The New Ecology of Early Childhood:

Revisiting Bronfenbrenner's Theory in the Context of Contemporary Challenges and Opportunities

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Origins and Overview of Ecological Systems Theory

In the early 1970s, the American psychologist Urie Bronfenbrenner started formulating a conceptual framework of human development that came to be called Ecological Systems Theory. One can discern from his writings that the impetus for this may have come from concerns about how research in the field of developmental psychology was being conducted. At the time, much child development research consisted of laboratory-based studies that generally neglected to incorporate the influences of family, community, and cultural contexts in which children resided. Bronfenbrenner's somewhat sardonic summation was that the field comprised "the science of the strange behavior of children in strange situations with strange adults for the briefest possible periods of time" (Bronfenbrenner, 1979).

Bronfenbrenner's initial theorizing about human development coincided with an era marked by significant changes in social policy and programs for young children and their families. In the United States in particular, the Great Society agenda of the Lyndon Johnson administration, launched in 1964–65, was designed to reduce widespread opportunity gaps between poor and middle/upper income families. Those policies and programs, including Head Start, the Economic Opportunity Act, the Civil Rights Act, Medicaid, and Medicare, built upon the social safety net programs of the New Deal that were established during the Great Depression. In this way they extended earlier efforts to mitigate structural and systemic inequalities, reduce racism and discrimination, and legislate and implement fundamental changes in the social fabric surrounding families of young children. Subsequent authors have pointed out that Bronfenbrenner's efforts were in part intended to develop a practical theory of child development that was relevant to these antipoverty policy initiatives (Tudge et al., 2009).

Notably, Bronfenbrenner's ideas about human development continued to evolve over the subsequent three decades. During this time, many aspects of his theory underwent significant revision, adaptation, extension, and even renunciation. These changes were so substantial that Bronfenbrenner ultimately renamed the model "Bioecological Theory," incorporating the emerging scientific understanding of the interaction between nature (inherited characteristics and genetic influences) and nurture (environmental contexts) (Bronfenbrenner & Morris, 2006).

Because of the extent to which his theorizing changed over time, and perhaps because of the overall complexity of his writing, scholars of his work have noted that Bronfenbrenner's ideas are often misrepresented. Specifically, they argue that Ecological Systems Theory is often presented in highly oversimplified terms, primarily emphasizing the overall importance of context on

human development but not the dynamic and omnidirectional nature of influences across levels of the ecosystem (Navarro et al., 2022). These scholars further note that many references to Bronfenbrenner's theoretical formulations are not described in terms of where they fit chronologically in the 30-plus years in which he was actively writing (Tudge et al., 2016). For example, a review of articles based on Ecological Systems Theory found that only four out of 25 employed a version of Bronfenbrenner's theory in a manner consistent with the primary source formulation cited by the authors (Tudge et al., 2009). [1]

These challenges notwithstanding, Ecological Systems Theory remains a dominant force in developmental psychology and related fields. Central to the theory is the concept of human *ecology*. The term ecology is sometimes used (especially within the environmental movement) to refer to efforts to protect the natural world from damaging human impact. However, the original meaning of ecology, and the one to which Bronfenbrenner was alluding, involves the reciprocal influences of organisms and environments upon each other—in other words, understanding human development across the lifespan as fully embedded within, and having an impact upon, the contexts in which it occurs.

