for cultural semiosis: a form of self-expression that other humans are equipped to share, enjoy, and be educated by in artful performance of collective poly-rhythmia

(Malloch & Trevarthen 2009). The rhythmic, musical time of human movement has a unique narrative power that invites shared learning: that is its meaning (Kühl 2007).

SYMPATHY: DETECTING COMPANY AND SYNCHRONISING ACTIONS TO MAKE SHARED MEANING

Time and measure are to instrumental Music what order and method are to discourse; they break it into proper parts and divisions, by which we are enabled both to remember better what has gone before, and frequently to foresee somewhat of what is to come after: we frequently foresee the return of a period which we know must correspond to another which we remember to have gone before; and according to the saying of an ancient philosopher and musician, the enjoyment of Music arises partly from memory and partly from foresight (Adam Smith [1777] 1982: 204).

The pulse and modulation of human-life timing is infectious, adapted to make cultural narratives about a human-made world and its history in a community of minds (Donald 2001). From birth, the rhythm of life, and the stories of human vitality, are shared – building in imagination and memory a "proto-habitus", or companionship in meaning (Gratier & Trevarthen 2008). People live together in the times they make, in themselves and with others.

William Condon and Lou Sander reported in *Science* in 1974 that the gestures of a newborn may respond, in coordinated precision, to the prosodic rhythm of an adult voice (Condon & Sander 1974). The claim was greeted with skepticism by psychologists and paediatricians alike, persuaded that such temporal coordination with another person was beyond the psychological/neurological powers of a newborn, who they deemed to be at the mercy of reflex reactions to stimuli, incapable of such precise coordination of their body movements. However, the phenomenon – along with the authors' suggestion that intersubjective timing and expression is important for language acquisition – has been confirmed by subsequent studies. Those studies have looked at how communication with infants develops with the aid of rhythmic vocalizations and gestures, synchronized both within the infant and in engagements with others (Stern 1971; Jaffe, Stern & Peery 1973; Bateson 1975, 1979; Trevarthen 1979, 1986a, b, 2009b; Beebe, Stern & Jaffe 1979; Stern & Gibbon 1980; Tronick, Als & Brazelton 1980; Beebe *et al.* 1985; Jaffe *et al.* 2001; Stern 1985, 2010).

Daniel Stern (1974, 1985, 1992, 1999, 2004) has developed a science of the *vitality dynamics* of infant actions and of infants' sympathetic responses to the vitality and mutual "attunement" of movement in dialogues and games with a partner. He demonstrates that these – mutually regulated – dynamics, mediated by *intermodal fluency* in a common sense of time, play a major role in deciding the fate of communication in therapy and explaining the aesthetic powers of all the temporal arts: dance, music, theatre, and film (Stern 2010). Nigel Osborne (2009b) reviews a wide experience of how active music may, by engaging with the impulses of performers' movements, be used as therapy for individuals traumatised by war: helping the regulation of their physiological functions while inspiring self-confidence and pleasure in companionship. Clearly, it is a core part of human biology to move in time with others, both for well-being and for learning. This is the essential source of the world's many languages.

INTRODUCTION	DEVELOPMENT	CLIMAX	RESOLUTION
1 Come on	7 Oh yes!	10 Tell me some	15 Ch ch
2 Again	8 Is that right?	more then	With INFANT
3 Come on then	9 Well tell me	11 INFANT	16 Ahgoo
4 That's clever	some more then	12 Ooorrh	17 Goo
5 INFANT		13 Come on	
6 INFANT		14 Ch ch ch ch	
		With INFANT	

Figure 6 – Communicating the embodiment of voice: in a mother’s proto-conversation with her six-week-old daughter, the voices collaborate with precise timing and intonation to make a musical story that has an *introduction*, an excited *development*, a cooperative *climax*, and a graceful *resolution*. It lasts 27 seconds. Both participants vocalise around and above middle C (C4); but, as the mother expresses her enjoyment, she carries her voice through more than one octave. Her daughter makes her sounds coordinate precisely with the mother’s phrases (from Malloch & Trevarthen 2009).

