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The Infant's Creative Vitality, In Projects of Self-Discovery and Shared Meaning: How They Anticipate School, and Make It Fruitful

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Abstract:

This paper presents the child as a creature born with the spirit of an inquisitive and creative human being, seeking understanding of what to do with body and mind in a world of invented possibilities. He or she is intuitively sociable, seeking affectionate relations with companions who are willing to share the pleasure and adventure of doing and knowing with 'human sense'. Recent research traces signs of the child's impulses and feelings from before birth, and follows their efforts to master experience through stages of self-creating in enjoyable and hopeful companionship. Sensitive timing of rhythms in action and playful invention show age-related advances of creative vitality as the body and brain grow. Much of shared meaning is understood and played with before a child can benefit from school instruction in a prescribed curriculum of the proper ways to use elaborate symbolic conventions. We begin with the theory of James Mark Baldwin, who observed that infants and young children are instinctive experimenters, repeating experience by imitating their own as well as other's actions, accommodating to the resources of the shared world and assimilating new experiences as learned ideas for action. We develop a theory of the child's contribution to cultural learning that may be used to guide practice in early education and care of children in their families and communities and in artificially planned and technically structured modern worlds of bewildering diversity.

Cycles In Moving and Learning of the Human Spirit

In 1894 Baldwin published his seminal thesis on psychological development of the infant. He studied the motor development of children to discover the origin of intelligence, and his attention was attracted to the repetition of actions, most obvious at first in limb movements of the young infant, but true of all the infant's actions, including looking movements of the head and eyes, touching with the hands, and vocalizing. He termed this tendency for moving and sensing to repeat itself the 'circular reaction'.

“... the self-repeating or 'circular' reaction... is seen to be fundamental and to remain the same, as far as structure is concerned, for all motor activity whatever: the only difference between higher and lower function being, that in the higher, certain accumulated adaptations have in time so come to overlie the original reaction, that the conscious state which accompanies it seems to differ *per se* from the crude imitative consciousness in which it had its beginning.”

(Baldwin, 1894, p. 23)

Baldwin claimed that the tendency for an action to be repeated expresses an invariant principle of organisation within human psychological development, which persists in behaviours at every degree of complexity. Baldwin's circular reactions were the forerunner of Jean Piaget's sensorimotor and cognitive 'schemas' (Piaget, 1962). Both conceived the developing mind as generated in embodied movement. Higher mental functions emerge as abstractions from earlier sensorimotor experience, and are therefore

structured by the same principles. Repetition observed in early motor action in infancy, develops into repetition in complex and abstract cognitive thought process in later childhood and adult life. The invariant feature is the tendency for an act, in real movement or in thought, to repeat itself, and for the plan of successfully accomplished acts to be retained and developed through further repetition with variation.

The idea has become a core principle of preschool education theory, originating from the understanding of early childhood gained by the revolutionary educators Comenius, Pestalozzi and Froebel (Athey, 1990; Bruce, 2012). But attention only to object use is insufficient to understand the way a young child learns meanings in human company (Donaldson, 1978). A young child's action is to be understood in the context of innate capacities for signalling intentions, feelings and experiences to communicate about a shared world, first with parents and family, and then with assistance from companions and teachers in an expanding community (Whalley et al., 2007). The circular reactions of intelligence must be expectant of experiences in relationships, with different degrees of intimacy and reliability.

Baldwin was aware that social collaboration in the making of shared meaning needs circular reactions between the intentions of individuals. He observed the growth of the young child's self-awareness in engagement with other persons, and their readiness to learn from individuals by attending to the different purposes of their actions. He saw the principles of repetition in action -- 'accommodation' to new circumstances in awareness enabling creative novelty, and 'assimilation' of successful experience to guide further actions -- also regulate and elaborate social habits. He was as interested in changing sociological theory as in advancing developmental psychology in a science of the "child and the race". These ideas influenced George Herbert Mead's sociological theory of the development of a social 'Me' (Mead, 1934) and Jerome Bruner's psychological theory of development within 'the culture of education' (Bruner, 1996). We are built from the start to be attuned social creatures seeking engagement with initiatives and knowledge of other humans. That is how all our cultural habits and achievements are made (Trevarthen and Delafield-Butt, 2013; Trevarthen et al., 2014).