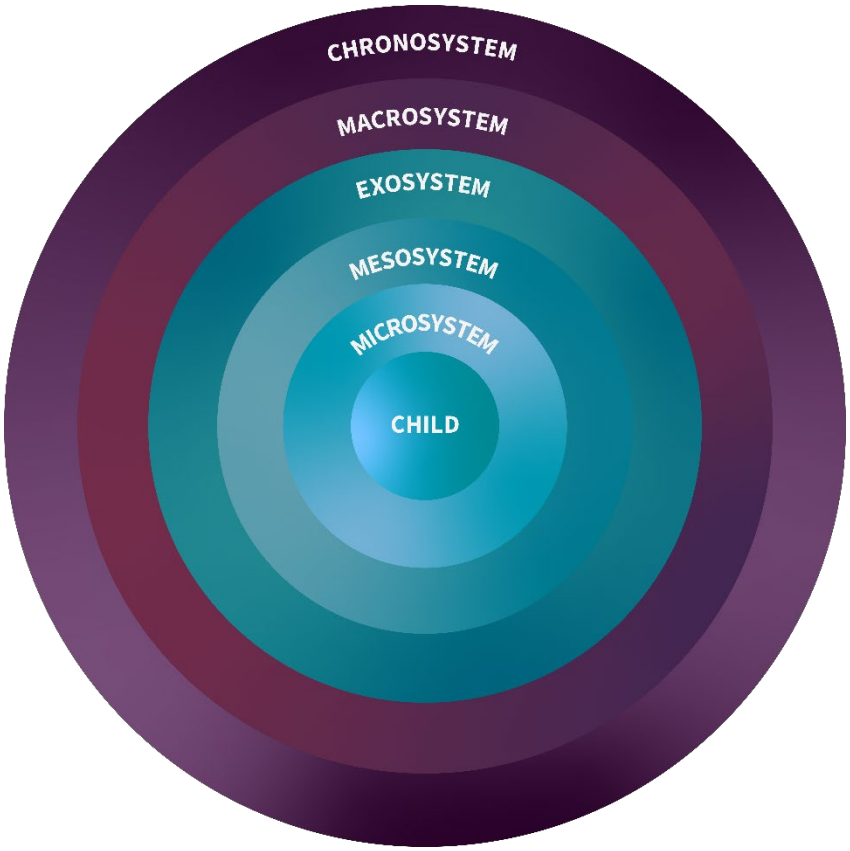


Figure 1. Bronfenbrenner's nested ecological levels. Adapted from Blair, 2023.

[1] The focus of this article is what some have referred to as the "second phase" of the development of Bronfenbrenner's model, between the early 1980s and the mid-1990s, when he still referred to it as Ecological Systems Theory and before he renamed it Bioecological Theory. (Rosa & Tudge, 2013). Although some have suggested that the Bioecological model should always be centered when referring to Bronfenbrenner's ideas, our view is that this latter model, along with Bronfenbrenner's formulation of the Process-Person-Context-Time concept that appears in his later work—though necessary and useful for research to validate the theory—is less applicable for the policy and programmatic contexts to which our writing is oriented.

Bronfenbrenner described five nested ecological levels in which the child is embedded, represented as concentric circles. Importantly, this is arguably the aspect of Bronfenbrenner's model that has been most subject to oversimplification and misrepresentation. Not only are the concentric circles and their contents sometimes mislabeled, they are also commonly characterized simply as exerting less influence on the child as one moves from inner to outer circles.

In order to provide a more complete explication of the model, we will employ a description of a fictionalized four-year-old child growing up in a city in the American Midwest. Imagine that this child lives in a small apartment complex with an extended family, including her two primary-school-age siblings, her mother, and her elderly maternal grandparents. She attends a local center-based preschool program near her home and is also cared for part time by a neighbor in the apartment complex during early morning and evening hours when other care is not available. This arrangement allows her mother to work and support the family while also attending community college. Her grandparents immigrated to the United States when her mother was a child, and the family is a dual-language household. They are part of a social network of multigenerational families who immigrated from the same country, and they participate in community activities that celebrate the culture in this country of origin.

Within Bronfenbrenner's conceptualization, the child is at the center of her ecological system (see Figure 1). The level most proximal to the child is the microsystem, defined as "a pattern of activities, social roles, and interpersonal relations experienced by the developing person in a given face-to-face setting … that invite, permit, or inhibit, engagement in sustained, progressively more complex interaction with, and activity in, the immediate environment" (Bronfenbrenner, 1994). For the child in our example, the most salient microsystems—i.e., face-to-face settings in which such interactions occur—would include her home environment (including her interactions with siblings, mother, and grandparents), the time she spends with the teachers and other children in her preschool, and the adults and children in the apartment where her neighbor provides her with care.

The ecosystem level that is immediately contiguous to the microsystem Bronfenbrenner called the mesosystem, defined as "the relationships between two or more settings; in short … a system of two or more microsystems" (Bronfenbrenner & Morris, 2006). Noteworthy in this conceptualization is the fact that the child's mesosystem is dynamic, changing as the child enters or exits specific microsystems in which she spends time. In our example, the child's mesosystem would be represented by the daily routines and sources of nurturing care she experiences across her home, preschool, and child care settings; however, her mesosystem would change if she changed preschools or if a different neighbor started to provide care for her. One notable change in young children's mesosystems in recent years has been the rise of publicly funded prekindergarten programs. These vary state-to-state with respect to whether these programs are implemented in the public school system or in a mixed-delivery model of

public schools and child care settings; nevertheless they do represent a change in the availability of public funding for early care and education beginning at age four.

