Learning in Relationships

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Introduction

Since antiquity, human beings have distinguished themselves from other living creatures by their language. To this day, language is a characteristic specific to Homo sapiens. Comparative evolutionary behavioral research and human infancy research of the last few decades have shown what a wealth of communication abilities develop in human beings before language is learned. Non-verbal communication, body language, as it is also called, is expressed through facial expression and gesture, through touch, through vocal intonation, and finally, through whole body posture. These human expressions of communication exhibit differentiation and variety that is unique in the animal kingdom.

As adults, we regulate our lives, our information, and our relationships through language to a large degree; and, increasingly, through communication of digital-electronic symbols. But this symbolic language is always dependent upon a more aboriginal form of communication that, in a manner of speaking, already connects our physical bodies with each other, and produces a fundamental relationship that the French philosopher Merleau-Ponty once described as "intercorporeity". It is the basis of what I will be examining in the following: Learning in physical interactions; in intercorporeal relationships. Aristotle knew that the human being is a "*zoon politikon",* a social being. But we now understand what that means; namely, that through association with others, human beings' physical organisms, also inside the brain, are formed through interaction.

In the following I will present the biological, psychological, and social foundations of learning in intercorporeal relationships. I will begin with a brief look at brain development because the brain presents itself as the matrix, so to speak, for all learning processes that take place during childhood. Then we will trace a few basic features of the steps of development in human social learning.

1: Neuroplasticity and Development

Human beings, like no other living creatures, require the presence of their fellow beings in order to develop their abilities. Also, no other species comes into the world with such a plastic and malleable brain as the human being. By reason of neuronal plasticity; that is, development of synapses structure, especially in early childhood, the brain develops into an organ that, in complement with its environment, fits like a key in a lock; and that applies first and foremost to the social environment. Our neurobiological structures require appropriate emotional and intellectual offerings from our attachment figures in order to develop. In other words: *The human brain is essentially a socially and biographically formed organ*.

In 1949 the American neurophysiologist, Hebb, formulated the basic law of synaptic learning: Simultaneously activated neurons strengthen their synaptic couplings, and accordingly, form additional connections. This leads to facilitation; that is, future increased signal transmission. In contrast, connections that are seldom or never used are dismantled; the equivalent of forgetting. Compare it to a jungle path that, with frequent use, gradually becomes wider until finally it is a comfortable road. However, if it were to remain unused it would become overgrown and finally disappear again. Frequently used neuronal connections are the same as well-trodden

paths; while seldom activated connections are lost.
A massive surplus of neurons and synapses are formed in the first months of life. Then, according to their stimulus and use, they are either strengthened or dismantled. Initially, it is nearly double as many synapses as will eventually be needed. Up to the end of the second year of life, this experience-dependent selection process forms the permanent nerve network. However, its microstructure remains alterable throughout life in the form of synaptic connection patterns. In the same way muscles grow through training, but atrophy with inactivity, so does the capacity of the responsible neuronal network either grow or degenerate depending upon its frequency of use.
The structure of our brain changes with every use, in dependency with the stimuli the brain encounters every second, and the relationships it communicates. The human brain represents quasi all experiences from its past. It is all the more impressionable the younger the person is, the more intense the impressions are, and the more often these are repeated. Basically, this applies throughout our lives: Through our experiences, we constantly create and change the neuronal structure of our brain, and with that, also our cognition – and willingness for activity – In short, we alter ourselves.

Primary Intersubjectivity
After the above introductory remarks, I will now turn to my actual theme, which is the development of communication in early childhood. Let us begin with the first year of life. "In the beginning was relationship" – and the most immediate form of relationship to the world is the sense of touch. Tactile body contact, touching, lifting, rocking, and, of course, breast feeding, is the first form of communication between mother and child. It conveys not only the experience of being carried, being held, warmth and protection, but also pivotal experiences for the development of trust in the world and in other people. From a biological standpoint, both of those things also bring about a release of oxytocin, a hormone that not only stimulates breast milk production, but also supports bonding between mother and child. Even animal mothers care for their young more intensively the higher their oxytocin levels. In aboriginal cultures, body contact between infant and caregiver is more pronounced than in industrialized nations. This has surely resulted in a more secure bond between those children and their caregivers.
Let us now examine the sense of sight. Here, also, infants are biologically attuned to social interactions. For one thing, they have an inborn ability to differentiate between objects that are liked or disliked. For another thing, from their birth, infants exhibit a heightened attentiveness to faces. What's more; from the beginning they are also able to accurately imitate adults' gestures such as sticking out the tongue, opening the mouth, wrinkling the forehead, etc. (Meltzoff and Moore 1977). They possess an inborn social body schematic so that the infant's own body connects with the perception of the other; that is, from the outset, both things are experienced as related. A newborn does not perceive its mother as just an "image", or something vis-à-vis; but rather, imitatively, in that the newborn emulates her expression within itself. Research in the last one to two decades supports the premise that human infants' ability for spontaneous imitation of the expressions and actions of others is the foundation for empathy. I will return to this subject.
Through numerous comparative culture studies, it has now been proven that certain basic patterns of human facial expressions are innate. There is a series of six basic emotions – namely, happiness, sadness, anger, revulsion, surprise, and fear – that are associated with the same facial expressions in all cultures. Associated forms of expression are things like:

