

Constructions Toward a Theoretical Framework on Prenatal Cognition and Bonding

W. B. Sallenbach

Institute for Prenatal Studies, Maple Falls, USA

Abstract

In this paper we attempt to develop a framework relevant to prenatal learning and education. The model is active and processive in understanding the dynamics of *in utero* learning. This would follow an epigenetic view of cognitive-affective development for the prenatate.

Three phases, indigenous to learning, are identified. The first is based on somasensory responses. The second upon vestibular and auditory formations. The third is more advanced, multisensory, but inclusive of the other two. During the last trimester, the prenatate may be capable of cross-modal functions and perhaps even exhibit an elementary form of self awareness.

Zusammenfassung

In diesem Artikel haben wir versucht, einen modellhaften Rahmen für pränatales Lernen und pränatale Erziehung zu entwickeln. Dieses Modell ist dynamisch und prozeßhaft aufgebaut, um ein Verständnis der Lernvorgänge im Uterus zu ermöglichen. Dabei gehen wir von einer epigenetischen Auffassung der kognitiv-affektiven Entwicklung des Ungeborenen aus.

Wir haben drei Phasen der Entwicklung der Lernvorgänge charakterisiert. Die erste beruht auf somatosensorischen Antworten und die zweite auf Funktionen des Gleichgewichts- und Hörsystems. Die dritte Phase ist entwickelter, multisensoriell, schließt aber die beiden anderen ein. Es ist gut vorstellbar, daß das Ungeborene während des dritten Trimesters das Zusammenspiel verschiedener Funktio-

nen steuern kann und vielleicht über eine elementare Form der Selbstwahrnehmung verfügt.

Introduction

The desire to understand the role of perception in child development, in part, has its origin in the great philosophical traditions, as well as in the fields of developmental psychology and neuropsychology. Each field has attempted to define the origins of perception, the influence and meaning of perception, and the causal connection between the subject and the object perceived. The intent of this paper is to explore the theoretical considerations regarding cognition and affect during the prenatal period. Prenatal learning and bonding is just beginning to gain scientific interest. Yet we need a great deal of solid research in order to properly assess the dynamics of *in utero* learning and affective patterns. We will explore possible directions for inquiry in this paper.

Traditionally, the field of child development has viewed the neonate as the initial stage for development. Little regard has been given to the dynamics and emerging processes in the prenatal period. Another assumption, which has been dominant most of this century in the western cultures, has been the view that this initial stage (newborn) is governed mostly by reflex, generalized states of arousal. In short, experiences not able to coordinate into any coordinated form for the newborn and infant. Without neurological maturity, it has been assumed that the prenatate would not be able to perceive in an organized fashion, and therefore is incapable of memory function, or even emotionality in response to perception.

There are two fields which currently pose a challenge to many of these assumptions related to prenatal and early life. One comes from the cognitive-developmental research which is currently revolutionizing our understanding of infant development. The achievements demonstrated by the young infant raises questions of origins, particularly in regard to prenatal correlates. One area is the neonate's documented abilities to perform initiative skills. Andrew Meltzoff, from the University of Washington (Seattle), has referred to this as *the linkage problem* (1985). Just how is the neonate able to link adult behaviours with his/her own, particularly when the neonate has not been able to perceive his/her own features or actions before hand. Such questions direct us to the areas of the interconnection between sensory modalities, the perceptual capabilities of the body, and the role of subjectivity in prenatal and neonatal experience.

Philosophical Structures Related to Scientific Inquiry

The second field which raises questions to the traditional views is that of the emerging field of pre- and perinatal psychology. Research and clinical work in this area (Chamberlain, 1987; Cheeck, 1970; Emerson, 1989) indicates that prenatates and neonates are able to store early memories and feelings. Possibly, even early emotional traumas are retained in the unconscious throughout one's life time.

These are dramatic findings, as they raise philosophical as well as scientific questions. One could argue that scientific methodology is heavily influenced by the antecedents of previous philosophical systems (Sallenbach, 1980). The question for us is whether development, in the course of events, is an enduring set of facts, self-sufficient, or is it fused with life itself. Alfred North Whitehead once wrote, in the essay, *Nature and Life*: "The status of life in nature . . . is the modern problem of philosophy and science" (1957).