Nested outside the mesosystem is the exosystem, which Bronfenbrenner defined as "the linkages and processes taking place between two or more settings, *at least one of which does not contain the developing child* but in which events occur that indirectly influence processes within the immediate setting in which the developing person lives" [emphasis added] (Bronfenbrenner, 1994). An example would be if one of the child's older siblings started a new elementary school that started an hour later each day, thereby affecting the family's weekday morning routine and who is dropping the child off at preschool. Another might be if her mother finished community college and started a new job with a different work schedule that required her to find additional child care. Even if this job had better pay and benefits, this change in the child's mesosystem might pose new challenges and stressors for the entire family, including the child.

Contiguous to the exosystem is the macrosystem. Within this level of ecology Bronfenbrenner identified collective contexts such as "culture, subculture, or other extended social structure" in which there are shared overarching experiences, beliefs, and values (Bronfenbrenner, 1979). Individuals within the same macrosystem are posited to be more similar than individuals in other macrosystems in terms of the interconnections among their micro-, meso-, and exosystems (Bronfenbrenner, 1993). For instance, the child in our example would exist in a similar macrosystem as those in her community, especially those whose grandparents immigrated to the United States from the same country, share a similar dual-language home environment, or participate in the same community celebrations of that country's culture.

Although not contained in the original formulation, later iterations of the Ecological Systems model included the chronosystem, defined by Bronfenbrenner as "the individual's own developmental life course … as embedded in and powerfully shaped by conditions and events occurring during the historical period in which the person lives (Bronfenbrenner, 1995). This particular concept emphasizes not only the continuous (e.g., physical growth) and discontinuous (e.g., pubertal onset) maturational development of the individual over the life course and the ways in which early experiences impact subsequent development, but also the manner in which the world is constantly changing over time. As such, the chronosystem of the child in our example as she moves through preschool and into primary education would be very different depending on whether she was born before, during, or after the pandemic.

As we note above, the Ecological Systems model is often mischaracterized as being intended solely for illustrating the strength with which different influences impact the child. Although Bronfenbrenner did ultimately postulate that microsystem processes have the most proximal and thus the greatest influence on individual development (Bronfenbrenner & Morris, 2006), it was primarily the continuously dynamic, reciprocal, and interactive nature of developmental influences across all levels of the child's ecosystem (e.g., the microsystem on the child, the child on the mesosystem, the exosystem on the chronosystem, etc.) that he sought to elucidate.

The New Ecology of Early Childhood: Changing Conditions

While Bronfenbrenner's ecological approach to human development—and early childhood in particular—remains highly influential in scholarly work, policy, and practice, much has changed since its formulation. For example, our understanding of neuroscience and the importance of the early years to child development has deepened and gained more public attention. Specifically, there is extensive and compelling evidence that what happens in the early years has an impact on long-term health, learning, and behavior. In our own research and that of others, the absence of supportive, predictable, and nurturing care has been documented to lead to alterations in the development of key biological systems regulating how we respond to stress (Bruce et al., 2009) and in areas of the brain associated with processing social information (Stamoulis et al., 2017). Yet US public policies have not kept up with our increasing awareness of the importance of the early years or the changing realities of families.

In addition, a constellation of conditions currently exists that is impacting the ecosystems of young children in unprecedented ways and leading to new challenges for children and the adults in their lives. We refer to these conditions as the *New Ecology of Early Childhood.* One consequence of these changing conditions is that emotional distress and mental health issues are affecting large proportions of the adult population who have children. Indeed, the situation is sufficiently concerning that in 2024 former US surgeon general Vivek H. Murthy issued an "Advisory on the Mental Health and Well-Being of Parents" (HHS, 2024). Such advisories in the past have been issued in response to such major threats to public health as the risks associated with smoking and the opioid crisis. In an editorial in the *New York Times* (Murthy, 2024), explaining the reasons for the current advisory, Dr. Murthy notes:

> "A recent study (APA, 2023) by the American Psychological Association revealed that 48 percent of parents say most days their stress is completely overwhelming, compared with 26 percent of other adults who reported the same. They are navigating traditional hardships of parenting—worrying about money and safety, struggling to get enough sleep—as well as new stressors, including omnipresent screens, a youth mental health crisis and widespread fear about the future."