The Innate Rhythms of Experience In the Time of Action

The existence of a 'motor image' formed in the mind, one that anticipates and organises bio-mechanical effects of moving, in the body and in engagement with objects, was firmly established in the 1920s by a young Russian neurophysiologist, Nikolai Bernstein (1967), who used examination of film to accurately trace the regulation of forces in the moving body of a tool-user, a runner, or a child learning to walk. He analysed how the many motor components of any body action are assembled by the dynamic *motor image* formed in the brain into a coherent, intended movement, which is highly efficient, wasting almost no energy. Bernstein noted that well-done movements are always rhythmic, smoothing out the irregular inertial forces they master through planned steps of time. This power of the brain to integrate its activities in coherent rhythmic patterns is recognised in the philosophy of phenomenology, which admits that motility and consciousness express the brain-generated 'subjective' time of intentional doing and thinking (Merleau-Ponty, 1962; Goodrich, 2010). We share an inborn sense of time, and this makes shared doing and thinking or shared meaning possible (Trevarthen and Delafield-Butt, 2013).

The Developmental Psychobiology of Sensori-Motor Learning.

Two lines of research in the last four decades have brought new evidence confirming the generative power of human motives and their timing in self-discovery, and in regulation of relationships.

Careful attention with the aid of film and video recording technology to the capacities and needs of newborns, including those born up to three months before term, has brought to light an intelligence that is expressive in human ways and highly sensitive to the pulse and qualities of human expression, and their tendency to compose narrations (Trevarthen, 2011a). Developments of sensori-motor intelligence in the first three months lead the infant to be a skilled performer in a 'musicality' of companionship with a willing partner (Malloch, 1999; Malloch and Trevarthen, 2009). In every human community babies three

to four months old begin to enjoy participating in the rituals of traditional action games or baby songs (Trevvarthen, 1999, 2006, 2008; Gratier and Trevvarthen, 2008; Ekerdal and Merker, 2009) (See Figures 4 and 5).

Newborn infants less than a week old respond to the expressions of other persons and use the imitated actions to establish a dialogue of purposes and experiences (Nagy, 2011). However, in spite of controlled studies by Maratos, Meltzoff, Heimann and others that prove the infants can imitate, this is a highly controversial area of research, because the findings contradict long held beliefs and rational arguments that an infant can have no an intentional self conscious of an outside reality for weeks or months after birth, and no ability to perceive the actions of another person as like those of a self (Kugiumtzakis and Trevvarthen, 2014).

Detailed study of videos of interactions with full-term and premature infants in the first days after birth shows a baby can focus attention and imitate movements of head, eyes, and mouth, with parts of their own body they cannot see, and even try to imitate simple sequences of vocal utterances (Figure 1). Emese Nagy and Peter Molnár (2004) made an important modification of the testing procedure by waiting for a few seconds after the newborn infant has imitated her, which evokes a repetition of the imitated act by the baby as a 'provocation' for a response from the adult. Concurrent recording of heart rate changes showed that while 'imitation' is associated with effort signalled by heart beat acceleration, 'provocation' is accompanied by a slowing of the heart, indicative of focussed attention for a response.