Perhaps the traditional framework of prenatal and neonatal development have rested upon a classical view of nature. As Whitehead further points out about this viewpoint:

There are bits of matter, enduring self-identically in space which is otherwise empty. Each bit of matter occupies a definite limited region. Each such particle of matter has its own private qualifications, such as shape, its motion, its mass, its colour, its scent. Some of these qualifications change, others are persistent. The relationship between bits of matter is purely spatial. Space itself is eternally unchanging, always including in itself this capacity for the relationship of bits of matter. (p. 179)

The flaw, when applied to human development, is that this view cannot sufficiently deal with the dynamic aspects of change and relationships. Answers are incomplete as they do not represent a broader context.

Kurt Lewin had also criticized scientific psychology along the same lines:

Every scientific psychology must take into account whole situations, i.e. the state of both person and environment. This implies that it is necessary to find methods represent thing person and environment in common terms as parts of one situation. (1936, p. 12)

We must allow for the dynamic aspects development, relative to the extended environment. We would be best suited to explore the prenatal developmental patterns if we see such development as processive, active, and engaging. Initially, this may even be the best line of inquiry for prenatal learning and bonding. If we look at a contemporary view, such as Whitehead's process philosophy, we can see prenatal development as a process from potentiality to actualization, a movement involving creativity and novelty (Whitehead, 1969).

Whitehead also believed that perception existed in two modalities. The first is *presentational immediacy*. This mode is the conscious sensory discrimination which characterizes most of our perceptual experience. The other is *causal efficacy*. This is exhibited by the "withness of the body". This is a more elementary form of perception, somatic, and in many ways unconscious. Whitehead points out that "it is this withness that makes the body the starting point for our knowledge of the circumambient world." (p. 25). We may need to explore that prenatal learning may indeed involve somasensory perception.

The traditional views have not fully explored that the presentational forms of knowing are derived, and inclusive of, the elemental "knowingness" of the somatic sense organs. In the Whiteheadian view, we see with our eyes, even though we do not see our eyes (LeClerc, 1975). This may well provide the *link* to the "linkage problem" which Meltzoff has described above.

In other words, the ability to relate information in a *cross-modality* manner may be inherent, in some capacity, in the somatic structures themselves. What

accounts for this occasion of efficacy is a *felt* perception of the world around the pre-nate. This is a very elemental form of "feeling" that provides for an "awareness", at some level, of an extended environment, and allows a relationship with that environment.

Phases of Prenatal Learning and Interaction

The work of Andrew Meltzoff (1977; 1990), has demonstrated that newborns are able to imitate the facial gestures of an adult, without prior exposure or perception of their own faces. This seriously challenges traditional ideas that there has to be developed corresponding mental schemes of the baby's facial features before such an imitation could happen. From a Piagetian perspective, there is only external relatedness in the beginning. Meltzoff's work shows that there is an internal relatedness, where one form impacts another. Likewise, the neonate's performance may well have prenatal antecedents which have evolved during gestation.

In a process view, the imitation is also an interplay of causal efficacy as well as presentational immediacy. The infant is involved in the experience, feeling the objective into his/her own subjective experience. If we look only for neurological explanations, we can only infer upon the qualities inhering specific components. If the newborn demonstrates such abilities, then we should next examine that there may well be prenatal correlates for the integration of perception and experience. As Meltzoff points out: *It is as if the senses already "speak a common language" and perception and action are closely hooked even from the earliest phases of postnatal growth.*" (1990). The "common language" described may well be a causal efficacy represented in the prenatal experience.

The hypothesis becomes even more defined when we explore some of the newer findings regarding prenatal brain functions and memory systems. Prenatal memory structures may be much more fluid than previously thought (Chamberlain, 1987; Bergland, 1985; Pert, 1987; Bucheimer, 1987). Chamberlain (1987) has described the rise of the term *wet brain* to describe the connection of the neurological, immune, and endocrine systems in the possible transmission of memory data. Again, the causal efficacy of the body joins the somatic with its structures.