Below we identify four domains in which there is strong evidence of changing conditions that are exerting intersectional impacts on ecosystems of young children, including (a) the persistence of poverty and increasing inequalities, (b) the unmet demand for quality child care, (c) the changing climate, and (d) the exponential acceleration of digital technology. In our narrative, we locate these domains within and across the five ecological system levels that Bronfenbrenner described. Next, we postulate a common mechanism of impact across all of these ecologies for which there is a growing body of evidence from research on brain, biological, and behavioral development: uncertainty and unpredictability. We review the research in this area, and make the point that unpredictability is highest—and has the greatest impacts—among the most socially and economically marginalized children.

We wish to emphasize that we do not intend our formulation of the New Ecology to challenge Bronfenbrenner's original model nor to be a full accounting of early childhood ecosystem changes. Rather, we seek to highlight the current contexts in which children are growing up today in the United States so that we can develop strategies for promoting optimal development and preventing negative outcomes for all children. We welcome others to extend this line of thinking. We expect such extensions will occur in the form of new commentaries, and we also hope to stimulate new research on these topics. In the below discussion, within each of the four domains we examine, we cite relevant data and research and endeavor to articulate where within and across the five levels of the original Ecological Systems model these domains are most relevant. Where possible, we examine changes beginning in the 1970s, to align with Bronfenbrenner's initial theorizing.

The Persistence of Poverty and Increasing Inequalities in Early Childhood

Insufficient public funding and, in some cases, the reduction of the Great Society policies and programs that were launched in the 1960s have led to the perpetuation of the income and opportunity gaps those policies were intended to address (Hinton, 2016). As such, the overall rates of childhood poverty remain quite high. According to the American Community Survey (Center for American Progress, 2023), in 2023 one in five children under age five lived in poverty. The situation is most concerning for young children; according to Zero to Three (Zero to Three, 2018), there are two million infants and toddlers living in poverty in the United States, and two out of five infants and toddlers live in families earning less than 200 percent of the Federal Poverty Guidelines ($55,000 a year for a family of four).

Our own research and numerous additional sources of data show that, if anything, the income and opportunity gaps between many demographic subgroups have only increased across the decades since the 1960s (e.g., across different racial and ethnic groups, in single vs. two-parent households) (Liu et al., 2024; Akee et al., 2019; Manduca, 2018). Moreover, income mobility (going from lower to higher income) has diminished at the population level during this time. In addition to increasing opportunity gaps, the overall distribution of wealth in the US has changed, with more individuals at the very low and very high ends of the continuum. This is especially pronounced among families with children.

Our team has been examining more recent trends in the economic conditions of families with young children via the RAPID monthly national survey of households with young children (Rapid Survey Project, 2024), which has been ongoing since early 2020. In that survey we measured material hardship, defined as the ability to pay for basic needs, including food, housing, utilities,

health care, and child care, in the past month. Because RAPID was initiated early in the COVID-19 pandemic, we have limited information about pre-pandemic rates of hardship. However, our data show that since 2020 the proportion of all families with a child age birth to five years experiencing at least one area of hardship at any given time has never dropped below 25 percent, and for the past two years it has been hovering at 40 percent. We have also observed significantly higher rates of hardship from 2020 to the present for Black families (compared with White families) (Ibekwe-Okafor et al., 2023), for single-parent households, (RAPID Survey Project, 2020), and for households in which a child has a disability (Liu & Fisher, 2022).

There is an additional point worth making from the RAPID data on material hardship. As shown in Figure 2 below, there have been large month-to-month fluctuations in the proportion of families experiencing hardship in recent years. That has two implications. First, it suggests that many families with young children may be on the margins of hardship—financially solvent one month but not the next, introducing uncertainty in their ability to make ends meet on a monthly basis. Second, the graph shows a major decrease in hardship rates between spring of 2021 and 2022, when the Expanded Child Tax Credit (CTC) was in place. Other sources (Center on Poverty and Social Policy, 2021) have noted similarly that the CTC cut child poverty rates in half. Both of these exosystem issues have implications for practice, policy, and advocacy that we discuss at the conclusion of this commentary.

