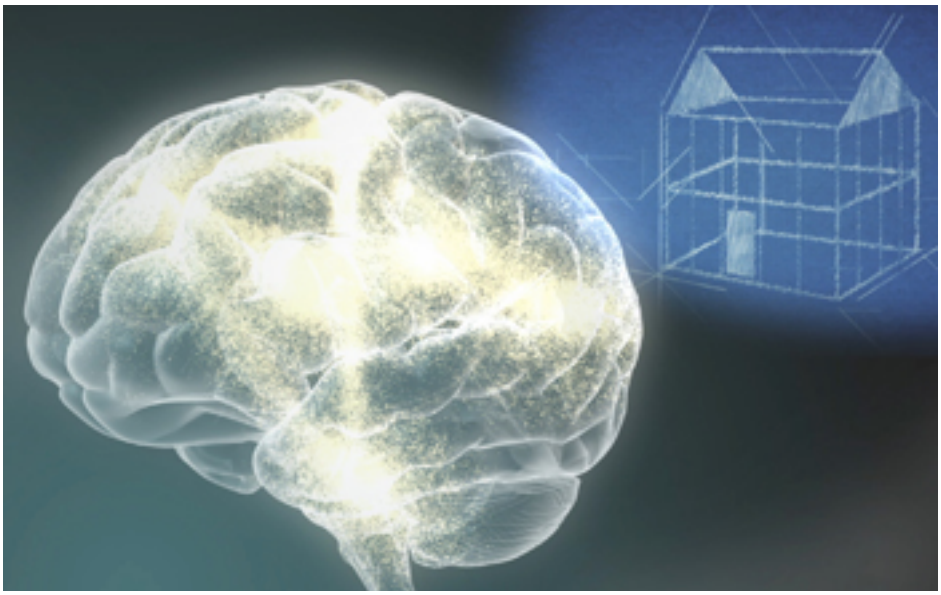
Brain Architecture

Early experiences affect the development of **brain architecture**, which provides the foundation for all future learning, behavior, and health. Just as a weak foundation compromises the quality and strength of a house, adverse experiences early in life can impair brain architecture, with negative effects lasting into adulthood.

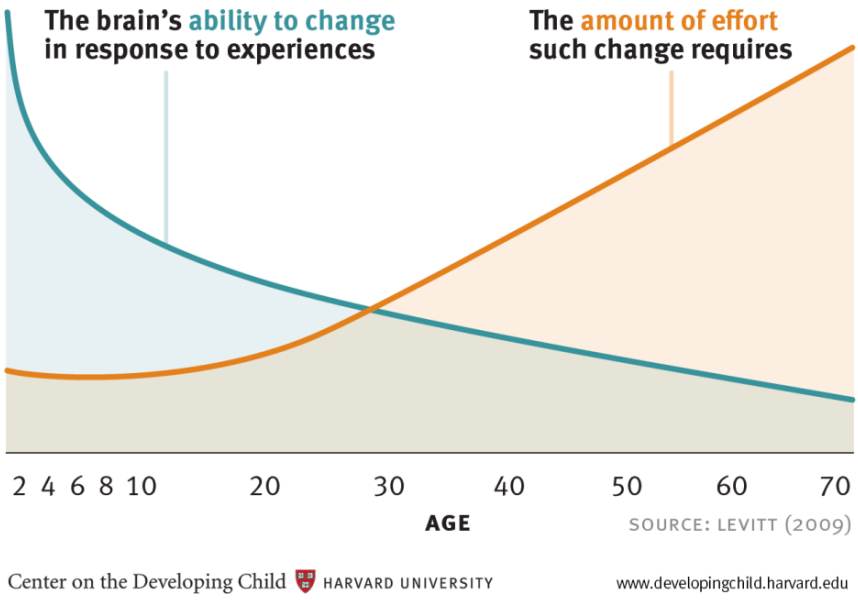


The development of a child's brain architecture provides the foundation for all future learning, behavior, and health.

Brains are built over time, from the bottom up. The basic architecture of the brain is constructed through an ongoing process that begins before birth and continues into adulthood. Simpler neural connections and skills form first, followed by more complex circuits and skills. In the first few years of life, more than 1 million new neural connections form every second. After this period of rapid proliferation, connections are reduced through a process called pruning, which allows brain circuits to become more efficient.

Brain architecture is comprised of billions of connections between individual neurons across different areas of the brain. These connections enable lightning-fast communication among neurons that specialize in different kinds of brain functions. The early years are the most active period for establishing neural connections, but new connections can form throughout life and unused connections continue to be pruned. Because this dynamic process never stops, it is impossible to determine what percentage of brain development occurs by a certain age. More importantly, the connections that form early provide either a strong or weak foundation for the connections that form later.

The interactions of genes and experience shape the developing brain. Although genes provide the blueprint for the formation of brain circuits, these circuits are reinforced by repeated use. A major ingredient in this developmental process is the serve and return interaction between children and their parents and other caregivers in the family or community. In the absence of responsive caregiving—or if responses are unreliable or inappropriate—the brain's architecture does not form as expected, which can lead to disparities in learning and behavior. Ultimately, genes and experinces work together to construct brain architecture.



It is easier and less costly to form strong brain circuits during the early years than it is to intervene or "fix" them later.

Cognitive, emotional, and social capacities are inextricably intertwined throughout the life course. The brain is a highly integrated organ and its multiple functions operate in coordination with one another. Emotional well-being and social competence provide a strong foundation for emerging cognitive abilities, and together they are the bricks and mortar of brain architecture. The emotional and physical health, social skills, and cognitive-linguistic capacities that emerge in the early years are all important for success in school, the workplace, and in the larger community.

Toxic stress weakens the architecture of the developing brain, which can lead to lifelong problems in learning, behavior, and physical and mental health. Experiencing stress is an important part of healthy development. Activation of the stress response produces a wide range of physiological reactions that prepare the body to deal with threat. However, when these responses remain activated at high levels for significant periods of time, without supportive relationships to help

calm them, toxic stess results. This can impair the development of neural connections, especially in the areas of the brain dedicated to higher-order skills.