Proto-Conversational Beginnings

The study of timing and sequencing showed that certainly the mother and probably the infant, in addition to conforming in general to a regular pattern, were acting to sustain it or to restore it when it faltered, waiting for the expected vocalization from the other and then after a pause resuming vocalization, as if to elicit a response that had not been forthcoming. These interactions were

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

Mary Catherine Bateson – an anthropologist and linguist with an interest in ritual – describes in these words her experience of what she calls a *proto-conversation* between a mother and her nine-week-old infant, whom she recorded on film and studied at MIT in 1974. She broke fertile new ground when she accepted this communication as mutually motivated, preparatory to human language and ritual culture.

Bateson used her knowledge of animal ethology and her father's theory of *ecology of mind* to propose that:

...Human behavioral and adaptive diversity provide the prime argument against innate knowledge, unless we can express that knowledge as an innate, perhaps highly specific, ability to learn. In fact, imprinting and other such innate learning and teaching mechanisms are what we should expect to find in human learning, because imprinting is precisely a way of taking advantage of the economies of genotypic programming in species whose patterns of adaptation require flexibility and variation (Bateson 1972: 67).

Her description of how a mother is attracted to support her infant's interest in joint performance and learning how to enrich it anticipates Bruner's (1983) proposal that any *language acquisition device* (LAD) needs a *language acquisition support system* (LASS).

Bateson's account is incompatible with Skinner's language learning theory; Noam Chomsky's theory of a special genetic LAD adapted to make infinite messages out of digital elements, in a way unrelated to the communicative powers of other animals; and Stephen Pinker's theory that song and music are for emotional gratification only, of no significance for a theory of the *language instinct*. Researchers into the song- and dance-like behaviours of animals – along with the special motivation for their learning – are convinced that antecedents exist for the evolution in human education of the grammatical flexibility and semantic productivity of both music and language (Wallin *et al.* 2000, Merker 2009a, Cross & Morley 2009, Dissanayake 2009).

Bateson concludes her richly theorized account of the mutual motivation for proto-conversation:

...We are suggesting that in addition to the advantages for learning given by intense attention and pleasure, the infant's participation sets the stage for learning: once he knows the 'rules of the game' and can anticipate patterns, he can also deliberately and playfully vary them and he has a 'handle' on what he is trying to understand. Here at the prelinguistic level we can see the child playing a 'grammatical' game. This should cast new light on our data on games playing, imitation and mother-child interaction at later stages of development. Indeed, it provides an analogy for understanding a wide variety of interactions in which change or learning takes place, from psychotherapy to religious ritual to the ordinary pleasures of conversation, and the general phenomenon of active participatory learning (Bateson 1979: p. 76).

Malloch's theory of *communicative musicality* (Malloch 1999, Malloch & Trevarthen 2009) – derived from microanalysis of a proto-conversation between a six-week-old girl and her mother (Fig. 6) – details the expressive parameters that enable the infant, with the support of her mother's affectionate sensibility, to find intersubjective harmony of purpose. They compose a melodic story together by sharing the *pulse*, *quality*, and *narrative* of their expressive sounds and movements.

Gratier has applied similar analysis to vocal dialogues between mothers and infants across cultures, with different states of sensitivity or security in intimacy. She shows how, in a thriving relationship, mother and infant discover a 'proto-habitus', or shared world of meanings, as conventions of expression invented in their play (Gratier & Trevarthen 2007, 2008; Gratier & Apter-Danon 2009).

Playful Compositions Stretch Subjective and Intersubjective Spaces, Improvising Ambitious and Provocative Forms of Agency

Animal social life is full of drama: of performance, in play, of actions done to celebrate what the body can do and to display vitality of intentions that are not 'true' – to trick or tease in engagement (Bateson 1956, 1972; Byrne & Whiten 1988; Cheney *et al.* 1995; Bekoff & Byers 1998; Bråten 2009; de Waal 2009). From infancy, human play negotiates new forms of play, and ritual theatrical performances in which expectations are tested in narratives where imaginative goals and personalities come alive (Turner 1982, Dissanayake 2000, Reddy 2008). It is 'an intermediate area of experiencing, to which inner reality and external life both contribute' (Winnicott 1958: 2).