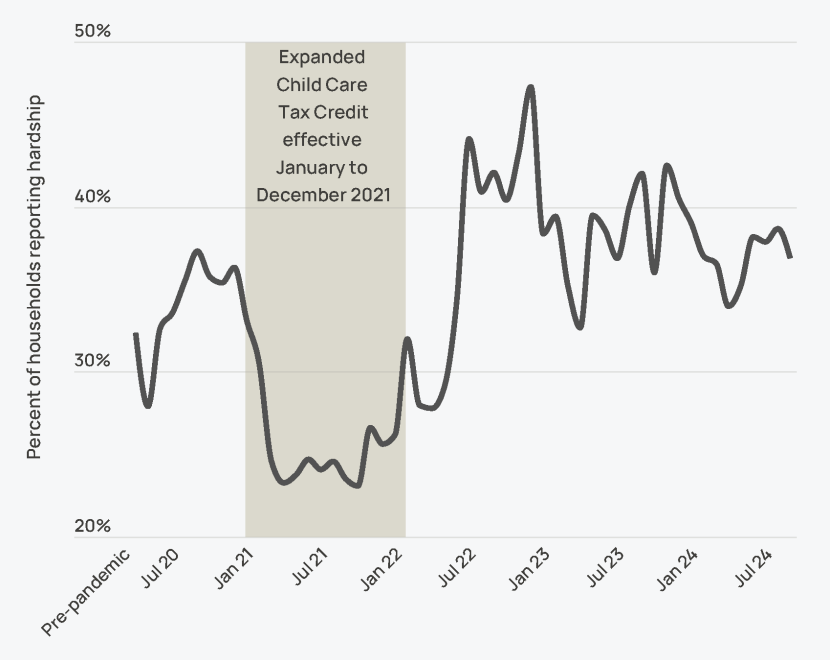


Figure 2. Percent of households reporting hardship over time, pre-pandemic through July 2024 (RAPID Survey Project, 2024).

It is also extremely important to note that persistent structural and systemic inequalities are evident in the early childhood poverty data. For example, Black children are three times as likely to live in poverty as White children, and three in five Black (62.3 percent) and Native American (61

percent) infants and toddlers live in families with low incomes (Aladangady & Forde, 2021). Recent research also finds that young children of color experience racism at earlier ages and higher rates than was previously understood (Ibekwe-Okafor et al., 2023).

These are powerful forces that interact with all other levels of the early childhood ecosystem. They have direct effects on the child, impact the child's home and early care/education microsystems and the collection of microsystems (i.e., the mesosystem) within which the child is embedded, and they are associated with exosystem effects (e.g., the well-documented racial wealth gap) (Aladangady & Forde, 2021) on the child. In short, they serve as social determinants of health and mental health, beginning in early childhood (Berry et al., 2021).

The Demand for Quality Child Care

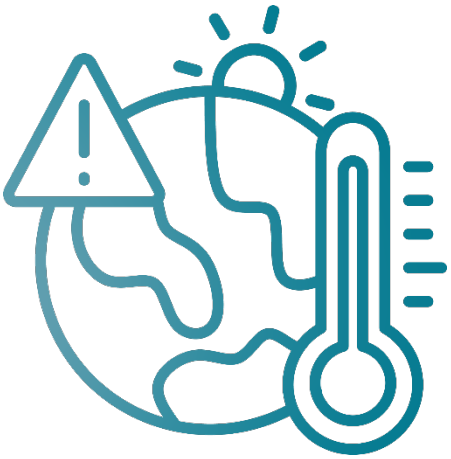
A dramatic change in young children's ecosystems in recent decades has been the proportion of children who spend time in early care and education settings. In the mid-1960s only 17 percent of children ages three to five were enrolled in pre-primary programs. By 1980 this number had increased to 53 percent, and these numbers have continued to grow (National Center for Education Statistics, 2024). The number of women in the workforce has grown dramatically from 12 percent just after WWII to 64 percent by 1999 (US House of Representatives Ways and Means Committee, 2000), and that number continued to grow through the opening decades of the 21st century. In 2016, 59 percent of children under age five were in some form of regular child care arrangement (US Department of Health and Human Services [DHHS], 2020), and for children under age five with employed mothers, the percentage in regular child care increased from 76 percent in 2010 to 79 percent in 2016 (US DHHS, 2020; Laughlin, 2013).