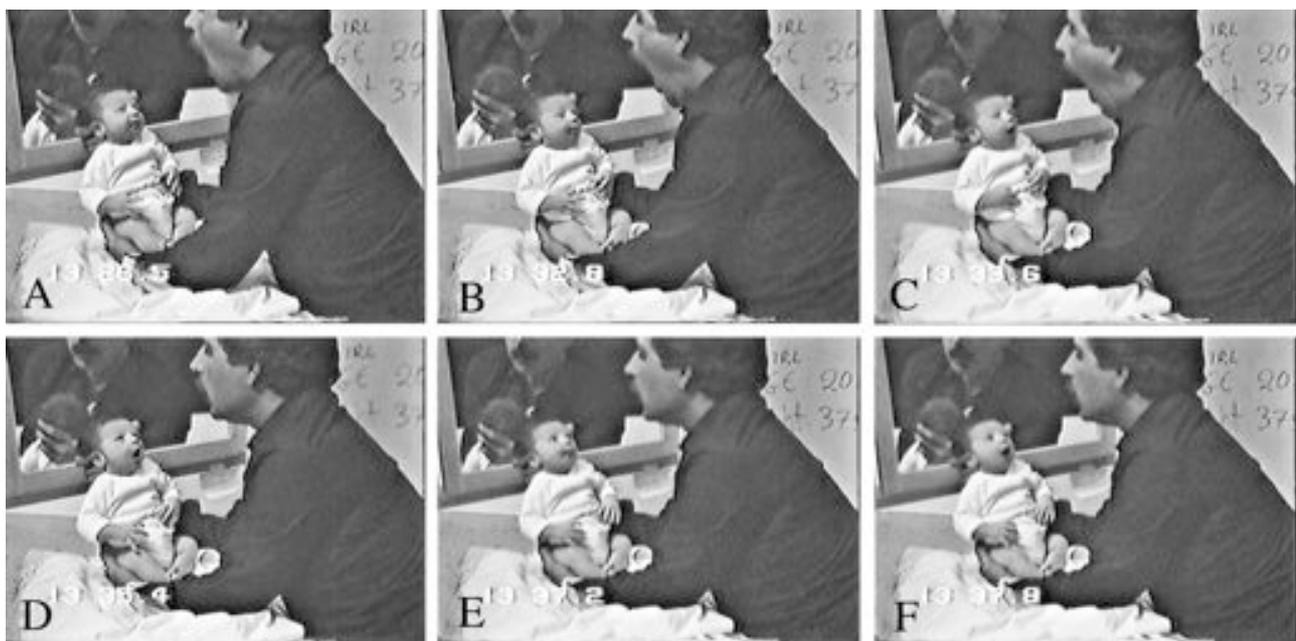


Figure 1: A cycle of imitations of Mouth Opening with a female infant 20 minutes after birth. Recorded a maternity hospital in Herakleion, Crete in 1983 by Giannis Kugiumutzakis for his PhD research at the University of Uppsala. (Kugiumutzakis and Trevvarthen, 2014)

A (0 sec.) The researcher presents a wide open mouth for the first time to the attentive infant, focusing on his mouth, and with slightly closed eyes and pursed mouth.

B (6.3 sec.) The researcher opens his mouth for the fourth time. The neonate continues to observe his mouth with evident interest. The right hand moves up.

C (11.1 sec.) The researcher opens his mouth for the fifth time. The neonate imitates him once, synchronously while watching his mouth. The right hand closes.

D (12.9 sec.) The infant imitates a second time, looking up at the researcher's eyes as he waits.

E (14.7 sec.) Both pause, waiting. The infant is still looking at his eyes.

F (15.3 sec.) The infant makes a third large imitation while looking at the researcher's mouth.

Imitations of a newborn infant are the product of nine months of development in brain and body. Research tracing the first stages of the conception of a human being reveals a time-regulated process of collaboration between living elements (Delafield-Butt and Trevarthen, 2013).

The human foetus at 8 weeks has distinctive body form with adaptations of hands, hearing organs, eyes, mouth and vocal organs that show anticipation of a life in conversation (Trevarthen, 2001). At this stage the subcortical brain, that will be the integrator of intrinsic motives for sensory-motor functions of the whole, and for emotional appraisal of objects of action is forming in close relation to the systems that regulate hormonal functions of the vital self.

“The first integrative pathways of the brain are in the core of the brain stem and midbrain, and the earliest whole body movements, though undifferentiated in their goals, are coherent and rhythmic in time. When sensory input develops, there is evidence, not just of reflex *response* to stimuli, but of the *intrinsic generation of prospective control* of more individuated actions, before the neocortex is functional. In the third trimester of gestation, when the cerebral neocortex is beginning formation of functional networks, movements show guidance by touch, by taste and by responses to the sounds of the mother's voice, with learning.” (Delafield-Butt and Trevarthen, 2013, p. 205)

The origin of the mental life of a child is identified at this time, at 50 days gestational age, as the integrated neuromotor system enacts the first spontaneous circular reactions of the organism (Delafield-Butt and Gangopadhyay, 2013).

