

# Shaping the Brains of Tomorrow

What developmental science teaches about the importance of investing early in children

BY ROSS A. THOMPSON

**W**HAT WOULD HAPPEN IF THE BEST MINDS in the country concluded that investments in early-childhood development are necessary and cost-effective? That the early years present an opportunity, unequalled later in life, to enhance inborn potential and avert harm? What if they could identify the “active ingredients” of healthy psychological development, and how to enhance these in young children growing up in deprived conditions? Wouldn’t society become mobilized to do its best for young children?

We are in this situation today, and the arguments for investing in early-childhood development are scientific, not political. As the result of several blue-ribbon studies of the forces shaping young children’s growth, developmental scientists today agree on some basic conclusions: The early years are important. Early relationships matter. All children are born ready to learn, both intellectually and socially. Even in infancy, children are active participants in their own development, together with the adults who care for them. Early experience can elucidate, or diminish, inborn potential. The early years are a period of considerable opportunity for growth and vulnerability to harm.

What we do with this knowledge will shape the lives of the next generation.

## DEVELOPMENT IN THE EARLY YEARS

Developmental psychologists and neurobiologists agree that the developing mind is astonishingly active and self-organizing, creating new knowledge from everyday experiences. Newborns crave novelty and become bored with familiarity, so their eyes, ears, and other sensory organs are attuned to events from which they can learn. A few months later, the infant mentally clusters objects together that are similar in shape, texture, or density, and explores gravity and causality as crackers are dropped from the high chair. A toddler categorizes faces, animals, and birds according to their properties, and by age 3 or 4, children make logical inferences about new members of a group, such as appreciating that a dolphin breathes like the mammal it is rather than the fish it resembles. Just as the developing brain is expanding its interconnections, the developing mind is making connections between the new knowledge it discovers and creates.

The remarkable intellectual accomplishments of the early years extend to language development. Newborns have an innate capacity to differentiate speech sounds that are used in all the world’s languages, even those they have never heard and which their parents cannot discriminate. But later in the

first year they lose this ability as they become perceptually attuned to the language they will learn. By age 3, a child is forming simple sentences, mastering grammar, and experiencing a “vocabulary explosion” that will result, by age 6, in a lexicon of more than 10,000 words. Equally important, language will enable the child to put developing ideas and concepts into words that he or she can share with another, revolutionizing his or her thought by gaining access to the concepts, ideas, and values of others.

Sensitive caregiving—not educational toys or Mozart CDs—provides the most essential catalysts for these feats of intellectual growth. People are critical to the development of the mind: Newborns attend in a special way to human faces and voices, toddlers learn new words based on their interest in the intentions of adult speakers, and memory develops through the shared recounting of everyday events. Relationships stimulate the mind and provide the emotional incentives to new learning as young children share their discoveries with another. This is why promoting school readiness is not simply a matter of encouraging literacy and number skills. It must also ensure the secure, unhurried, focused attention from sensitive caregivers that contributes to the growth of curiosity, the eagerness to discover, self-confidence, and cooperation.

Healthy brain development relies on people to provide the stimulation that organizes connections in the cortex for language and complex thought. It also relies on people to protect the baby from overwhelming stress, manage the child’s emotions, and promote security. This is why strong attachments between infants and their caregivers are as biologically basic as learning to crawl and walk. Throughout evolution, attachment relationships have ensured human survival by keeping infants protected and nurtured. By their first birthday, infants have developed deep attachments to those who care for them. And these attachments, in turn, provide a foundation for positive relationships with peers and teachers, healthy self-concept, and emotional and moral understanding.

In the absence of nurturing relationships, things can go wrong. It isn’t surprising to find that insecure attachments develop more frequently in homes where parents are stressed or depressed, or in chaotic child-care settings. Even more disturbing is research demonstrating how early children show signs of depression, conduct problems, social withdrawal, and anxiety disorders, and how closely these problems are tied to the quality of the parent-child relationship. These studies show that relationships with caregivers who are neglectful, physically abusive, or emotionally troubled can predispose young children to psychopathology. So the importance of

these earliest relationships is a double-edged sword: Sensitive caregiving underpins healthy development, while markedly inadequate care renders young children vulnerable to harm.

