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Chapter 11

Infant Research and Systems Intelligence: Some Observations

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The infant and the mother form a system that has been studied by both psychoanalysis and experimental development researches. Synthesis of these fields extends our knowledge of how the infant develops. The infant has complex mental structures and capabilities already at birth. She is capable of attunement, i.e. has the capability to share feelings without delay. From a systems intelligence perspective this opens up the possibility of conceptualizing through infant capabilities adult human action particularly in the dimension of the non-verbal and the implicit. The systems intelligent infant as a concept can enrich both infant research and systems intelligence as an intellectual framework.

Introduction

It starts rather simply, or so one might think – a baby is born. In a relatively short period of time, she develops into a complete personality. But what exactly happens during those crucial first months of growth, both mental and physical, that changes the infant almost day by day? A key finding of developmental research is that the development of the infant does not happen in isolation, but quite the opposite. Interaction between the infant and her environment is a crucial part of the process of becoming a human being.

In recent decades infancy research has undergone several major changes. Firstly, authors like Stern (1985) have combined the perspectives of clinical psychoanalysis and experimental infancy research in a way that helps us to ask new questions and to answer old ones. Secondly, a systems perspective on infant-development has been developed by Beebe and others[1]. Drawing from the tradition of psychoanalysis and developing new kinds of approaches, this point of view has shed light on the complexity of infant-development.

A key assumption of much of the most interesting infant research is that the infant is intelligent. What kind of "intelligence" is it? In particular, is intelligence

[1]See e.g. Beebe at al. (2003a) for an introduction.

exhibited by the infant a form of systems intelligence as defined by Saarinen and Hämäläinen (2004)? This is the question explored in this chapter.

But what does systems intelligence mean and why is it a relevant concept in this context? There is no single exhaustive definition, because systems intelligence is more of a research program than a completely formed and articulated theory. Under its umbrella a number of themes have been discussed, ranging from the productivity of nations and corporations, to leadership, architecture and the human-connectivity aspects of the therapeutic patient-therapist relationship. However, all of these points of views share one common characteristic that is the belief in the possibility of human action to bring about positive change. The emphasis is on action as opposed to articulated rational knowledge. Although intellectual framings have their place and value, most situations we face in actual life are too complex and emergent to be approached by rational analysis. Yet we somehow manage and cope. As Hämäläinen and Saarinen (2004) put it:

> By Systems Intelligence (SI) we mean intelligent behavior in the context of complex systems involving interaction and feedback. A subject acting with Systems Intelligence engages successfully and productively with the holistic feedback mechanisms of her environment. She perceives herself as part of a whole, the influence of the whole upon herself as well as her own influence upon the whole. By observing her own interdependence in the feedback intensive environment, she is able to act intelligently.

Why approach infant-development from the point of view of systems intelligence? One reason is suggested by the theme of the infant's self-expression. Although the idea of the infant's pre-verbal communication with mother has been recognized for quite some time, it is only recently that researches have started to appreciate its complexity fully. Combining this fact with the common sense notion that most of the time the infant-mother system *works* in that obvious sense that a healthy human being emerges out of a system that no-one can describe even in retrospect, makes one wonder, how successful human action is possible in such a complex and epistemically opaque situation? This is exactly what systems intelligence tries to study and understand.

This chapter does not try to build a systems intelligent theory of infant development. Rather it reviews some main ideas of the theories that take the idea of "the systemic infant" seriously. Then the question presented earlier is studied in the light of these theories.

Before proceeding on to these theories, I try to frame the question of what kind of a system is the dyadic mother-infant relationship. There seem to be three distinct principal systems involved:

1. the infant
2. the mother
3. the interpersonal mother-infant system.

The interpersonal nature of the system means that there is more to the situation than just the presence of two separate human beings, as also the relationship between them is critically important.

