Early Childhood Development and Learning:

What New Research on the Heart and Brain Tells Us about Our Youngest Children

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Describes important new research on the role of the heart as well as the brain in early childhood development and learning, and important tools and applications that enhance emotional skills, brain development and intelligence. Paper presented by Dr. Rozman at the White House Conference on Early Childhood Development and Learning - San Francisco meeting, April 17, 1997.

The Heart/Brain System

Recent research results at the Institute of HeartMath® (IHM) have shown that heart rate coordination influences the coordination of the brain's electrical activity. Furthermore, IHM studies (published in the *American Journal of Cardiology, Stress Medicine* and other peer-reviewed journals) have shown that positive emotional states (such as love, care or appreciation) create harmonious, coherent patterns in the heart's beat-to-beat rhythms, while negative emotional states (such as stress, anger, frustration or anxiety) create jagged, incoherent patterns in the heart's rhythms. This correlation can be measured through Heart Rate Variability (HRV) analysis of the electrocardiogram (ECG). HRV is considered by cardiologists to be a measure of autonomic nervous system balance and function. Stressful, incoherent patterns in the HRV are communicated from the heart to the brain. Conversely, harmonious, coherent HRV patterns, generated by positive emotional states, entrain the brainwaves into harmonious patterns. In addition, positive emotional states and the coherent heart rhythms they generate have been shown to increase health and have positive effects on the nervous, immune and hormonal systems.

The Biology of Heart/Brain Communication

The heart to brain communication system can be described as follows: The heart has an electrical field that is very strong, and the coherence of the heart's rhythms can change the coherence of brainwave patterns (EEG). The heart sends electrical information about one's emotional state (as measured by coherence) to the cardiac center of the brain stem, which in turn feeds into the intralaminar nucleus of the thalamus and thence to the amygdala. This region is directly connected to the base of the front lobes. In addition, the intralaminar nuceli send signals to the rest of the cortex to help synchronize its activity. This central part of the

thalamus lies between the projections to the frontal and limbic forebrain and those to the rest of the brain (the cerebral convexity). Thus, the intralaminar complex can serve as a focus for relating emotional to cognitive processes in early childhood development as well as later in life.

The amygdala itself receives an input from baroreceptors, sensors within the heart and in the lining of the major blood vessels carrying blood from the heart to the brain. The baroreceptor system has been shown to regulate a person's "openness" to exteroceptive sensory input. In other research, the amygdala has been shown to regulate heart rate and blood pressure. When such regulation is interfered with by removal or damage of the amygdala, rapid learning (in which a situation becomes familiar) is impaired. The heart and blood pressure systems serve as a "booster" to such learning. A Russian scientist expressed this as follows: "an ounce of emotion is worth a pound of repetition."

In short, the amygdala organizes what becomes "familiar" to the child, whether coherent or incoherent. If patterns generated by the heart and blood pressure control systems are disordered and incoherent, the baby learns to expect disharmony as the familiar; thus, the child comes to feel "at home" with incoherence, which will affect learning as the child grows. This incoherence also affects peer selection: the child will feel "comfortable" only with incoherence, that is, discomfort among peers.

On the basis of what has become familiar, the frontal cortex mediates decisions as to what is appropriate or not in a given situation. Studies using EEG have shown that the frontal lobes of the brain are maturing rapidly in the early years up to age 3, then not again until the ages 17-21. Thus these early years are critical to the development of emotional maturity. Initially there is an overgrowth of junctions in the brain, especially in the cortex. These junctions are pruned back as an infant grows. "Pruning" is literally a pruning and shaping of developing patterns of brain connections. Language provides an example which can be extrapolated to emotional maturation: all children can learn all languages at an early age. But as they grow older, certain language abilities get lost through this pruning process. In Oriental cultures, after a certain age the "l" and the "r" are experienced as the same. It is plausible to argue that under certain conditions, the baby loses the ability to discern the difference between coherent and incoherent emotional states, perceiving them as "the same." This would affect the child's behavior.

It is thus, in the early years that the initial cognitive and emotional patterns are laid down and shaped through pruning. Frontal lobe controls are initiated at this early age; if there is separation from a loving primary caretaker, say before age 3, problems in development can occur unless another loving caretaker can take his/her place. Allan Schore has reviewed in detail the evidence for this course of events in his excellent book, *Affect Regulation and the Original of the Self: The Neurobiology of Emotional Development.*

According to electroencephalographic (EEG) analysis, there is also a difference between how boys' and girls' brains develop. A simplification of considerably more complex evidence indicates that in general, the brains of boys mature from the back forward, while those of girls mature from the frontal lobes back. This has important consequences. For example, one of the things we know is that more boys wet their beds than girls, most likely because bladder control is a function of the basal part of the frontal lobe system. In girls, the far frontal regions mature earlier. Because the auditory parts of the brain are located further forward in the brain, baby girls respond better to singing and talking than do boys. By contrast, boys are more active than girl babies — this leads to earlier visuomotor control (especially of large axial muscles) which, in turn, produces and is produced by maturation of the cortical convexity. A positive visual environment, smiling, etc., is helpful to baby boys.