Movies made by ultra-sound, which enable sight of the foetus alive in the mother's body and the measurement of activities, confirm that from mid gestation limb movements of the foetus are purposefully guided, anticipating sensory feedback, and experimenting with it. These self-regulating movements not only show differences of vitality that identify different foetuses as more or less animated personalities, even in 'identical' twins (Piontelli, 2010). They also reveal a special sensibility for the presence of an 'other', reaching and touching with special care toward a twin. Facial expressions show that the foetuses have emotions of pleasure in appreciation of 'good' tastes or physical sensations, and of anxiety or disgust for 'bad' experiences. Hearing develops in the last months and the mother's distinctive voice is recognised by the newborn to identify her as a preferred partner. This helps the baby learn her face in the first days.

New Brain Science of Shared Intentions

Perceiving the intentions in others' actions is now shown to be mediated directly by neural resonance, or 'mirroring' (Gallese, et al., 1996), but the process is not an automatic reflection; it requires persons to receive and take up one another's purposes. It demonstrates reciprocal inter-subjective and sympathetic engagement with mutual accommodation of actions and emotions (Ammaniti and Gallese, 2014). This is how experiences of the world can be assimilated into a common 'human sense' of meanings (Donaldson, 1978). Mutual learning by accommodation, and the playful assimilation of rhythmic game routines, are enacted in facial expressions and vocal utterances, and in the 'vitality dynamics' or 'musicality' of repetitive actions of the whole body (Malloch and Trevarthen, 2009; Stern, 2010; Trevarthen and Delafield-Butt, 2013).

Humberto Maturana has called the spontaneous need of a human organism to move in creative, expectant ways that express ideas of being in the world 'linguaging' (Maturana et al., 1995). The reactions of a newborn to affectionate and playful attentions of a companion indicate that there is a specific readiness for linguaging in movements that have the power to 'make sense' for others, without words. We can see this in a picture of a newborn engaging with attentive others with the emphasised expressions in attitude and gestures of an orator, or critic (Figure 2). The cerebral hemispheres develop complementary ways of taking care of inner life functions with the help of maternal care, and seeking adventures in discovery of

the resources of an external world (Trevarthen, 2001; Trevarthen et al., 2006). This is shown by the ways a newborn baby's hands move. Commonly the right hand projects outward 'declarative' gestures while the left is more directed to the body.



Figure 2: A 4-day-old girl intently regards her grandmother, who is speaking to her, using an expressive body, with an attentive mouth and asymmetric hand gestures, 'langauging'.