wrinkling the forehead, nose wrinkling, widening the eyes, crying, smiling, lifting the eyebrows, etc. About six to eight weeks after birth, infants develop the ability to react to their surroundings with smiling, thereby interacting with other people and forming connections with them. Of course, later on other stronger, culturally influenced emotions and forms of expression appear.

Over and above these forms of imitation and expression, there is also increasing development of *emotional resonance* between infant and mother. She intuitively answers the child's signals and initiatives with appropriate reactions of voice and gestures. Mothers unconsciously use simplified mannerisms (baby talk, facial expressions, eye contact, reaction to greeting, etc.) that are appropriate for the as yet undeveloped repertoire of the child. Infancy researchers, M. and H. Papousek, described these and other similar behaviors as "intuitive mothering skills". Mothers (and also fathers) possess biologically-based, unconscious knowledge that affords them the ability, through voice, facial expressions, and gestures, to make themselves understood by the infant, and to appropriately calm or stimulate the child, while letting themselves be guided by the child's signals.

This early dialogue between mother and child is infused with *musical* qualities of expression; with rhythm, and with the dynamic of facial expression, vocal, and gestural interaction (crescendo, decrescendo, flowing, soft, explosive, etc.). This leads to the interactive "emotional attunement" that infancy research has highlighted. Daniel Stern (1998) spoke about a "shared dance" that mother and infant spontaneously perform together. During this communication process the child increasingly learns to differentiate between the various signals of the mother's emotional expressions. At the same time, the infant becomes better able to understand and differentiate its own emotions. But, above all, the infant develops the prime feeling of living together with others in a world of emotions, and to feel connected with them.

If we combine all of these observations of emotional expression and imitation together, then we can speak about a primal, and biologically rooted, system of resonance and empathy that is engraved upon a child's early development. We grow up in a primal sphere of communicative "inter-physicality" within which we remain throughout our lives: Whenever two people encounter each other, they are, from the beginning, drawn into an interaction that connects them physically, and creates an intuitive understanding. The emotions of the other are immediately understood by their expression, because this elicits in us a mostly unnoticed physical impression with subtle sensations and emotions. The result is an *inter-physical resonance:* The other person is literally felt in one's own body.

Mirror Neurons

The result of this resonance is empathy. It is the foundation of our social life, and is the reason communication is even possible in the first place. People constantly empathize with the thoughts and feelings of others. They feel the pain and the joy of others, and understand why another seeks solace. The neuronal basis of empathy has been discovered and researched in the last ten years. It is called the mirror neurons system.

These neurons were first identified in the premotor cortex of monkeys; an area of the brain responsible for organization and regulation of movement. In the meantime, such neuron groups have been proven to exist in various areas of the human brain. Mirror neurons are activated when we carry out very specific actions such as reaching for an apple or a cup, as well as when we perceive the same action carried out by another. The effect can be explained like this: I

understand what it means when you reach for a cup because it indicates a similar movement in my own arm. As far as we can tell today, the system has two main functions:

- It creates *resonance* between one's own body and that of the other, thereby making it easier to understand the other's actions.
- Resonance of the mirror neurons paves the way for willingness to act. The more often action by another is observed, the lower the threshold for imitation, and the easier it is to imitate actions. Imitation in infants also has to do with the activity of mirror neurons. The mirror neuron system is the basis of imitation and model learning; a centrally important human ability affecting cultural development.