Relationships also influence the growth of social and emotional understanding. Far from being egocentric, young children are fascinated by what goes on in others' minds, and social experiences are the laboratory in which these discoveries emerge. A 2-year-old whose hand inches closer to the forbidden VCR while carefully watching her parent's face, for example, is testing the adult's expected reaction. And a 3-year-old whose roughhousing has resulted in a crying younger sibling learns from an adult about the connections between exuberant running and inadvertent collisions, enhancing his or her emotional understanding and empathy.

### FROM MIND TO BRAIN—AND BACK AGAIN

Whether we are concerned with the growth of the mind or the person, all of these remarkable early achievements take place in the developing brain. Brain development begins within the first month after conception, and by the sixth prenatal month, nearly all of the billions of neurons that populate the mature brain have been created. This means that the quality of prenatal care, particularly the mother's nutrition, health, and exposure to dangerous viruses and drugs, can have a profound effect on the developing brain of her fetus. Health, nutrition, and drug exposure continue to influence brain development after birth.

Both before and after birth, there is an initial "blooming" of connections between neurons, creating a brain densely packed with many more neural pathways than it needs. This proliferation is followed by a period of "pruning" in which little-used connections gradually erode to reach the number required for optimal efficiency. Experience is the central determinant of which neural pathways are retained or disappear. The early experiences that sculpt the developing brain can be stimulating or neglectful, supportive or traumatic, secure or stressful. Through a "use it or lose it" principle, those neurons that aren't activated through experience progressively wither. Language exposure, for example, helps to account for the transition from the newborn's capacity to perceive universal speech sounds to the 1-year-old's language-specific speech perception. Developmental neuroscientists offer similar accounts to explain the early development of vision, memory ability, early categorization and thinking skills, and emotional development.

Brain development is an extended process—not limited to a narrow "window of opportunity" between zero and three, as conventional wisdom sometimes suggests. Neural con-

nections in areas of the brain guiding higher forms of thinking and reasoning grow and atrophy into early adolescence, for example, and the adult brain even creates new neurons in certain regions governing memory. Brain architecture continues to be subtly refined throughout life in ways that reflect the individualized, everyday experiences of the person. The brain of a musician who plays a stringed instrument, for example, differs from the brain of a poet who works with words and abstract ideas because they have exercised different brain regions throughout life.

Despite these exciting discoveries, neuroscientists are still at the early stages of understanding how experience refines the brain. They are concerned with how early deprivation (such as that experienced by orphans from Romania and the former Soviet Union), abuse, and trauma influence early brain growth, and whether these effects can be altered. They are also studying how relational problems, such as the challenges faced by an infant of a depressed mother, influence brain development.

### INVESTING IN YOUNG CHILDREN

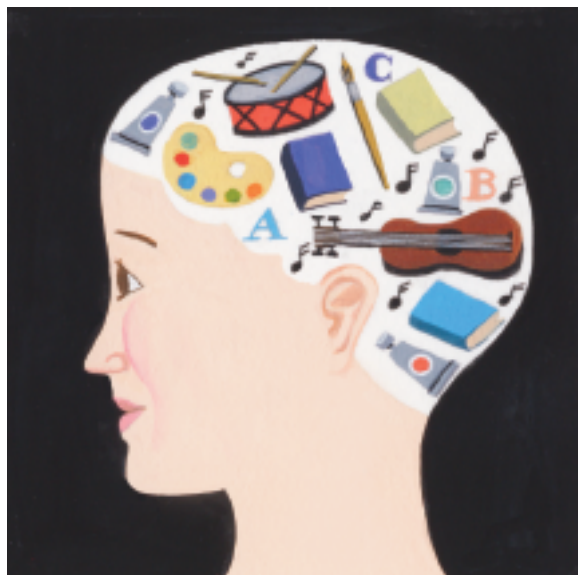
These and other conclusions from a landmark study of the National Academy of Sciences, *From Neurons to Neighborhoods: The Science of Early Childhood Development*, underscore the importance of early experiences for development throughout life.