Stern's Theory of the Infant's Interpersonal World

Daniel N. Stern's book *The Interpersonal World of the Infant* (1985) has as its subtitle "A View from Psychoanalysis and Developmental Psychology." This describes well Stern's way of combining these two different approaches to infant development. But what is so special about this?

To simplify a delicate and complex issue is to say that psychoanalysis focuses on words, e.g. on the way the patient verbalizes her past. This enables the reconstruction of events of the early life. There can be difficulties in handling experiences, including also preverbal experiences. However, the point is to approach those problematic experiences with the instrument of words. On the other hand, developmental psychology is interested in neurobiology and cognitive functioning of the infant's mind. Stern develops a synthesis that takes into account both of these.

I am not trying to cover all the ideas in Stern's book, but will rather concentrate on his ideas concerning development of the infant-mother system.

There has been a tradition in infant development research to propose different kinds of developmental stages, and Stern is not an exception. His model consists of four stages. They are about developing a sense of the self and the other. These stages and their properties continue to effect the infant's mind even after a new stage has been reached.

The stages are

1. Emergent Self
2. Core Self
3. Subjective Self
4. Verbal Self

Because I am concentrating on preverbal forms of communication and consciousness, the verbal self is left out of the following developments.

Stern gives us rough estimation of when the stages manifest themselves. The emergent self appears at the age of 2 months. The core self appears at the age of 2–7/9 months. The subjective self appears at the 7/9–15/18. The verbal self appears at the age of 15/18 months onwards.

Emergent Self

This stage starts from birth and lasts about two months. The self of the infant is at a very early stage of development. However, according to Stern (1985), intelligent behavior can already be detected in the infant's actions. The central question is how to understand the infant's experience of the world. Stern argues

that the Freudian theory of "stimulus barrier" is inadequate and it has to be at least revised. Stern describes what he calls a revolution in infancy studies, related to "posing questions" to infants. Stern describes one such method:

> The newborn does not have good control of his or her head and cannot hold it aloft in the upright position. But when lying on their backs so that their heads are supported, newborns do have adequate control to turn the head to left or right.

Stern then goes on to describe how it has been shown that infants can recognize smell of their mother's milk. Brest milk was put on two different pads which were then placed on two sides of the infant in question. Her head movements were registered and it was consistently observed that the pad with the mother's milk was preferred.

Another way to "ask" infants something is to take advantage of the fact that they are good suckers, being one condition of their survival. Infants like to suck to gain nutrition and also for pleasure. By using artificial nipples, interesting experiments can be conducted. A slide carousel can be wired with artificial nipples to give the infant control over what she sees. Thus it is possible to know what kind of images the infant prefers.

A third method is to use vision as a mechanism to figure out what is going on in the infant's mind. The infant can move her eyes, because those muscles are under voluntary control. Gaze movements tell where the infant is focusing on.

These three methods make it possible to study what kind of structures the infant has in her mind, although these have to be inferred indirectly. Stern reports that infants prefer vertical symmetry in the vertical plane to symmetry in the horizontal plane. It should be noted that parents usually line themselves in this manner.

Core Self

The formation of the core self starts at the age of two months and lasts for about five to seven months. There are two distinct sides in the formation of core self. They are Self vs. Other and Self with Other. Both are very important.

Formation of the core self is dependent on many different stages of development, also known as self-invariants:

1. Self-agency
2. Self-coherence
3. Self-affectivity
4. Self-history

Self-agency means the feeling that the infant is in control of herself and has the ability to guide her motions in a meaningful manner. It consists of three invariant

experiences: the sense of volition, the feedback and the predictability of actions. The infant starts to form motor plans so that guided movement of limbs is possible.

Self-coherence is the subjective feeling of wholeness that encompasses the fact that all the bodily and mental characteristics of the infant in fact belong to the same entity. Without coherence there can be no agency. The locus where the infant's core self resides starts to form at this stage. It means that the infant has a certain feeling of being in one place at a time. The infant starts to understand that the similar movement in time of some objects means that they belong together.