Many parents rely on a patchwork of arrangements in order to align care arrangements with their work/school schedules. Although limited data are available in this area, one study (Morrissey, 2008) analyzed the national NICHD Study of Early Child Care and Youth Development dataset (NICHD, 1998) and found that 11–13 percent of children ages two to three were in two or more child care arrangements. All these factors contribute to the likelihood that today's young children exist in larger and more diverse mesosystems than in the past. These changes represent both opportunities (e.g., more individuals to provide nurturing care) and specific challenges (e.g., the child having to adjust to different patterns of care in the mesosystem).

Related issues exist regarding present-day ecologies of early care and education. First, in many communities, the demand for care (especially quality care) far exceeds the supply. Low wages and poor working conditions for care providers have created extensive volatility in the child care sector, with many center- and home-based providers struggling to remain open and high staff turnover rates (Center for American Progress, 2023). During the pandemic, new policies helped

temporarily to prevent the complete collapse of the early care and education sector, although there was extensive attrition in the early care and education workforce and widespread closures of home- and center-based care (The Conference Board, 2024). However, the expiration of those policies is likely to accelerate pre-pandemic supply-and-demand imbalances. Indeed, data indicate that access to child care continues to be an issue, particularly for families with children under age five (O'Dell & Smith, 2024).

Extensive research demonstrates that precarity and instability in care pose challenges to children's well-being, increasing the likelihood of emotional distress and decreasing prosocial behavior (Claessens & Chen, 2013; De Schipper et al., 2004; Morrissey, 2009; NICHD ECCRN, 1998). Moreover, these circumstances may impact the larger ecosystem. For example, lack of child care may affect parents' ability to work (an exosystem impact), and the lack of affordable quality care options (i.e., "child care deserts") may cause families to relocate, affecting community macrosystems in which children are being raised.



Environmental Conditions Brought on by the Changing Climate

The 1960s marked the beginning of a large-scale climate movement in the United States, with efforts to raise awareness about the effects of pollution and fossil fuels on personal and planetary health. In the ensuing decades, the changing climate and long-standing environmental hazards have exerted an increasing influence on child development and the stability and behaviors of, and stresses on, families. Climate change is most often experienced through heat, air quality, flooding, drought, and other conditions. These in turn impact every aspect of nurturing care, particularly health and nutrition, but also parents' ability to respond to their children, to provide safety and security, and to assure consistent early learning opportunities. At the same time, the impact of environmental toxins in the air, soil, and water is compounded by the changing climate.

Young children are particularly vulnerable to these environmental risks, and they experience negative consequences disproportionately compared to other demographic groups (Cuartas et al., 2024). Young children breathe twice as fast as adults, putting them at risk for respiratory illnesses from air pollution. They have higher metabolism and sweat less, exposing them to increased risk of extreme heat. Given that their immune systems are still developing, young children suffer a higher burden of disease trying to fend off infections that are increasing due to changing environmental conditions. According to the Environmental Protection Agency (USEPA, 2023; UNICEF, n.d.; WHO, 2024), climate impacts experienced by children can have lifelong consequences from impacts on learning, physical development, chronic disease, and other complications.

In addition to physical health impacts, climate change is also affecting children's mental health and psychological well-being. Specifically, studies have found increasing rates of climate-related anxiety among young children (Crandon et al., 2022). More generally, Burke et al. (2024) note risks for PTSD, depression, and sleep disorders arising from concerns about climate change.

For young children and families in America, these are not future issues; they are experiencing climate disruptions from wildfires to flooding at an increasing rate. Moreover, parents of young children are worried, impacting their stress and ability to care for their children. Recent data from our RAPID survey show that over half of the families reported that they had experienced at least one extreme weather event (See Figure 3 below). These included extreme heat and cold and drought. Moreover, the vast majority of parents (78 percent) reported that they were worried about the impact that climate and conditions around their home might have on their children (RAPID Survey, 2023).