Andrew Meltzoff has used the term *Cross-Modality Coordination* to refer to the capacity to take information received in one sense and transfer it to another for application. In his experiment (1977), the infant is able to take visual information and transfer it into proprioceptive action, without the visual context of his/her facial features. Meltzoff (1990) speculates that this early imitation is possibly accounted for through a process of active intermodal mapping (*AIM*). As he states:

The crux of the *AIM* hypothesis is that neonates can, at some level of processing, apprehend the equivalence between body transformations they see and body transformations of their own that they "feel" themselves make. The adult's gesture would truly act as a model against which infants would compare their responses. (p. 6)

The skills of the newborn do not emerge from a vacuum. It may be that similar processes of intermodal mapping are evident, at least, during the third trimester of gestation. Thus, the neonate extends those responses inherited from the pre-nate.

Seeing the possible complexity of prenatal learning, there may also be distinct phases in this developmental process. In very elementary terms, there is a phase 1 which is formative around the first trimester. The formation is primarily somatic, and learning and perception can be described as *somasensory learning*. This corresponds to the casual efficacy described by Whitehead. The body, as a whole, responds to experience. Experiences, both positive and negative, can be incorporated into the somatic structure, along with corresponding emotional features (Emerson, 1989). The somasensory phase does not necessarily dissipate, but becomes inclusive into the higher phases of learning and development.

The second phase of learning involves the emergence of the "primary" structures of somasensory learning. Here, we see the beginning dominance of the vestibular and auditory systems, as well as olfactory awareness. This begins towards the end of the first trimester and dominates most of the second trimester. Here, the fetus begins to discriminate through movement and auditory perception. There is a more refined discrimination between the Self and the exogenous environment.

The third phase corresponds to the increased dominance of the central nervous system in development. It is at this point that we may find a growing integration of sensory information. The pre-nate, in the last trimester, is able to contemplate intermodal mapping processes, similar to those demonstrated by the neonate. Yet underlying all of these processes is the primary link to somatic efficacy and the somasensory prehension of experience.

Learning, in respect to prenatal stimulation, may differ according to each of the phases. In the first phase, the primary modality would be of a deep massage nature. This could be tactile and auditory, bearing on low frequencies. The second phase would be auditory, combined with movement. As Thomas Blum has indicated (1991), this could include low frequency tones and moving sound stimulation. Human voices, particularly the parents can also be successfully utilized. In the third phase, we see the ability to integrate multisensory learning, particularly in a cross-modality manner. Higher sound frequencies are compatible, and human sounds can also be linked to language phonemes and possible discrimination. Table 1 indicates the learning phases, learning modalities, and possible corresponding emotional components.

It is our speculation that the skills evident at birth do have prenatal correlates, especially during the last trimester. We will refer to such structures as *protostructures* as they provide for an elementary integration of cross-modality coordination, speech perception, and rudimentary forms of awareness.

Fetal learning, to this point, has centered upon conditioning and associative learning (Van de Carr, 1988; Logan, 1990). De Caspar (1980) has shown that there is continuity between prenatal learning and postnatal preference in performance. This would fit with Restak's conclusion (1986), that memory is achieved at full term, prior to birth. Unfortunately, what still lacks in this research are the

Table 1. Theoretical paradigm for prenatal learning

	Learning phase	Modalities	Emotional tone
I.	Somasensory	Deep massage – tactile and auditory with low frequencies	Somatic identification with emotions of mother/family
II.	Vestibular-auditive	Soft low frequency tones and human voice connection	Rudimentary awareness of exogenous environment
III.	Sensory integration	Higher auditory frequencies, multisensory and language	Element sense of Self

links between prenatal learning and the emerging cognitive developmental skills sequenced in early infancy and in later child development.

We must realize that even in the womb, the preborn is capable of responding to experience in a meaningful way (Verny, 1981). Performance levels would be epigenetic as they approach the levels of the newborn. Hence is our speculation for the existence of mental protostructures for the mapping of cross-modal functions and the elementary coordination of mental regulations and compensations.