Self-affectivity refers to the invariant nature of feelings that the infant has. Feelings like joy, fear, anger etc. have different, recognizable effects on the feeling person and they are relatively stable throughout lifespan. For example, the infant can recognize that the sadness she feels in different situations is in fact one feeling and not just separate experiences. On the other hand, joyfulness of the infant and the adult are pretty similar when it comes to respiration, facial expressions, subjective feelings etc. These feelings are both internal and external because they involve objects outside the infant's sphere of experience (the Other), and also its own bodily functions, like rise in heartbeat as a sign of excitement. One interesting finding is that when presented with many instances of one feeling (joyous faces etc.) the infant forms a model and then has the capability to recognize the feeling in another context. For example, when the infant learns to be afraid of something, this new feeling can take place in different contexts which do not necessarily have anything to do with the original situation.

Self-history is a property of memory. It makes possible the continuity of the infant's mind and her experience of self. It is the uniting property which enables the mind to work. The infant has memory that cannot be accessed directly. This phenomenon is also evident in the adult experience. We cannot always remember everything and often our mind works on issues and themes without us explicitly understanding it.

One important concept is that of episodic memory, that can be understood as whole comprising of the different self-invariants described. It means that the infant (and the adult) remember things in clumps or episodes. These are made of sights, sounds, smells, feelings etc. The important conclusion is that facts can almost never be perceived without feelings. The human mind works in such a way that it always attaches some feeling to episodes in memory. This makes the memory system effective and robust but it also sometimes makes it difficult to be objective or to understand how the infant thinks.

Development of With Other differs from the traditional views of symbiotic relationship of the infant with the mother. Stern criticizes Winnicot, Mahler and others for their idea of the undifferentiated image that the infant has about the mother-infant system. According to this view the infant's mind conceives the "I" and the "we" as one and same. Stern states that present account takes into consideration the very early development of core self. With this view comes the problem:

> If we conceive of being-with experiences as the result of an active integration of a distinct self with a distinct other, how can we conceive of the subjective social sense of being with an other? (p. 101)

This question comes to mind also in the context of the social experiences of adults. For example, if someone dies the memory and presence of the deceased is often very lively in the minds of those who knew her.

The social experiences and the matrix of social relations are something that has to be understood in the context of "self/other" differentiation problem. Stern approaches the question by considering experiences that infant cannot reach by herself. Games like "peek a-boo" and "I'm going to getcha" are typical examples where the infant's excitation and feelings are dependent on the social interaction.

In his book, *Child's Talk: Learning to Use Language* Jerome Bruner (1983) states that in games like "peek a-boo" it is important that the child is given a more active role as her skills develop. Bruner describes a "motto" for these kinds of games: "where before there was a spectator, let there now be a participant."

These ideas are very similar to the Fogel's idea of alive communication (Fogel and Garvey 2007). Fogel and Garvey instruct us to go beyond simple theories of sending-receiving in communication. There are lots of processes going on that have to be taken seriously if we are to understand the mother-infant system and its communication structures.

Subjective Self

After the core self has been formed, there develops in the infant's mind something that is called the subjective self. What does it mean? The basic idea is that the infant becomes aware of the existence of mind, both of her own and of her mother's. This subjective experience enables new kinds of actions. This happens between seven and nine months after birth. The infant's mind is capable of doing many things. She can want to do something ("I want to sleep"), she can have emotions ("This is frightening"), she can have a focus of attention ("Look at mom"). It boils down to the theory of other minds, a question pondered by philosophers for centuries. But for the infant, it is not a question of theory, but rather a very true part of her life and subjective experience and also a condition for survival.