As the infant grows from three months and starts to pay more attention to the world, increasingly playful, provocative negotiation – exploring the embodiment of the self in performances – comes to life. This change attracts the attention and participation of parents and siblings. Negotiating the balance between self-satisfying creativity in the infant's 'scientific' curiosity on the one hand, and social play that needs others' appreciation on the other, seems a key motive in preparing for the serious business of mature language and intelligence, wherein individual interests and knowledge must be shared (Bateson 1955, Trevarthen & Hubley 1978, Turner 1982, Hobson 2002, Whitehead 2008, Reddy 2008). This mixing of motives explores the embodiment of Self and the performance *for* and engagement *with* an Other, testing the trading of initiatives in shared tasks (Hubley & Trevarthen 1979).

Maya Gratier (2007, 2008) has compared mother-infant vocal play with the improvisation of jazz and the experimental interpretation of a score in classical music performance. Provocative irregularity of composition – twisting conventional expectations – is as central to the collaborative solving of practical problems as it is for creativity in the arts. Stravinski explored this in his lectures on *The Poetics of Music*:

But just as the eye completes the lines of a drawing, which the painter has knowingly left incomplete, just so the ear may be called upon to complete a chord and cooperate in its resolution.... Dissonance, in this instance, plays the part of an allusion.... All music is nothing more than a succession of impulses that converge towards a definite point of repose. That is as true of Gregorian chant as it is of a Bach fugue, as true of Brahms's music as it is of Debussy's.... This general law of attraction is satisfied in only a limited way by the traditional diatonic system, for that system possesses no absolute value (Stravinsky 1947: 34-36).

The creative mixture of personal and interpersonal talents is foundational to learning language and the propagation of all cultural meaning. Bateson's account of the foundations of human communication, and her theory of its importance as a species-specific mechanism for learning of

language and cultural rituals, are supported by contemporary studies with young infants of musical sensibilities in games and dialogues: in New York (Stern 1974, 1985; Stern *et al.* 1977); in Harvard (Brazelton 1973, 1979; Brazelton *et al.* 1974); in Cambridge, England (Bernal 1971, Richards 1973); in Edinburgh (Trevvarthen 1974, 1977, 1979); in Munich (Papoušek & Papoušek 1977); and in Toronto (Trehub 1973). The findings have been richly confirmed by a host of studies of the last three decades: human beings come to life with an *innate intersubjectivity* embodied in the forms and the rhythms of human vitality, expressed in intimate communication even where there is no language.

Infants' sensitive to the melody, rhythm, timbre, and consonance of musical sound invites mothers everywhere to sing to their babies: to amuse them or help them sleep (Trehub 1990, 2000; Trevvarthen 1999, 2002). Baby songs have similar musical/poetic structure (Unyk *et al.* 1992), varying to fit the infants' moods and interests, their ages, and the kind of shared body play they are meant to inspire to (Trehub & Trainor 1998). Infants respond strongly to the different moods of action games and soothing lullabies, allowing the vital rhythms of their minds and bodies to be excited, or slowed into peaceful states (Trehub *et al.* 1998, Trainor 1996). The melodies of song tempt the infant's curiosity and imagination, encouraging a growing awareness of other minds and shared thoughtfulness (Hobson 2002, Reddy 2008). Shared musicality has an innate foundation in rhythms and tones that makes persons of all ages potential partners in its narratives and potential actors in its interpersonal dramas – in ways that lead to mastery of many kinds of language, arts, and technical domains (Dissanayake 2000, Malloch & Trevvarthen 2009). An 'action' song that intrigues a six-month-old is a ritual narrative, with rhythmic cycles of display that repeat – with teasing variations – forms of action and sound passed on from distant ancestors. It is a performance memorable as something shared with affection (Trevvarthen 1995, 1999b, 2005a, b; Eckerdal & Merker 2009).