Neuronal mirror systems also play a role in "contagious" laughter, crying, or yawning. At present, further intensive research into feelings of empathy has been applied to emotional reactions like pain or revulsion: If one observes the pain or revulsion of another, centers in the brain are activated that are at the root of one's own reactions of pain or revulsion.
Admittedly, this biologically rooted system does not bring about human sociality; that activity is not simply inborn, but rather is based upon typical, recurring experiences. The mirror system can only be activated by reaching for an apple, for instance, once the child has grasped the *meaning* of reaching for the object. In the same way, empathy with emotional reactions like revulsion requires an understanding of the situation, such as the connection between odor and revulsion. The mirror system can develop correctly only if it is embedded in a *context of social interaction.*

Implicit Memory

Now, let us go further into early childhood development. How does social learning take place in the first year of life? Memory, in which singular biographical experiences or learned facts are stored, begins to mature only in the second year of life. But there is a very different kind of memory. The vast majority of all we have learned we make use of quite automatically during the course of daily life without it prompting us to remember the past. Through repetitive experiences or practice, abilities and habits have formed that are involuntarily activated during applicable situations: Walking, swimming, riding a bicycle, speaking or writing; but also the ability to associate with others, that we have at our disposal with every movement, without having to consciously pay attention to it. In the field of memory research, the term *implicit* is used to differentiate from autobiographical memory (implicit = involuntary, automatic).
Implicit memory relies upon different brain structures than autobiographical memory; it is sub-cortically organized and functional considerably earlier. Through implicit memory, infants are able to recognize regularities in repeated experiences, acquire faculties, and learn, already at the age of 3 to 4 months. Above all, through contact with others, they acquire interactive behavior patterns that organize their interactions with others; "schemes-of-being-with" as Daniel Stern described them – "Me-with-Mother-breastfeeding", "Me-with-Father-playing-ball", etc. Out of this comes something that also can be described as *implicit relationship knowledge:* Knowing how to relate to others – how to have enjoyment with them, express happiness, get attention, avoid rejection, etc. It is, to a certain degree, the "musical" memory, organized in time, for the rhythm, dynamic, and "undertones" that inaudibly resonate within interactions with others.
Already in the first few months of life, a memory for shared interaction sequences can be proven; namely by the expectations of a mother's reactions that a child exhibits. Babies quickly learn to which emotional expressions parents respond, are spurned to action, or rather dismiss, etc. This can be very nicely shown through the *still-face* experiment: During play with her

infant, the mother is asked to assume a blank facial expression and stare straight ahead for two minutes. Babies usually react with clear irritation and unease – the expected resonance from the mother is absent – and they try every possible way, with gestures and vocalizing, to bring their mother back into the familiar form of contact.
Through this, two groups of children can be differentiated (Field 1984, Papousek 2001):

- Infants of sensitive and lively mothers remain active even in the *still-face* situation, and obviously expect to bring their mother back into contact in this way.
- Infants of mothers who are rather more detached, with a lack of resonance (possibly because of post-partum depression), react differently; in the beginning they are restless, but quickly become passive and helpless. They have not learned to effectively use their behavior to bring about contact. However, if the children do not succeed in acquiring relationship schemata through which they may enter into secure contact with others, then their bonding with others cannot develop appropriately. With further progression they show marked weakness in bonding (Field et al. 1988).

So, we see that, from the beginning, early interactions are deposited into the memory and brain structures of the child.

Bonding System
With that we come to a central concept of developmental psychology of the last 1 to 2 decades; the bonding theory. According to John Bowlby, who developed the theory in the 1950's, social relationships in early childhood are regulated by a biologically based bonding system that fulfills the function of securing the emotional proximity and care from the most important attachment figures. It includes:

- Biologically anchored, coordinated *signals* such as searching, calling, gazing, crying, clinging.
- The corresponding *driving emotions and needs* for things like feelings of security, care, warmth, and affection.
- The attendant *physiological* functions.

The basic needs of the infant are fulfilled through this system: The infant is dependent upon the mother's body warmth, her smell, her touch, her loving attention, and appropriate stimulation and calming. These interactions play an irreplaceable role in the emotional and social development of an infant. The child's early experiences of relationships are stored in the implicit memory and anchored as *secure bonds*. The infant gains the basic trust and secure basis with which to actively explore the world. The first relationships also become inner models that put their significant stamp upon later relationships, clear into adulthood (Brisch et al. 2002).
Conversely, however, insufficient attention, lack of feelings of security, or separation from the mother lead to psychophysical stress reactions in infants, with rising agitation at first, but then increasing resignation and apathy. The studies done by Rene Spitz in the 1960's (1967) with orphanage children are well-known; whereby complete withdrawal of emotional care and attention resulted in the development of serious deprivation syndromes with apathy, depression, and higher death rates. Even less serious relationship dysfunctions from something like post-partum depression in the mother, have negative effects on the cognitive and emotional development of the child. The maturing of the emotional relationship system is an experience-dependent process that is susceptible to disruption from many different causes.