Two interesting concepts of this stage are intersubjectivity and attunement, which are concepts about the sharing of feelings. What evidence there is for intersubjective relatedness? Because infants at that stage of development are still preverbal, the experimental methods devised to study this have to be quite clever. Stern proposes three mental states that can prove or at least illuminate the existence of the infant's interpersonal world and the infant's awareness of the separateness of minds. They are:

1. Joint attention
2. Sharing intentions
3. Sharing affective states

Joint attention can be described by an example provided by Stern. When the mother points at something, the infant at this stage understands enough to stop looking at the finger and start looking at the object that is pointed. But that is not

all. The infant can then look at her mother for visual feedback and information on what to think about the object. The infant also starts herself point at objects. All of these things prove the existence of complex mental systems working inside the infant's mind, Stern points out.

Sharing intentions is another instance of the intersubjectivity systems working. When an infant wants something, she can point at it, make sounds and she may also try visually to send a message to her mother, all this in order to get the object she desires. The remarkable thing is, all this is preverbal.

Sharing affective states means that the infant understands that she and others have feelings. For example, when an interesting, buzzing toy comes to the infant's range vision, she might not know what to think about it. But she can look at her mother for a visual clue on what to do. If the mother looks frightened by the toy, this same emotion can also be evoked in the infant.

By attunement Stern means the act of synchronization between actions of the infant and the mother. Attunement is about the sharing of feelings. But they do not have to be big and important. They can be little and down-to-earth. Rhythm can be very important in this context. Stern gives us an example:

> A nine-month-old girl becomes very excited about a toy and reaches for it. As she grabs it, she lets out an exuberant "aaaah!" and looks at her mother. Her mother looks back, scrunches up her shoulders, and performs a terrific shimmy with her upper body, like a go-go dancer. The shimmy lasts only about as long as her daughter's "aaaah!" but is equally excited, joyful, and intense.

Here it seems to me that the infant has capabilities which can be easily overlooked because of their preverbal nature.

Intersubjectivity: A Systems View

Theories of interaction are important for psychoanalytic theory, because the patient-analyst relationship develops as a process of interaction. Beebe et al. (2003a) bring forth a systems view of the therapeutic encounter. They suggest that the concept of intersubjectivity is important in understanding the way communication unfolds between the patient and the analyst. They borrow ideas from infant research literature, for example Stern (1985).

After certain age a child can express herself verbally. On the other hand, nonverbal communication can be very important for an adult, so these categories are not mutually exclusive.

Beebe et al. offer us three proposals which have guided their thinking. Here they are in abbreviated form:

1. All theories of intersubjectivity are about interaction. They can be examined based on how much they adopt a systems view, which integrates findings from infant research and psychoanalysis.

2. Different levels of cognitive development are important in understanding intersubjectivity. Distinction between presymbolic and symbolic intelligence has to be made.

3. "For a theory of intersubjectivity to be most generally useful for psychoanalysis, it must address both verbal and nonverbal, more recently conceptualized as explicit and implicit."

Another important distinction is between verbal and nonverbal. When an infant develops a theory of mind, i.e. a theory about existence of the minds like her own, the cognitive development speeds up and the possibility of verbal expression becomes viable (Beebe et al. 2003a).

The idea of a theory of mind is important for understanding intersubjectivity in the dyadic mother-infant system. It is through a mutual recognition of the intersubjectivity that the infant and the mother achieve a stage where their interaction works for the benefit of the system. However, this recognition in many ways is not explicit or verbal because the infant is preverbal and on the other hand because the mother does things intuitively based on her instincts rather than intellectually analyzing the situation and developing rational plans. But when time passes and the system evolves, this can change. There comes more and more space for rationality and calculation. And the infant can exhibit qualities that clearly are based on the theory of mind, like pointing at things she wants etc.

Peter Hobson's book *The Cradle of Thought* (2004) elaborates the interplay of the infant's mind and actions of others. He points out that there is a clear difference in how the infant perceives other people as opposed to inanimate objects. Hobson writes: "Being affected by others is a design feature of human beings – a design feature that transforms what a human being is."