Play is full of energy, fantasy, and self-gratification. With laughter, it brings joy to strengthen relationships (Panksepp 2000, Panksepp & Burgdorf 2003). It can energise the whole body: to run and jump, to shout with excitement, or to share itself with a rising intonation, wink, or shrug. It is a display of self-consciousness, full of invention, that appeals to others, inviting the co-creation of meaning (Whitehead 2008). Communication through play arises by means of *extravagant* and *ritualised* motility: using the body, not to perform essential acts within the environment or to use the environment, but to display itself to others, attentive to their response and appreciation (Bjørkvold 1992). It is made up of actions – or self-regulations – made in an exaggerated, non-essential way. It may find new purposes – not needed at all for the private self, but valued for their use in relationship or community. The Self becomes a social Me, sharing symbols of jointly created significance (Mead 1934), playing a game with the 'mirrors' of other minds (Bråten 2009).

Human vocalizations and gestures mediate the creation of a unique cultural world where motives are shared in *narrations of movement*, expressive of invention in thinking and acting. Organized sequences of actions convey original thoughts, intentions, and imaginary or remembered experiences. These actions are made, not only with logical order to perform some task in the world, but also *with*

feeling for the drama of changing experience (Gratier & Trevarthen 2008; Trevarthen 2009a, b). Gestural expressions – with their innate timing and combination in narrations – are the foundation for learning all the forms and values of the elaborate cultural conventions of art, technology, and language (Gentilucci & Corballis 2006).

Negotiating the Differences of Experience Between Self and Other

In social life, the distinction between a movement made or posture taken in communication – a ‘gesture’ – and one not intended for communication, but entirely for individual purposes, may be unclear. It appears to depend on the abilities of one individual to ‘feel with’ the motives that cause and direct the action of the other – aided by a special enhancement of motive and expression that makes that kind of action more conspicuous or public, and so more sensitive to the responses of other agents: hence, self-conscious and playful (Bateson 1955, 1956, 1972; Reddy 2008; Whitehead 2008; Bråten 2009). The process gains direction and subtlety through learning in real life communication; but this learning would appear to require innate adaptation for immediate, intersubjective, ‘self-other-conscious’ awareness: active from the start of life and able to appreciate good quality or sensitive responses emotionally (Trevarthen 1998, 1999a, 2004a,d, 2009a, 2010; Beebe *et al.* 2005; Zlatev *et al.* 2008).

Attachment theory focuses attention on the emotional bonds between infant and parent that serve to care for and protect the infant. Research has shown how important the mother’s sensitivity to her infant’s needs are for the infant’s emotional attachment to the mother, along with the damaging effects of deficiencies in sympathetic response on either side (Bowlby 1951, 1988; Ainsworth *et al.* 1978; Klaus & Kennel 1976; Parkes *et al.* 1982; Fonagy *et al.* 1991; Beebe *et al.* 2010). From the neonate stage on, infants and mothers gain joy from imitative companionship that leads to creative and cooperative play, in which the infant can be both imitative and proactive – or ‘provocative’ (Nagy & Molnár 1994; Kugiumutzakis 1998, 1999; Bråten & Trevarthen 2007; Reddy 2008; Trevarthen 2001, 2005a, 2006, 2009a,b, 2010; Nagy 2010). As Bateson proposed, this is the kind of motivation that leads to cultural learning about what is neither Self nor Other, but can be conceived as and by both, with agreement of meaning.

Motives and emotions are communicated between persons by an immediate, sympathetic perception of dynamic features: i.e., by assimilation of proprioceptive feelings and exteroceptive interests of others into *altero-ceptive* regulation (Trevarthen 1986a). This interpersonal regulation, in the moment of communicating, opens the way to further, more enduring fields of regulation for actions, both their manners and goals. What may be called *socio-ceptive* regulation of actions, in relationships and communities, leads to development of collective ways of behaving that provide an environment of common understanding: a *habitus* for cooperative life (Frank & Trevarthen 2012). Elaboration of conventional customs, rituals, structures, tools, institutions, symbols, beliefs, and languages gives cooperative works their trans-generational meaning, in an *icono-ceptive* regulation of

human cultural behaviour.