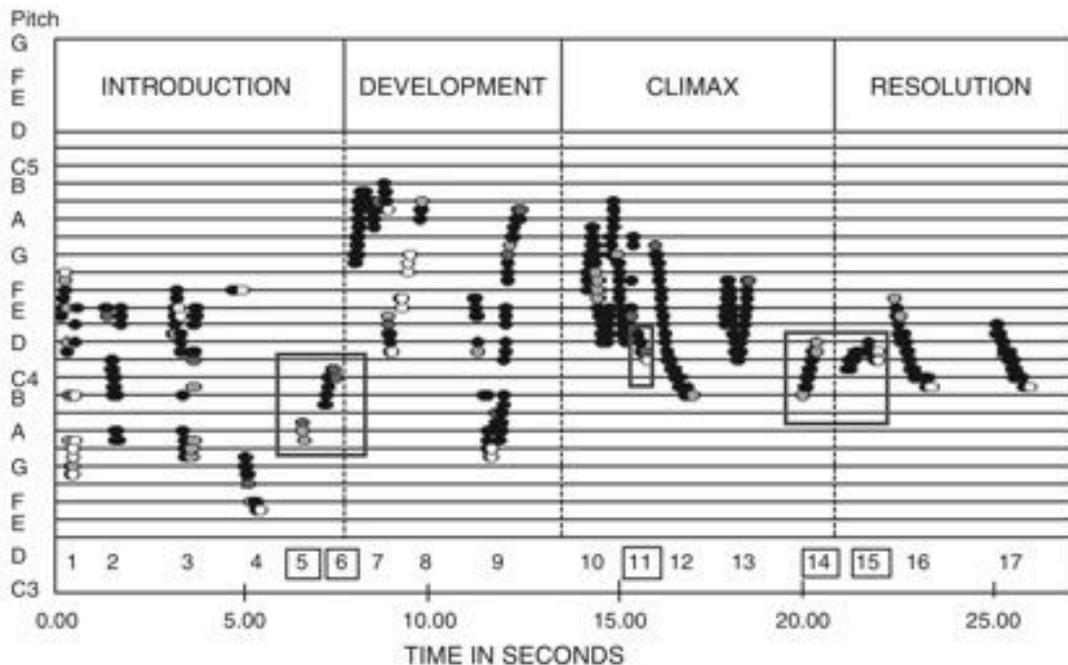
Emergence of Learning In Companionship

Infants are born at a fragile stage of life when the body is adapting to a new world and brain is growing rapidly (Nagy, 2011). They need support, protection and nourishment and are adapted to stimulate a mother's care. A mother who is emotionally depressed, anxious and inattentive to her infant will have difficulty holding her baby's attention, and the baby may be avoidant and even become depressed as well. Crucial help can come from others who offer care, and the baby will respond (Narvaez et al., 2012). We know that the quality of early care matters for future self-confidence and learning, and the infant has ways of expression that reinforces an affectionate personal relationship. In 'bonds' of mutual trust with favoured companions, shared repertoires of expressive tricks and exchanges of feeling are discovered that nourish the infant's vitality and imagination (Stern, 1995, 2000; Trevarthen, 2009, 2012a, b).

The intensity of interest and the delicacy of response of young babies to persons who speak to them reinforces an affectionate personal relationship, which has great importance in the baby's well being and mental development. In the 'bond' that develops between them, infant and favourite companion cultivate a shared repertoire of expressive tricks and exchanges of feeling.

Microanalysis of ordinary face-to-face play between parents and young babies confirms a precise *timing* in the way they address one another and reply. The infant stimulates an adult to use a gentle and questioning *infant directed speech*, 'motherese' or 'baby talk', that has a regular beat and characteristic expressions of mood in its changing intonation, rhythm, and in the accompaniment of movements of head, eyebrows, eyes, and hands. The infant listens and watches the affectionate and playful display intently, and then makes a reply -- on the beat, with a smile, and with head and body movements, cooing, hand movements, and lip-and-tongue movements of *pre-speech*. The attempts at vocal expression are synchronised with delicate hand gestures, as in adult conversation. In collaboration with the parent infants make rudimentary 'utterances' that form *phrases* of two or three seconds, and that are organised in *narratives* of expressed excitement with characteristic phases of 'introduction', 'development', 'climax', and 'resolution', typically lasting around 30 seconds. The enjoyment parent and child have in extended 'protoconversations' demonstrates a state of 'primary intersubjectivity' or dynamic interpersonal

awareness that allows mutual regulation of feelings and motives (Trevvarthen and Delafield-Butt, 2013) (Figure 3).



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

Figure 3: Proto-conversation with a six-week-old, showing mutual attention between infant and mother, the pitch plot of the narrative showing how the voices move in the octave above Middle C (C4), and the verbal utterances of the mother. The infant's vocalizations are enclosed in boxes. (Malloch and Trevvarthen, 2009; Trevvarthen and Delafield-Butt, 2013)

Analysis of vocal exchanges in protoconversation by acoustic techniques shows that the timing, rhythms, pitch modulations and quality of sound expressions constitute a 'communicative musicality' (Malloch, 1999; Malloch and Trevvarthen, 2009), and tests of young infants' preferences and capacities to discriminate sounds show that they hear musical melodies, harmonies, rhythms, and accents, in both vocal and instrumental sound. These sensibilities are particularly adapted to hear the melody of emotions

and states of animation in the human voice, especially the mother's.

