



Bowlby's "Environment of Evolutionary Adaptedness" Recent studies on the interpersonal neurobiology of attachment and emotional development (2013).

Schore, A.N.

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This review paper outlines how Bowlby's theories, in his classic book 'Attachment', have been largely substantiated by modern neurobiology. Essentially, the environment determines how the brain adapts during its development in the early years. Of course the environment for the developing child is largely affected by the interaction between the child and its primary care-giver, in most cases its mother, and then its father. The development of the emotional bond between mother and child occupies most of the review. In the first year, much of the mother-child interaction is non-verbal and operates through other communication channels such as touch and sight.

In the first 24 months of life, the child's brain grows dramatically but asymmetrically; the right hemisphere develops before the left. In the post-natal period, 40,000 new synapses (interconnections between nerve cells) are produced every second. Brain volume increases by 101% in the first year, compared with 15% in the second year. Infants under 2 years show larger right hemisphere volumes and by the age of 3 years, all the major fibre pathways are present. The right brain can be categorised as being broadly responsible for processing non-verbal, emotional and imaginative areas, whereas the left brain is more attuned to verbal, rational and object-oriented aspects. This remarkable growth of the brain is not just triggered by genetic mechanisms, there is a significant influence of experience gained by the growing infant during right-brain to right-brain attachment communications with its mother. Three types of attachment processes develop: 1, visual attachment; 2, auditory prosodic (mother's speech and tone) attachment and 3, tactile attachment.

Visual attachment is measurable at 2 months in right hemispheric activation when the infant is shown a woman's face. At 4 months, infants show differences in brain electrical activity that correspond to photos of a woman gazing in different directions. At 6 months, infants respond with a left-gaze bias when viewing faces.

Auditory communication is detectable differently between right and left brain in the first week after birth; slow sound patterns are detected in the right hemisphere. Prosodic processing is detectable at 3 months. By 7 months the infant responds to different emotional voices. At 11 months the infant begins to process a mother's child-directed speech, that is to say it begins to understand some of the mother's words.

(this Summary may be photocopied)

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Tactile attachment develops early in the infant's life through breastfeeding; by 6 months EEG changes in the infant's brain can be measured during this tactile attachment.

The right brain dominates the first year of life. In particular the right brain has a leading role in regulating the hypothalamic-pituitary-adrenocortical (HPA) axis where stress reactions are processed. At the same time as right brain dominance is observed, other regions of the brain are recruited in development. The orbital prefrontal cortex is important from 9 months to 18 months as the first stages of socialization occur. It is here that emotional processing and interpersonal behaviour are located. That processing affects the development of moral choice –acceptable/unacceptable behaviour. The development of the right brain and orbital prefrontal cortex in infancy also affects the way the mother responds; the mothers exhibit orbitofrontal activation when shown videos or photos of their smiling infant.

Where the infant experiences disorganised or disoriented attachments, such as abuse or neglect, the follow-through is an interference with right brain circuits; these affect the infants ability to play, experience empathy, and the competence to cope with future stressor events. Furthermore, this can lead to an increased risk for a range of psychopathologies and other medical disorders such as immune dysregulation, inflammatory conditions, adult cardiovascular disease and depression. Patterns of insecure attachment occur where an infant is placed for long periods in daycare where the primary caregiver(s) is no longer the mother. This problem is manifest as avoidance on reunion with the mother.

Schore calls for a detailed study of the neuropsychological outcomes on infants before, during and after early daycare. In the United States, most mothers return to work 6 weeks after the birth of the child. It had previously been argued that adverse early environments could produce resilient children, however recent clinical evidence counters that assertion; the children are not resilient but malleable for better or worse. To quote from Leckman and March¹ (2011) "Early experiences can affect adult health in two ways: either by cumulative damage over time, or by the biological embedding of adversities during sensitive developmental periods. In both cases there can be a lag of many years, even decades, before early adverse experiences are expressed in the form of (mental or physical) disease."

1. Leckman, J.F. & March J.S. (2011) Editorial: "Developmental Neuroscience Comes of Age" in *Journal of Child Psychology and Psychiatry*, Vol 52, 333-338.

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