These distinctions – of how actions are regulated for different purposes – are important in the sharing of creativity and exuberance in art, as well as any educational or therapeutic practice designed to strengthen the participation of persons – be they children or adults – in affectionate and meaningful relationships with others. All art and all therapy depend on respect for *altero-ceptive*, ‘higher’, more contrived forms of regulation. When a learner experiences difficulties understanding and practicing a culturally valued behaviour – such as appropriate social manners, speech, or sporting or musical performance – it is not sufficient to identify a fault and try to treat it as if the affected individual were a physical system without human sympathies. *Intent participation* in new experiences, with a teacher, is required (Rogoff 2003).

Figure 7 – The motives and emotions of cultural agents: the field of actions, experiences, and emotions of the embodied Self (S), acting in engagement with Objects (O) or in psychological communication with Persons (P). Different emotions regulate these relationships. Participation in culture – understanding its meanings and using them in companionship – requires both technical and artistic skills.

CONCLUDING THOUGHTS: HUMAN EMBODIED SEMIOSIS IN A RATIONAL AND TALKATIVE WORLD

Culture is activity of thought, and receptiveness to beauty and humane feeling. Scraps of information have nothing to do with it (Whitehead, 1929)

Sophisticated adult life – ruled as it is by intangible facts, beliefs, and rules, encoded in totally conventional and immaterial language – is, at the same time, full of playful, even theatrical extravagance (Dissanayake 1988). Preparing or eating a complicated meal when you are not hungry,

even dressing elaborately for it; looking about significantly when not interested in seeing anything; calling out incredulously at impossible stories or at a missed tennis shot; pretending to listen respectfully when not interested; running about when not going anywhere, as happens in sport; and – at least if one is a TV presenter or politician – waving one's hands about when one has nothing to say, expressing perhaps a search for ideas. Every encounter with others is regulated by the special intensities, emphases, and timing of actions, whether in courteous or persuasive conversation, in a sporting match with an opponent, or when acting in a performance before an audience.

Human artefacts also have playful or pretentious beauty, or *aesthetic form* – sometimes disciplined by the logic of construction or composition in sophisticated media, meanwhile exhibiting the care and artfulness with which they were crafted, or commanding significance for a ritual purpose that requires proper performance and may engender intensely shared feelings. Works of art are received as having aesthetic or moral value inferred from the manner of their execution or the stories they relate.

Morality, relationship-regulating displays of emotion, group status, and cooperative purposes beyond the needs of parental care or sex are all apparent in animal societies (see e.g. Cheney *et al.* 1995). The more elaborate cultural achievements of human society – as well as children's mastery of work and play in family and school – depend on modulation of expressions of self-satisfaction and modesty. All engagements are acted with care for feelings in a continuum between pride and shame (Scheff 1988, Barnes 2000, Trevarthen 2005b). This moral regulation gives humanly felt interpersonal value to the more rational understanding of intentions and *theory of mind* (Melzoff 1995, Tomasello *et al.* 2005), now conceived by cognitive psychology as the distinctive achievement of human intelligence.

How Feelings Revealed to Others Promote Solidarity of Understanding in Companionship

In every community, people make things that are not essential for practical purposes but greatly valued for their beauty and symbolic significance (Turner 1991). Beauty is a property of the making: a neurally mediated quality expected to be shared (Trevarthen 1995, Panksepp & Trevarthen 2009). Beauty is valued simply because it *can* be shared. It makes human works and natural objects 'special' in intimacy and in community (Dissanayake 1988, 2000, 2009). The appreciation of beauty in visible or audible art extends to objects or places not human made but similar in qualities of form, proportion, colour, melody, or harmony.

When one appreciates a picture, one senses and evaluates the work and feelings of the artist who made it. The same is true for a song or a performance of instrumental music (Brandt 2009). Art is concerned with the direct communication of pleasure in creating shareable experiences and objects. It enhances rituals and 'stories' of performance, without regard for practical products: that is what distinguishes it from technique. That said, the skills of advanced artistic performance combine art and technique (Flohr & Trevarthen 2008, Bannan & Woodward 2009, Rodrigues *et al.* 2009). Playful art

and rituals have special value for development of the child's brain and of skills valued in vital societies (Opie & Opie 1960, Trevarthen 1995, Bruce 2001, d'Aquili & Newberg 1999, Whitehead 2008). Early education in active, enjoyable musical experience – with opportunities to acquire and share fluent, emotive expressions of musicality – may have profound positive consequences for the rest of a child's mental apparatus and overall development (Bjørkvold 1992, Flohr & Trevarthen 2008, Bannan & Woodward 2009, Custodero 2009).