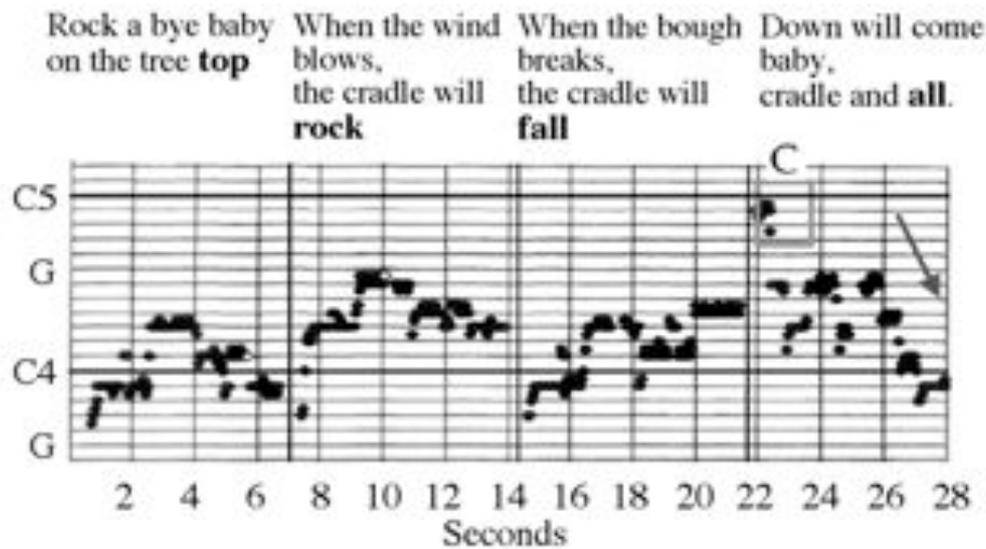
How Games With Mother Lead to Sharing of Tasks, Tools and Words, Artefacts of a 'Proto-Habitus'

In 1974, Penelope Hublely, in PhD research at Edinburgh University, made an observation that led to new understanding of how shared understanding of using and naming objects begin. She was studying of films of communication between an infant girl, Tracy and her mother from 3 weeks after birth (Trevarthen and Hublely, 1978). She observed a first proto-conversation at 4 weeks, and paid particular attention to the development of play from 3 months when the baby began to use her hands for grasping and manipulating objects. After 5 months games developed as her mother teased Tracy's interests in entertaining ways. The teasing became reciprocated, Tracy acting in provocative uncompliant ways for fun. This is how infants get to know minds better (Reddy, 2008). They played 'person-person' games with one another's movements, of face hands and voice, then after 7 months games were played with objects that the mother moved to attract Tracy's interest and participation. Tracy practiced 'secondary circular reactions', shaking and banging objects she was holding, and she watched when her mother joined the rhythmic game with her expressions. The object, or its use by Tracy to 'move' her mother, became a mediator in shared interest and action, animated by Tracy's clear expressions of pleasure, puzzlement, etc.

As Tracy's two handed play developed, the games with her mother became more elaborate and protracted. Then, at 40 weeks, for the first time Tracy acknowledged her mother's initiative in a new way, seeking to understand what new intention was offered. They began to share intentions in a task in what we called 'secondary intersubjectivity', person-person-object cooperation, and Tracy's new willingness to become a partner greatly changed how her mother communicated. As they efficiently 'worked' in joint tasks, performing complimentary steps, her mother's 'directives' by speech and gesture took over from playful 'reactive' imitations of sounds and actions.