Somasensory experience also infers much more complicated functions. This too has some validation in light of recent findings. Richard Bergland (1985), feels that the brain functions as a gland: secreting, receiving, and distributing hormones throughout the nerves and body. Candace Pert (1987), of the National Institute of Mental Health, feels that neuropeptides are instrumental in linking the nervous system, the endocrine, and the immune systems. Arnold Bucheimer (1986), researching the basis for prenatal and preverbal memory, believed that *RNA* had a memory storage function. Such research tends to support the notion that perception has a two fold system – one in presentational immediacy and a more elementary one in somatic efficacy.

Based upon current research findings, we would propose the following postulates in regard to prenatal learning:

1. Affect and cognition are integrally linked: aspects of one are inclusive of the other.
2. Bonding is a process of interrelationships which draws the prenatate and mother/family into a mutual inclusiveness.
3. Emerging skills are interactive between sensory modalities and epigenetic in nature.
4. The prenatate is capable of certain biases and preferences
5. During the last trimester a rudimentary Sense of Self emerges and interacts, at an elementary level, with the exogenous world.
6. During the last trimester, the prenatate is capable of cross-modal mapping in processing sensory information and perceptions.
7. By inclusion, the prenatate can organize elements of perception into a felt response.
8. Cross-modality functions are based upon the interplay of somatic efficacy and perceptual immediacy.

9. Through retroactive and anticipatory formations, the pre-nate is capable of rudimentary mental regulations and compensations.

At this point, there is little more than speculation regarding the nature of pre-natal learning. Most information is derived from newborns and preterm babies. As yet, there are many unanswered questions. From the current findings, there is the indication of habit/procedural learning formations in the prenatal period. But are there non-habit formations, functional memory systems, and even imitative skills also emergent at this time?

Constructs Toward Bonding and the Emerging Sense of Self

In many respects it is too premature to speculate on the emotional state of the pre-nate and the level of awareness. However, from the field of pre- and perinatal psychology there is much supporting evidence to indicate that such levels are higher than previously suspected. The work of William Emerson (1989) has demonstrated that infants, children, and even adults can retain birth memories, both somatically and around relevant emotional issues related to birth trauma.

Science has to recognize that the fetus is not just a passive recipient in a mechanical process. We know that the fetus can react to pressures, react violently to needle intrusions into the womb, react to tickling, and even show taste preferences (Chamberlain 1988). Signs of self-regulation and self-expression are evident to most mothers, as there is a great deal in the uterine life which the fetus does have control over (Verny, 1981).

Another way to speculate on the emotional development of the pre-nate is to examine those states evident to the neonate. From the current developmental research, Daniel Stern (1985) feels that there are general principles regarding infant perception, cognition, and affect. Following our hypothesis of prenatal protostructures, pursuant to neonatal performances, then these principles should be evident at some point during the last trimester.

Stern begins by pointing out that:

Infants seek sensory stimulation . . . they do it with the preemptory quality that is prerequisite to hypothesizing and motivational systems. (p. 41)

Information gathered from prenatal stimulation shows that pre-nates will attempt to continue sensory stimulation which is on-going (Logan, 1990; Van de Carr, 1988; Panthuraamphorn, 1991). Multisensory stimulation may be one way that the pre-nate relates with greater efficacy to the outside world. Linked to the bonding process, this may be related to a motivational system.

Stern's second premise is that infants:

Have distinct biases or preferences with regard to the sensations they seek and the perceptions they form. (p. 42)

This is also evident in the area of prenatal stimulation. If the music is soothing, the pre-nate will respond with gentle movements. Adverse sounds are often met with strong kicking (Verny, 1991). Pleasurable reactions are often linked to

like reactions in the mother, due to the hormonal flows. It would seem that the advance pre-nate is not far behind the neonate in these areas.

The third hypothesis proposed by Stern is that:

From birth on, there appears to be a central tendency to form and test hypotheses about the world . . . Infants are constantly evaluating, in the sense of asking, is this a different from or the same as that? (p. 42)

This point may be one of the most crucial in evaluating prenatal cognitive-affective structures. We do know that under stimulation, pre-nates will show anticipation of scheduled times (Logan, 1990), and sometimes anticipation of set sequences (Sallenbach, 1991). When there is dissonance in these sequences, the fetus may react with confusion and respond with increased attention. Following Emerson's work (1989), it would seem likely that pre-nates also form hypotheses about the external world. If verified within the prenatal context, this area may well revolutionize our understanding of *in utero* cognition and affect.