What about children, then, who live in deprived or high-risk conditions? Considerable research shows that many of them will lag intellectually from infancy and will suffer deficiencies in various facets of healthy psy-

chological development. Poverty significantly compromises healthy intellectual and socioemotional development, for example, and poverty during early childhood is more powerfully predictive of later achievement than is poverty at any later stage. The reasons include stressed caregivers, troubled parent-child relationships, dangerous neighborhoods, and inadequate schools and community supports.

Can early interventions improve the odds of healthy development for children at risk? The answer offered by the committee of scientists that wrote *From Neurons to Neighborhoods* is both optimistic and challenging. The good news is that there are successful strategies, especially programs that emphasize child-focused educational activities and parent-child interaction, and are governed by specific practices matched to clear goals. But the most effective interventions are rarely simple, inexpensive, or easy to implement. Changing the developmental trajectory of a young child growing up in deprived circumstances requires determination, persistence, and patience.

Are such interventions cost-effective? Determining the cost-effectiveness of programs for at-risk young children re-



quires putting price tags on the innumerable human consequences of early deprivation. Yet several studies of comprehensive early-intervention efforts have found that program costs are more than compensated by averted costs of educational remediation, juvenile or adult crime, and diminished job earnings.

While expensive, large-scale public efforts have been skeptically regarded by policy-makers most concerned about their costs, important new voices are emerging in support of these investments. One is that of James Heckman, Nobel laureate and University of Chicago economist, who argues that the varied benefits of early-childhood interventions—in cognitive learning, motivation, and socialization—are likely to have long-term advantages in the labor market because of the cumulative effects of early improvements in ability. Another is that of Art Rolnick of the Federal Reserve Bank in Minneapolis, who (along with colleague Rob Grunewald) estimates that public investments in programs to assist poor children yield a 16-percent real rate of return. This, he argues, compares very favorably to other public investments with more popular appeal, such as building sports coliseums, which typically have little or no return on public investment. Although much more research is needed, it appears that society's investment in improving the chances for young children at risk is economically worthwhile.

The views of economists like these shift the debate about public efforts to support healthy early development. And

they join the chorus of scientists whose work has consistently shown how much early-childhood experiences and relationships matter. It is now reasonable to ask why public policy lags so significantly behind the science and economics of early-childhood development.

The public policies that would support healthy early-childhood development are child-friendly and family-friendly. They include:

- child-care policies that ensure widespread access to affordable, high-quality child care;
- welfare-reform policies that enable parents to integrate work and family responsibilities constructively in children's interests;
- prenatal and postnatal health care that screens children for developmental difficulties before they become severe, guarantees adequate nutrition, provides early visual and auditory screening, and protects young children from debilitating diseases and hazardous exposure to environmental toxins.

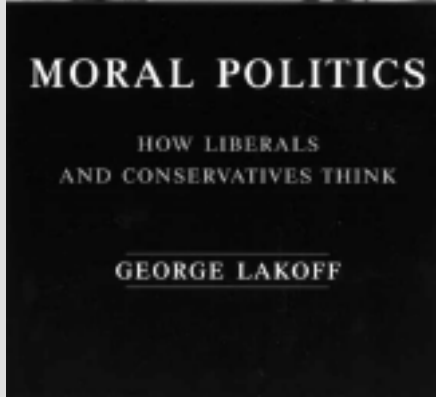
In the end, because children are society's most valuable asset, they are also a social responsibility and investment. Because the science of early-childhood development converges with the economics of public policy to confirm that investments in early-childhood development are both necessary and worthwhile, it is long past time for society to catch up. ■

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