Hublely followed this with a study of 5 girls making films at 2-week intervals when the infants were 34 to 54 weeks of age (Hublely and Trevarthen, 1979). All subjects changed in their willingness to follow directives of their mothers from 46 weeks and by the end of their first year were learning new purposeful acts from their mother's example, including some words. They were mastering Michael Halliday's 'proto-language' of gesture and vocalization (Halliday, 1979). We identified the infant as the motivator of the important development in companionship:

"Our work leads us to suggest that at the end of the first year our subjects had become pupils by some positive genesis of an adaptive function essential to being human. They could then gain understanding not only through their own activity, but also from another person by imitating, and even more powerful by the more complex tactics of cooperation that provoke assistance and instruction." (Hublely and Trevarthen, 1979, p. 74)



Clappa, clappa handies
 • • • •
 Mommy's at the well,
 • • • •
 Daddy's away to Hamilton
 • • • •
 To buy wee Emma a bell.
 • • • •



Round and round the gar-den
 • • • •
 Ran the ted-dy bear,
 • • • •
 One step, two step,
 • • • •
 And a tickly un-der there.
 • • • •

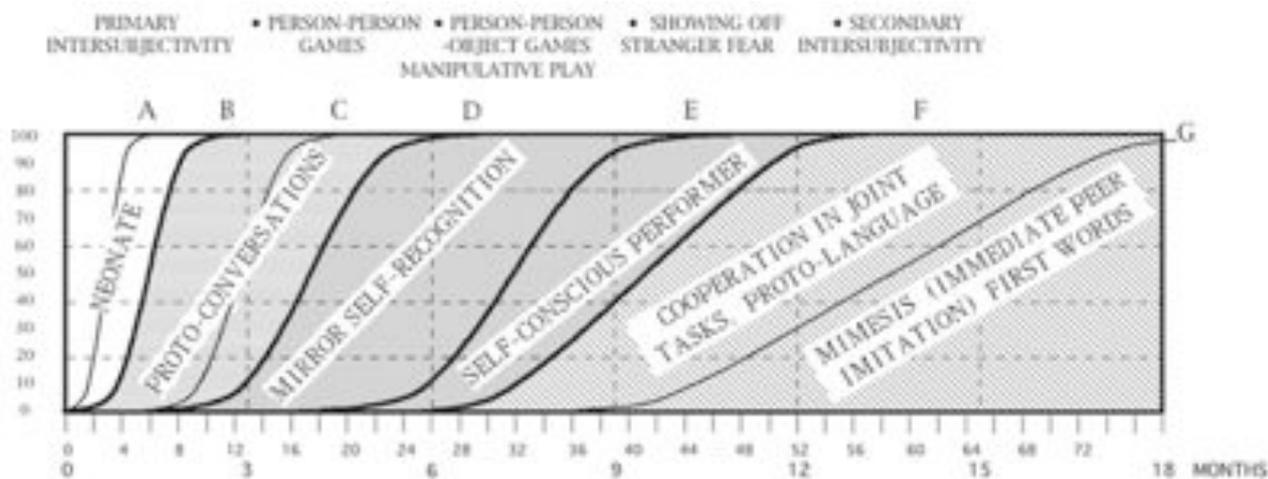


Figure 4: English baby songs show the universal structure, with groups of four lines, making verses each of which is a narrative that last around 25 to 30 seconds. The rhythm is ‘iambic’ with alternating accented and unaccented syllables, and commonly there is rhyming of words at the ends of the lines. The infants attend and react in time with the song. Many songs are accompanied by ritual body games, and in “Clappa-Clappa-Handies”, and “Round-and-Round-the-Garden” shown. “Rock-a-bye Baby” is a lullaby, sung slowly. The lines make up a four-part narrative. (Trevarthen and Delafield-Butt, 2013)

The Chart of Changing Motives for Shared Experience Through Infancy, and How Toddlers Make Meaning In Their World

Research on the development of communication with infants, which was recorded in three multi-disciplinary volumes in the 1970s (Schaffer, 1977; Lock, 1978; Bullowa, 1979), revealed stages by which innate capacities for action-with-awareness and communication are elaborated, from the subtle two-way imitations of expressions by newborns with mother and father, to the acquisition of speech. We defined age-related changes in infants’ motives for learning by their own efforts and in communication with

familiar companions and we found strong relationships between the ages of change and developments in the body and brain (Trevarthen, 2001; Trevarthen and Aitken, 2003). The most conspicuous changes were the development of protoconversations at 2 months (Figure 3), a period when the narratives of rhythmic action games and baby songs were enjoyed in months 4 to 8 (Figure 4), and the change to cooperative use of objects and significant actions at 9 months.