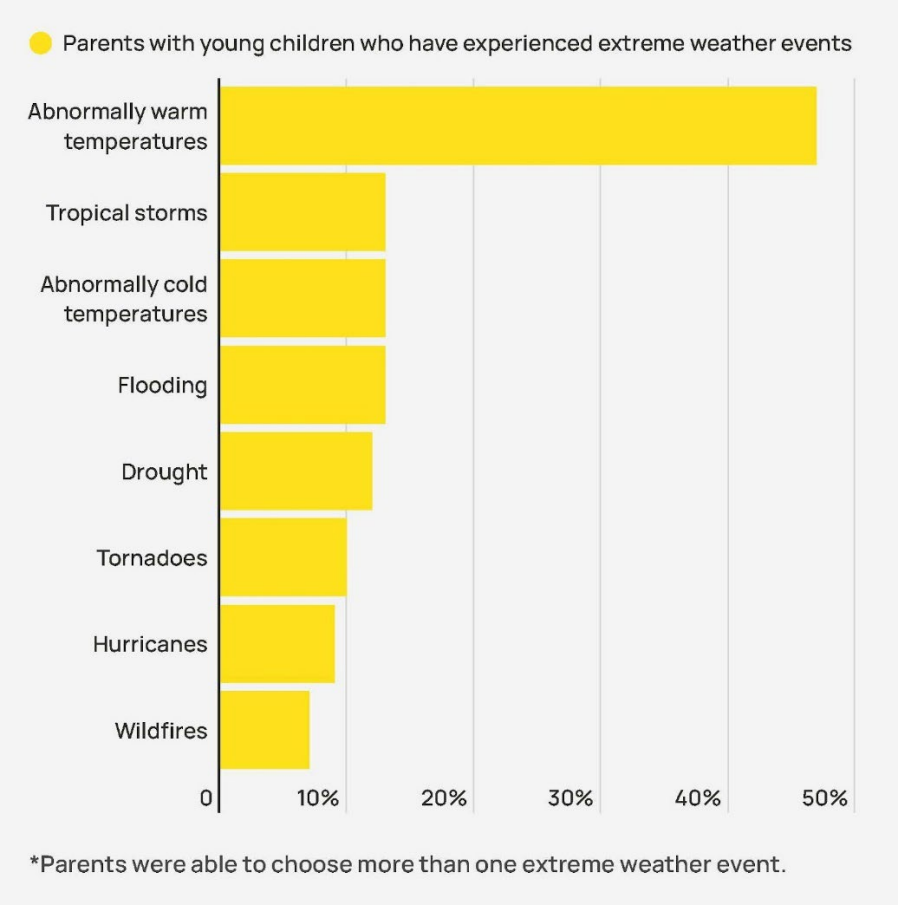


Figure 3. August 2024 RAPID national survey data from parents of children under age 6.

The summer of 2024, which produced the hottest days in recorded history, underscored these concerns. Families faced disruptions and growing tensions, child care programs were forced to limit outdoor play so essential to healthy development, and communities found themselves dealing with emergency conditions, such as the need to create cooling stations. States, cities,

and communities acknowledged the necessity of new plans to address these changing conditions which impact every level of a child's ecosystem.

The Rise of the Machines: Digital Technology and Early Childhood

Digital technology is an undeniably and increasingly powerful force in the lives of young children. Although recent advances in artificial intelligence and machine learning have increased attention to this topic, discourse about the impact of technology in early childhood—for better or worse—is not new. Battery-powered toys, dolls that speak and move, and other child-oriented mechanical and electronic devices have been around for decades. Since the 1960s and '70s, when children's public television programs like "Mister Rogers' Neighborhood" and "Sesame Street" launched, and millions of young children watched Saturday morning cartoons, there have been both voices of concern about the negative impacts of screen time and efforts to maximize the benefit that such technology might afford.

The relatively recent advent of personal computers, tablets, and smartphones, along with access to high-speed internet, has not only greatly increased young children's exposure to digital technology, it has fostered increasingly polarized opinions about the impacts that this technology has on them. In the context of what is likely to be ongoing divisive discourse on this topic, it is important to acknowledge that technology is likely here to stay, and therefore to separate evidence-based information about risks and benefits from arguments less well-grounded in facts.

Although the research on the impacts of digital technology on children is still emerging, there is clear evidence of the ubiquity of technology. A recent study by the Pew Research Center (see Figure 4 below) shows that for young children, television remains the most widely used form of technology; however, especially for children age three and older, other forms of technology are increasingly becoming commonplace. Below we discuss what research shows about the impacts of technology use on the ecology of early childhood.