Emotional Disorders are Disorders of Relating and, Therefore, Disorders of the Body and Meaning

Human minds naturally seek to live in relationships. Disorders of embodied motives and emotions – and, therefore, of learning, thinking, and communicating, with or without language – are disorders of processes between persons, in a system of engagements (Sander 1983, Tronick 2007). They are disorders of the feeling of being in intimate or mediated relationship and of experience in the Self (Mundale & Gallagher 2009, Stanghellini 2009). Dealing with a diagnosed fault in an individual – such as autism – leads to recognition that the effect of the fault lies between that person and others (Hobson 2002). Emotion is not simply the regulation of states of arousal nor the building of schemas for objects and relationships, but also the regulation of acting with intentions that have both defined goals and interpretive creativity. Actions are evaluated by the emotions accompanying their motives, as forces within the human psyche that the learning of language and other cultural skills channels and elaborates. All these functions of human gesture are evident in the first two years of life – before a child can speak, using the special shared intelligence of language (Stern 1985/2000). They show their beginnings before birth. After birth they create – in collaboration with sympathetic companions – what I have called a *communicative musicality* (Malloch & Trevarthen 2009).

The argument against sophisticated constructivism as an explanation for interpersonal consciousness or its disorders is lucidly set out by Vasudevi Reddy (2008). Reddy reviews, through skillful and systematically examined observations, the complex, engaging nature of human infants and their remarkable – hitherto largely unremarked – perceptive and intentional social awareness, rich in self-conscious humour. In her opening chapters, Reddy proposes that, like adults, infants experience the subjectivity of another through *second-person* interpersonal interaction. She argues that knowing the subjectivity or mind of another entails engaging with the other's expressions directly, thereby establishing a *second-person* perspective: i.e., one that is neither first- (from within an isolated individual mind) nor third-person (from an observing other, empathically). The second-person perspective engages self with other, sympathetically. Reddy describes studies of changed imitation, self-consciousness, humour, attention, intentions, and deception in autistic persons, all of which confirm that these persons are perturbed in feeling their engagement with other persons: in being related to by another and reflected in another's feelings.

From such a position – neglected by developmental psychologists seeking more rational and representation-based explanations, but shared by the folk psychologies of mothers the world over – one can see that knowing, and sharing with, another mind is not just about communicating by volitional calculation – or what Whitehead describes as ‘products of rational discernment’ (Whitehead 1926: 100). It is about awareness of another through direct, shared experience of living creatively and with passion. Felt intersubjective activity just *is* the ‘knowing’ people have of one another. Perinatal care confirms the intuitions of new parents that their unsophisticated child is a conscious human person. This brings great pleasure to the parents and strengthens the bonds they have with their infant and with one another (Brazelton 1993).

Disorders of the mind may take the form of – and be measured by – failures in creativity, language, or reasoning; but all are accompanied by failure in basic engagement with other persons’ impulses and feelings, as well as by confusion of self-felt impulses and feelings.

The Neuropsychology of Intrinsic Aesthetic and Moral Values of Culture

Contemporary brain science is helping explain how intersubjective communication of intentions, with emotions, is part of the adaptive design of human cerebral physiology (Adolphs 2003; Gallese 2003; Gallese, Keysers & Rizzolatti 2004). Nevertheless, while it is evident that vocal expressions and hand gestures function by engaging primitive, generative processes of *sympathy*, the dynamics of brain activity transmission between persons remain mysterious and controversial. One cannot explain how the gestural motives evolving in one brain become messages that motivate another brain to pick up the process, in a particular imitative or complementary way. Presumably we become aware of others’ intentions and feelings, and can participate in them, out of sensitivity to parameters of the control processes of self-awareness in others, understanding them as similar to those of our own self-awareness. Presumably the representation of the Self is similar to, but distinct from, the representation of the Other – as proposed by Stein Bråten (1988, 1992, 2009), and by Adam Smith in defining the agency of his ‘conscience’: ‘when I endeavour to examine my own conduct, I divide myself, as it were, into two persons. The first is the spectator.... The second is the agent, the person whom I properly call myself, and of whose conduct, under the character of the spectator, I was endeavouring to form an opinion’ (Smith 1759: 113).