Key Developmental Changes		
	Behaviour and Motor Activities	Communication
A (3):	Regulations of sleep, feeding and breathing. Innate "pre-reaching".	Imitation of expressions. Smiles to voice
B (5):	Pre-reaching declines. Swipes and grabs	Fixates eyes with smiling. Proto-conversations. Mouth and tongue imitations. Distressed by "still-face" test
C (12):	Smooth visual tracking, with strong head support. Reaching and catching	"Person-person" games, mirror recognition
D (16):	Interest in surroundings increases. Accurate reach and grasp. Binocular stereopsis. Manipulative play with objects	Imitation of clapping and pointing. "Person-person-object" games
E (32):	Babbling. Persistent manipulation, rhythmic banging of objects. Crawling and sitting, pulling up to stand	Playful, self-aware imitating. Showing off. "Stranger fear"
F (42):	Combines objects, "executive thinking". Categorizes experiences. Walking	Declarations with "joint attention". Protolanguage. Clowning
G (60):	Self-feeding with hand	Mimesis of purposeful actions, uses "tools" and cultural learning. Imitates first words.

Figure 5: Age-Related Changes in the abilities of infants that prepare the way for language and learning of culturally significant skills

After the 18 months of infancy, the body becomes very mobile and the toddler seeks wider social relations. Creativity within the experience of the repetitive act, discovering how, in communication, each repeated act is a newly created expression and will carry with it some degree of creative novelty or playfulness, is particularly strong in exuberant activities of young children, before school, and remains so for exceptionally creative adults (Bruce, 2001; Bateson and Martin, 2013; Trevarthen, 2014). In play repetition in the interpersonal dialogic cycle promotes the generation of understanding and the creation of

new meanings with socio-cultural value, and these become part of an endlessly inventive tradition of story-telling (Bruner, 1990). Each new expression offered in exchange contains within it reference to the utterance that came before it, from the other person. Next it may be assimilated with all of the associations, motivations, playful novelty, and intentional aspirations of the listener or watcher, who will reply by speaking or by doing a responsive action. Thus dialogue creates new meaning.

Two artists, a poet and a musician, praised the powers of sociable invention by young children. Both became investigative psychologists. The Russian poet and cultural activist Kornei Chukovsky, who became the most famous children's poet in Russia, had discovered, when he listened to young children playing where he was writing, that between two and five children are "linguistic geniuses", inventive and sensitive to the poetic resources of their talk in play (Chukovsky, 1968). Professor of Musicology Jon-Roar Bjørkvold, in his *The Muse Within* (1996), similarly reports discovering the inventiveness of "children's musical culture" when he studied material he had collected in Russia, the United States and Norway.

Baldwin's principle of psychological development as circular repetition reminds us that creative novelty is present in every new act, and the rhythms, feelings, and interests in engagement with the world are adapted to be shared between persons. Successful and rewarding experiences are repeated with playful variation. Appreciation of the child's contribution to the discovery of meaning by collaboration with companions in imitation supports a more generous, more creative, more enjoyable, and more fruitful, practice of education at all later stages (Whitehead, 1929; Malaguzzi, 1993; Bruner, 1996; Hurst, 1997; Donaldson, 1999; Rogoff, 2003; Trevarthen, 2011b, 2012c, 2013). This practice must be more than child-care by staff occupied with protecting babies and toddlers while mothers are at work. It needs specially trained teachers who appreciate the changing abilities of young children for active learning in rich environments that favour creative collaboration with companions of all ages, who know that children respond to exploration with the natural world, who involve parents in their children's learning, and who do not impose formal primary school instruction too early. Life-readiness is already richer before school-readiness is required.

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