Secondary Intersubjectivity

I have presented the early, that is, non-verbal forms of communication and relationship, which is also described as primary Intersubjectivity. During the next phase – secondary Intersubjectivity – verbal-symbolic communication develops; the actual human ability for dialogue. Let us take a closer look at this development.

One crucial step is the development of "joint attention", whereby the mother and child together turn their attention to an outside object. This ability is developed exclusively in human infants around the age of 9 months. At this age, babies begin to turn their attention to outside objects together with adults; and also making certain of the adult's attention by giving them short glances. However, the babies also soon transition over to attracting an adult's attention through pointing gestures. They will point to a glass so that Mother fills it; to an animal so that she sees it, or also to an object their mother is searching for, to help her. In the reverse, babies also now begin to understand the pointing gestures of adults; that is, the "meaning" of the pointing hand. The pointing implicates a joint relationship to a third thing that is seen or comprehended by both partners. A specifically human form of communication is manifested by the pointing gesture; coming to an understanding about a shared outside point of reference. Here lies the fundamental limit of the mental capabilities of other primates such as chimpanzees, who are unable to develop joint attention (Fuchs 2008). It is such a radical, new level of development that one speaks of the 9-months-revolution.

The first words are now also combined with pointing gestures. Parents point to an object and name it. And, likewise, the first words children use are often combined with pointing. They are integrated into cooperative activities in which the children are involved, that are structured by the parents: Diaper changing, eating in a highchair, riding in an automobile, feeding ducks, building a block tower, etc. The power of speech develops through shared practice that is directed toward the environment. The children must recognize that their attachment figures use words purposefully; that is, with the intention of describing. They adopt a word for a new object only when the adult's attention is actually directed toward that object. If the attachment figure looks in another direction, or if the voice comes from a recording, the child does not make the connection between the word and the object.

Adoption of Perspective and Self-awareness

With speech, the child learns a fundamentally new medium of communication; but also, knowledge of the world and their own self. Now, the child is better able to put themselves in another's position, comprehend their intentions, and follow another's thinking in regard to their perspective of their own actions. But how does a child actually learn to say "I"? How does it come to development of self-awareness? We will see that this phenomenon is also linked to relationship and communication with others.

The infant does, in fact, bring with it a very elementary sense of self; a physical experience of self. Already before birth it has basic sensations of touch and movement in which it likewise senses its own self. However, in the first months of life this elementary sense of self develops and differentiates itself above all through experiences with others who look at, and speak to, the infant. The precursor of self-awareness develops with the reflection of one's self in the eyes of the mother; that is, with being spoken to by others.

The pivotal step on the path to self-awareness takes place from the age of 9 months, when the infant has learned "joint attention" and begins to grasp the perspective of others. The infant then learns to also see itself with its own eyes – and that is the only way self-awareness develops.

For example, the child learns what it means to have a name; something like I am "Monica". This happens when the child realizes that the name "points to" itself. The child understands the significance of this during the course of the second year of life. Interestingly, at first, children will say: "Monica is playing with dolls" or "Monica did that". They use their name before they say the word "I".

Between the ages of one and two, it will also become possible for the child to recognize itself in the mirror. There is a well-known experiment whereby a red dot is put on the child's forehead unnoticed. From ages 16 to 18 months, when they look in the mirror they grasp at their own forehead. Therefore, they understand that the image in the mirror represents them. Before that age, it is simply a funny face. Recognizing yourself in the mirror signifies the ability to view one's self from the perspective of others; in a certain way, to see from the outside. This is a milestone in the development of self-awareness.

From the $2^{nd}/3^{rd}$ year of life, the child finally learns to utilize the "I" pronouns. Indeed, the pronoun "I" stands for "me", but it is also a difficult, namely, a changing word. It constantly changes its location according to who is speaking. Only when the child understands that everyone alike can say "I" does it grasp the universality of personal perspective. Now, the child has come to the understanding of being one among others; belonging to a community of people. The structures in the prefrontal brain necessary for this purpose mature with interactive experiences in which others speak to, and treat, the child as its own person. Self-awareness and, likewise, the ability to be considerate of others, are socially acquired abilities.