Because of differences in the way the term "intersubjectivity" is used in different contexts, Beebe at al. suggest we replace it with "forms of intersubjectivity". This term captures the fact that there are many possibilities in the domain of intersubjectivity. By talking about forms of intersubjectivity we take into consideration that there are clear differences in the way adults and infants operate. However, there are also lots of similarities, which make this fascinating area of study.

Forms of Intersubjectivity in Infant Research

Beebe et al. (2003b) synthesize findings of three infant researchers, Meltzoff, Trevarthen, and Stern[2]. One of the more interesting points here is the fact that the infant's sense of self starts developing through motion rather than by construction of mental structures. The feeling of being and the capability to move are pivotal in forming the self.

Meltzoff's work relating to imitation tells us about the infant's ability to recognize imitation in the facial and other expressions of the mother or other adults. The youngest infant to be shown imitating was only 42 minutes old!

[2]I consider Beebe et al.'s synthesis quite illuminating and therefore I present it here.

According to Meltzoff, the connection between the self and the other is created by the cross-modal functioning of the infant's mind and body. The fundamental experience of "you are like me" makes it possible to directly access the other.

Trevarthen's arguments are summarized by Beebe et al. as follows:

1. "Infants possess an emotional and communicative brain at birth."
2. "The basic dimensions through which intersubjective coordination occurs are time, form and intensity."
3. "The infant is aware of, and shows a preference for, contingent effects. The human brain is specialized for mutual regulation of joint action."
4. "The infant coordinates perception and action through a single time base."
5. "The most basic mechanism of intersubjective coordination is matching of communicative expressions through time, form and intensity, across modalities."
6. This intersubjective matching occurs through use of rhythms and sharing common time base ("an internal clock").
7. Cerebral representation of self and other is not necessarily based on limb movement or moving in general but rather on the "image" of those actions, i.e. the complete impression made by them.
8. There is a difference between primary (self and other) and secondary (self, other and object) intersubjectivity.

From the list above we can see, that Trevarthen's argumentation is very close to that of Meltzoff. They both share the idea of the creation of self being a process that is strongly related to the biological nature of the infant and to the intersubjectivity of the dyadic relationship.

I will not elaborate Stern's theory in this context in detail because that is done already in the previous section. However, Beebe et al. point out interestingly the concept of attunement which is important for understanding Stern's thought.

Affect attunement is about connection of feelings at a level outside of normal awareness. As mentioned before, by attunement the mother and the infant can experience same feelings at the same time. That is how the mother-infant actually becomes an interdependent system of two human beings.

Intersubjectivity: Implications

Beebe et al. (2003c) take ideas presented above and use them to highlight some important conclusions for psychoanalysis. The forms of intersubjectivity that are presymbolic form the base for the symbolic development.

Meltzoff, Trevarthen and Stern share the idea of "shared mind" which completely shifts the psychoanalytic theories of "autistic" or isolated mind. This helps us understand the difference between conventional view of the closed mind and the metaphor of "shared mind."

Enter Systems Intelligence

Systems intelligence can be approached from different angles. Hämäläinen and Saarinen (2007a) suggest we consider three systems questions. They are relevant in the context of infancy studies. They are:

1. What does the System generate – and to what extent is this what we want?

2. How do systems mould us as human beings?

3. What kind of in-between does the System endorse?

These are useful to apply for inspecting the case of the mother-infant system. This leads us to consider the active, dynamic functioning of the system in question. In a nutshell, structure creates behaviour and vice versa.

What kinds of problems are possible in the interpersonal mother-infant relationship? One possibility is that of holding back. Hämäläinen and Saarinen (2006) describe system of holding back through a rose-buying case. They ask, why so few Finnish men buy roses to their wives on normal weekdays and why the wives lack romantic spirit and gestures. Their answer is that there is system of holding back which is so powerful that the persons inside do not even recognise the system as something that governs their action. Holding back has thus negative consequences or at least it prevents good things from happening. It can be postulated that life could be better for all concerned if the system of holding back were unleashed. But this is non-trivial. First of all, the system must be recognised and the will to change something has to merge.