References

- Bergland, R. (1985). *The Fabric of the Mind*. Viking Press, New York, NY
- Blum, T. (1991). Prenatal auditory stimulation. Paper presented to the *Fifth International Conference of the Pre- and Perinatal Psychological Association of North America*. Atlanta, GA
- Buchheimer, A. (1986). Memory – preverbal and verbal. In: Verny, T. (ed.) *Pre- and Perinatal Psychology: An Introduction*. Human Sciences Press, New York, NY
- Chamberlain, D. B. (1983). *Consciousness at Birth: A Review of the Empirical Evidence*. Chamberlain Communication, San Diego, CA
- Chamberlain, D. B. (1988). *Babies Remember Birth*. Tarchen, Los Angeles, CA
- De Caspar, A. J. (1980). Of human bonding: newborns prefer their mother's voice. *Science* **208**, 1174–1176
- Emerson, W. (1984). *Infant and Child Birth Refacilitation*. Institute for Holistic Education, Surrey, UK
- Emerson, W. (1989). Psychotherapy with infants and children. *Pre- and Perinatal Psychology Journal* **3**, 190–217
- LeClerc, I. (1975). *Whitehead's Metaphysics*. Indiana University Press, Bloomington, ID
- Lewin, K. (1936). *Principles of Topological Psychology*. McGraw Hill, New York, NY
- Meltzoff, A. N. and Moore, M. K. (1977). Imitation of facial and manual gestures by human neonates. *Science* **198**, 75–78
- Meltzoff, A. N. (1985). The roots of social and cognitive development: models of man's original nature. In: Fields, T. M. and Fox, N. A. (eds.) *Social Perceptions in Infants*, Ablex, Norwood, pp. 1–30
- Meltzoff, A. N. (1990). Towards a developmental cognitive science; the implications of cross-modal matching and imitation for the development of representation and memory in infancy. In: *The Development and Neural Bases of Higher Cognitive Functions*. *Annals of the New York Academy of Sciences* **608** (December)
- Logan, B. (1990). *Neurogenetic Effects of Sonic Imprinting: An in utero Curriculum for Improving Postnatal Performance*. Prelearning Institute, Snohomish, WA
- Panthuraamphorn, C. (1991). The effects of a designed prenatal enrichment program on growth and development of Thai children: a preliminary report. Paper presented to the *Fifth International Conference of the Pre- and Perinatal Psychological Association of North America*. Atlanta, GA
- Piaget, J. (1977). *The Development of Thought*. Viking, New York, NY

- Pert, C. (1987). Neuropeptides: the emotions and bodymind. *Noetic Science Review* 2, 13–18
- Restak, R. M. (1986). *The Infant Mind*. Doubleday, Garden City, New Jersey, NJ
- Sallenbach, W. B. (1980). *Patterns of experience among abused and neglected children: developmental outcomes*. Doctoral Dissertation, Claremont, CA
- Sallenbach, W. B. (1991). *Bonded Beginnings: A Tri-Level Curriculum for Prenatal and Postnatal Bonding and Learning*. Institute for Prenatal Studies, Maple Falls, WA
- Stern, D. (1985). *The Interpersonal World of the Infant*. Basic Books, New York, NY
- Van de Carr, R. (1988). Prenatal University: commitment to fetal-family bonding and the strengthening of the family unit as an educational institute. *Pre- and Perinatal Psychology Journal* 3, 87–102
- Verny, T. (1981). *The Secret Life of the Unborn Child*. Summit, New York, NY
- Verny, T. (1991). *Nurturing the Unborn Child*. Delacorte Press, New York, NY
- Whitehead, A. N. (1957). *Modes of Thought*. Macmillan, New York, NY
- Whitehead, A. N. (1969). *Process and Reality*. Free Press, Toronto