Summary

Human beings do not come into the world as singular beings who must be gradually introduced into community. Much rather, they are already, from the beginning, biologically inclined to relationships with others. For the infant, this *bonding system* carries out the task of securing close proximity to, care from, and emotional connectedness with the most important attachment figures. Above and beyond that, with the *resonance and empathy system,* a biologically based system for a subtle, physical understanding develops. Upon this basis, human beings, like no other species, develop the abilities of verbal communication, sympathy, and empathy. Within the first year of life the foundation is laid for relationship, bonding, and mutual understanding that is necessary for the development of symbolic-verbal communication during the 2^{nd} and 3^{rd} years of life.

In early childhood development, this symbolic communication appears for the first time in the form of spontaneous gestures and pointing. They are based upon the ability of human beings to establish joint attention; that is, with another person, to direct one's attention to an object, and to know that the other person is doing the same; to form common objectives, intentions, and mutual knowledge. (Speech development is based upon the basic motive of human communication; namely, to inform others, help others, and share emotions with others. This altruistic and cooperative primary focus differentiates humans from even the most highly developed primates, as they only make use of their gestures to secure some advantage for themselves with the help of others. (Tomasello 2009))

In closing, I will once more say something about the role of the brain. We have seen that human communication, speech, and self-awareness can develop only through interaction with others. The corresponding neuronal patterns are impressed upon the brain during the course of early childhood development. The brain works like a matrix that takes in the child's relationship

experiences and transforms them into permanent abilities (Fuchs 2008). Through this the brain becomes the organ of the mind. However, the mind is a gift from others – the community – and not a product of the brain.

Finally, let us take another look at the relationship between the neurosciences and education. Essentially, the relationship between these two fields is just beginning to be known. What can one say with reasonable certainty?

- In many cases, learning takes place implicitly; that is, quasi "along the way", and not through directed "feeding" of material. It begins with relationship learning in early childhood, with walking and speaking, and it continues with learning processes in groups whereby social behaviors are learned through shared practice and imitation, or by example.
- The basic pattern for human learning from early childhood on is *in relationships to learning;* namely, in personal contact to those teaching, and other learners. Relationships activate the motivation system; neglect cripples it, and, in return, increases aggressiveness. No lessons are so well remembered as those that are combined with meaningful, intensive experiences of relationship.
- The years up to the end of puberty are especially sensitive phases of learning. The earlier children begin to play a musical instrument or learn a foreign language, the better. Some abilities are dependent upon certain windows of time in a child's development during which they must be cultivated, while others can be learned at any time during one's life.
- Learning is a holistic, namely, cognitive, emotional, and physical process. Cognitive, emotional, and physical memories are inseparably woven together, and the various kinds of memory support each other in learning. The result is:

- Children can better retain what is learned when learning takes place in a positive atmosphere and is associated with positive feelings. That means, a central concern of education should be to create beneficial and wholesome social and spatial environments.
- Facts should be embedded in a familiar frame of reference, and connected with emotional experiences; history must be given a "face", and connected with real people; Patterns and pictures support memory formation (Sicily is triangular; Italy is a boot, etc.).
- Unattractive environments that aren't true to life hinder learning. On the other hand, environments that exhilarate the senses and appeal to the whole body have a stimulating effect. Children retain information easier when it is presented through multiple senses, and when they can approach it practically, through movement and touch.

Admittedly, neurobiology cannot specify upon which ideal of humankind we should base our education, what goals we should attain as teachers or what form of education should be provided to our children. Those who expect such fundamental guidance from neurobiology will be disappointed: The brain is a matrix that absorbs what we put inside it. But answers to the questions of what we should do and why it has to do with the field of education cannot be expected from the brain. Additionally, many questions about brain development and the connection between the brain and the mind are still completely unanswered; such as the questions about how information attaches to sense structures, or how higher cognitive functions come into being. At this time, cooperation between education and neuroscience can only address very basic learning processes. That being said, knowledge of neuroplasticity

already can support education that is not primarily cognitively oriented, but rather looks upon learning as a development that integrates knowledge, feelings, senses, and practical experiences. Learning is more than acquiring knowledge and abilities; it is always also the *formation* of the personality, a person's experience and relationship model. Indeed, it goes clear into the organic structure of the body; into the brain. We carry the responsibility for creating educational environments that foster children's natural tendencies; namely, to learn in and through relationships.