What might holding back mean in the infant-mother case? Perhaps the mother does not communicate enough with the infant who in turn becomes more and more passive. A vicious circle is created. What starts as a small thing grows and grows and may even become a serious problem. Without outside intervention it can be difficult to change the system.

Systemic intervention starts from recognition of a problem. Or even if there is no evident problem, there can be a sense, or a hunch that things could be better.

What parenting does to the mother? She changes physically, psychically and socially. Of course for the infant changes are total as her personality develops. The capability of intersubjectivity that is already present at a very early stage changes and grows and affects other areas of development. Without implicit cognitive skills learning for example language could be very difficult. This is how the mother-infant system changes its sub-systems.

The question of in-between as understood in the systems intelligence literature is a little trickier. Here it can mean the intersubjective mother-infant relationship, a some kind of emotional "space" where the mother and the infant can act. And they act, intensively. Beebe et al. (2003a) point out that the concept of intersubjectivity is meaningful and has gotten much attention lately.

Implications for Systems Intelligence

It seems that infant research demonstrates that we as human beings show capability to function systems intelligently almost straight after birth. As the self of the infant develops, there come new phases and possibilities.

What can we learn from infants that has relevancy for systems intelligence? The mother-infant system evolves through time. The mother's role changes as the system evolves. The mother has to take different roles at different times. The dyadic system turns into a system of two different human beings. There is also the question of what Hämäläinen and Saarinen call the human-in-between. The possibility to be in relation with another person is a distinct human capability which makes our lives more meaningful and rich. Without that kind of element it would be difficult to build stable human structures like families, or nations. What is more, it would be impossible to become a human individual, breakthroughs in infant research teach us.

Systems intelligence is about the little extra that makes human action successful. For example two strangers can meet for the first time and still bond strongly after only few words or seconds. This is possible because of our inner attunement abilities. And it is not far-fetched to suggest that this is reminiscent to the working of the dyadic mother-infant system. There is intelligence at play although it is not articulated, verbalized, objectified or rationalized.

There are similarities in the way the mother-infant and the patient-therapist system work. These are important for systems intelligence thinking, because of the significance of the "moments of meeting" as a form of the human-in-between. As Lyons-Ruth and The Boston Change Process Group put it (1998):

> In summary, these moments of intersubjective meeting are experienced and represented in the implicit relational knowing of infant with caregiver. They are also experienced in the patient-therapist interaction, with similar resulting changes in the patient's implicit relational knowing. These "moments of meeting" between patient and therapist may or may not become the subject of interpretation. Nevertheless, these moments of meeting open the way to the elaboration of a more complex and coherent way of being together, with associated change in how relational possibilities are represented in each participant's implicit relational knowing.

I suggest that this idea should be generalized. It is something we can use every day when we are "connected" with others. That is systems intelligence in action.

Hämäläinen and Saarinen (2007b) sketched some questions for systems intelligence in the context of infant research. I suggest that one further point can be indicated on the basis of this chapter: the attunement of the infant-mother system is very similar to that of strangers meeting and instantly feeling connection. Hämäläinen and Saarinen (2007b) write:

> Our systems endowment, the human systems intelligence we possess as human beings, was far more than ability to think about and know

> about systems, we felt. The systems endowment is not only about explicit, knowledge-like and propositional, symbol-intensive and analytic capabilities with systems, notwithstanding the merits of such a quintessentially human acumen.

Studying infants can help us understand some key features of systems intelligence. The infant acts systems intelligently without explicit, articulated or symbolic knowledge. Yet she somehow usually succeeds. Importantly, this does not happen in isolation. The human-in-between of the mother-infant system supports the infant's success and development. It can be thought that strangers meeting are using their special human endowment that dates back to infancy. This happens without rationalization or objectification. Of course the idea of learning about adults by studying infants is not new in itself. But by applying systems intelligence to the case, we can go one step further.

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