Heart Entrainment—The Effect of the Parent or Caregiver's Emotional State on the Child

Thus, through the development of the far frontal cortex and its connections to the amygdala and perirhinal cortex, the "state of the heart" of the primary caregiver becomes important in a child's brain maturation. As a mother nurses her baby in a loving state, the baby's HRV patterns will entrain to the mother's HRV pattern. Research has shown that 80% of mothers, whether they are right or left-handed, carry their infants in the left arm which is closer to the heart. When a parent is peaceful, loving and caring, a harmonious, coherent HRV pattern is communicated. The mother-child interaction (or primary caretaker-child interaction) produces the basis of later emotional and ethical development.

Emotional states are contagious: Smile at a baby, and the baby smiles back. You get upset, and the baby cries. You can sense an immediate shift in the baby's emotional state by virtue of muscle tone and the way it holds its whole body. And you can measure the shift in the coherence of the heart rhythm. And, just as you can sense the baby's emotional state, the baby is able to sense yours.

So the pathway of early learning would be from the parent's or caregiver's heart electrical field to the baby's heart electrical field then to the brain. This is especially important in the first years of life. Touching, singing, talking to or reading to young children won't be effective if the parent or caregiver is anxious, angry or stressed. If mother is trying hard to be nice and read to her child while she is anxious, the HRV patterns pick that up and go direct to the baby. The heart and nervous system detect the real signal.

Touch serves to facilitate the exchange of cardiac coherence between people. Research at IHM is showing that when a person is touching another or in close proximity to another, the electrical energy produced by the heart can be measured in another's EEG or brainwaves. This finding gives new and more precise meaning to the concept of contact comfort and places touch as the first and most fundamental means of communication and interaction between parent and child. The loving caregiver becomes harmoniously attuned to child, allowing the child's brain to function harmoniously. **The beneficial effect of touch, loving contact or proximity between caretaker and child can be amplified by the adult *consciously* adopting a more sincere loving or caring emotional state, thus introducing increased coherence into the cardiac field.**

Applications in Early Brain Development and Learning

The most exciting discovery of IHM research is how problematic emotional and intellectual development can be corrected or at least improved. IHM has developed simple applications and tools to help parents, caregivers and children to quickly shift out of negative states and into positive states. As inner security is established through using the tools, the heart and brain patterns become more coherent. Parents, caregivers and teachers can be taught these simple tools that allow them to shift out of worry, frustration, anger, anxiety or stress and to bring their heart/brain rhythms back into coherence. Children can also learn to use tools for emotional self-management and healthy maturation early in life. From infancy to age 3, attention must be placed first on the emotional state of the parent and caregiver because their emotional states will reflect in the child's early development and the child's development later in life.

Summary

Research has shown that our emotional state as measured by heart rhythm coherence patterns, affects how our brain matures. Our emotional state affects others in close proximity via the heart's electrical field. Stressful, incoherent emotional states in a primary

caregiver impair development and learning in children, while positive emotional states enhance coherent maturation and learning. Tools have been designed and tested that are helping parents, caregivers, teachers and children to decrease stress and increase positive emotional states. This reflects in healthy brain maturation and enhances learning and healthy behaviors.

Appendix

New research just released by Harvard University revealed that adults who did not feel loved as children have a much higher rate of disease. Children need real love and care. Even an older child's brain is responsive to harmonious, coherent heart rhythms generated by love, care and appreciation. There are many cases where a loving caretaker, foster parent, "big brother" or mentor showed sincere care for a troubled child and this care over time enabled the child to overcome emotional and intellectual disabilities. This is evidenced in studies of resilient children who overcame tremendous obstacles to succeed in leading happy, intelligent, effective lives. In almost every case, the "resilient" child gave credit to a loving relative, minister or teacher who encouraged and believed in him or her. As parents, teachers and children learn tools to offset the increasing stress of today's world, they develop healthier attitudes and life skills essential to success and a positive future.

HeartMath Materials for Early Childhood Development

The HeartMath tools, provided in the books *A Parenting Manual* and *Teaching Children to Love,* and the audio tape, *Buddy Bubbles: Magical Games for a Child's Heart,* give parents, caregivers and children, tools and applications necessary to work things out when life becomes difficult. The tools, based on extensive research, testing, and case studies, have been successfully taught to children, parents and teachers in homes, day care centers and classrooms. In field testing in an inner city Phoenix elementary school, reading test scores in a remedial reading class of behaviorally-challenged 4th and 5th graders went up one to three grade levels after just *three* weeks using the HeartMath tools. In another classroom of seventh grade children using HeartMath tools in Dade County, Florida, highly significant results ($p < .0001$) were achieved in decreased risky behaviors, increased teacher comfort, decreased aggressive behavior/anger management, improved perception of family support and satisfaction, and in perceived locus of control (internal rather than external). These same tools are now being introduced in the nation's top corporations, governmental agen-

cies and the military to increase performance, leadership, productivity and health. Cardiologists and medical practitioners have recently begun teaching these tools to patients to reduce stress and improve the health of the heart, nervous system, immune and hormonal functions.

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