There must be an adaptive enhancement of the evidence in movements – beyond what is required to guide the actions of the Self – to sustain efficient, online communication, such as Bateson describes between a mother and her young infant. There must be an immediate appraisal of the *quality* of engagement and a regulatory process that can adjudicate between the representations of communicating subjects. Indeed, one finds abundant evidence for a special extravagance and adornment of movements and actions serving communication of complex and rapid mental activities, along with a set of powerful emotions evaluating the coupling of their motivations in separate individuals.

Can Meaning Leave the Body?

There appears to be a paradox or a disconnect between the embodied *generative* or *creative* process on the one hand and the *created substance* of objects that have cultural meaning – such as tools or texts – on the other. However dependent a meaning may be on embodied expression of imaginative feeling, both for its creation and its appreciation, once it becomes accepted as a metaphor, it begins to leave the body: to take on an ethereal, timeless, and lifeless power to signify. It become a symbolic 'thing'. The symbol may be an object, a mark on paper, a car, an electronic pattern in a computer, etc. The logical meanings of symbols, though made explicit by human action, have themselves no embodiment. Can they not become part of an ideal repository of material information, accepted as 'true', persisting through many lifetimes and distributed beyond the limits of individual human mobility: implements that outlast their maker?

At the same time, symbols and other tools have no meaning without live, embodied understanding. They are dead. Every signifying form must be taken up by a correctly educated mind to be 're-incarnated' in ideas, thoughts, opinions, and actions rich in practical utility and emotional potency (Donald 2001, Turner & Whitehead 2008). Every symbol has two parts: an intersubjective motivation and a referential connection to an object, event, or action of human interest (Trevvarthen 1994, 2009a). Regulations – or rules of behaviour – are essential in ritual culture: there is a proper way to hunt, elect a leader, pray to the gods, tell a story, play tennis, play a children's game, conduct an election, drive or walk through a city, etc. (Durkheim 1912/1995; Opie & Opie, 1960; Radcliffe-Brown 1961; Turner 1969, 1982; Merker 2009b). Language is essential to the building and empowerment of rational meaning in any large community. It must obey rules of grammar (Bourdieu 1991). Meanwhile, a song or a symphony can be written according to a conventional score. Both music and language attend embodied activation in symbolic form. Both wait to be brought to life in execution, after which their manner is open to rational, aesthetic, and moral appreciation that can only be felt by living persons who know what was intended by the authors. In this way, a social 'mind', *habitus*, or 'sociosphere' is generated through human cooperative play (Durkheim 1912/1995, Bourdieu 1990). A symbol or a ritual can only be made to have meaning through a commitment to its making sense in embodied use or performance, in experiences shared with others (Frank & Trevvarthen 2012).

When a child goes to school, she learns to behave in many 'correct' ways. She comes to know many things and perform many skills. These are best learned by sharing embodied understanding in *intent participation* with a teacher or as part of a *community of learners* (Bruner 1996, Rogoff 2003, Rogoff *et al.* 2003). Eventually the true knowledge, good behavior, and efficient skills come to be employed in a cooperative adult world, in which each agent has an accepted place. From time to time, however, pleasure is required from the performance of less practical activities of recreation and artful performance. As the wisest philosophers of education have insisted: the romantic, trustful, and

inquisitive communication found in live play – which starts the process of learning conventional culture – remains a foundation for the most practical and rational occupations.

In the end, all products of the *sociosphere* and the *semiosphere* (Lotman 1984) are embodied. They are regulated emotionally within the *ethiosphere* (Stuart 2010).

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