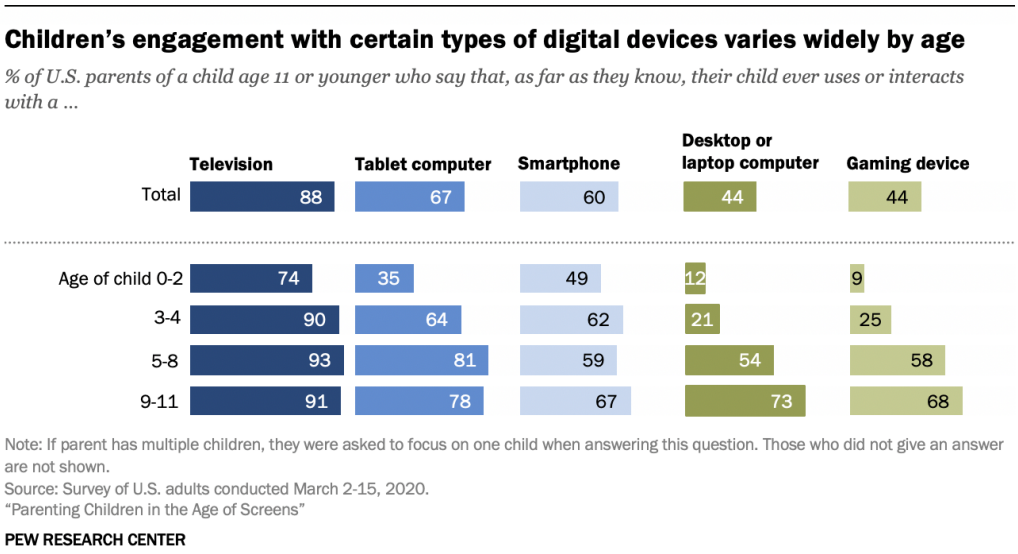


Figure 4. Pew Research Survey 2020 data on children and screens. Source: Pew Research Center, 2020.

We begin with what is known about *direct impacts of technology on children*. There is now fairly robust scientific evidence (Muppalla et al., 2023) that children who spend extensive amounts of time on computers and other electronic devices do face some risks—particularly for slower language and gross motor development, poorer social skills, and adiposity/obesity. Various interrelated factors explain these effects, including lack of physical activity as well as less verbal and social interaction.

At the same time, the potential exists for this technology to confer some benefits. Perhaps most evident is the use of technology for screening, detection, and treatment of childhood illnesses. In addition, for children who are isolated due to geography, illness, or other circumstances, online microsystems of friends and family may help to provide social connections. Relatedly, videoconferencing platforms allow for virtual classrooms, which (as we experienced during the pandemic) can somewhat mitigate disruptions in academic learning when in-person attendance is not possible. More recently, advances in artificial intelligence and machine learning are providing assistive technology that can provide more precise instruction to meet the needs of children with disabilities, support high-impact tutoring for children who are behind in academic progress, and expose children to supplemental, out-of-school learning experiences. The balance of risks and benefits to children suggests that rather than characterizing technology for young children as harmful or beneficial, it should be viewed as a neutral but significant influence, and proactive public health efforts should establish ways to optimize positives and minimize risks. Perhaps most important, more research is needed, especially focusing on impacts of digital technology exposure on infants and toddlers, so that proactive evidence-based guidance and policies can be put in place to limit potentially harmful impacts.

In addition to the direct effects of technology on young children, *technology use by adults may confer additional, indirect effects*. For example, a well-researched area involves documenting how distraction arising from adult screen time can impact parenting and other adult-child interactions, which are particularly important in early childhood. One recent review of studies in this area (McDaniel, 2019) reported several noteworthy findings. First and not surprisingly, the amount of time parents and other adults spend on electronic devices is on the rise. Second, negative impacts of adult distraction arising from screen time have been observed, including decreased parenting awareness and sensitivity, fewer verbal and nonverbal interactions with children, less coordinated parenting and coparenting, dissatisfaction with time spent together, and negative child reactions (e.g., problem behaviors). This study importantly identified mechanisms by which these negative impacts may occur, including (1) difficulty switching attention between device and child, leading to diminished adult responsiveness and sensitivity, and (2) negative emotions arising from social media use and other online experiences.

It is important to point out that, as with direct effects of technology on children, there are potential benefits. For example, some online games and educational technology can be used to promote positive adult-child interactions, help parents to be more responsive, and provide professional development and coaching to the early childhood workforce. Videoconferencing can facilitate extended family relationships. And, in families whose financial circumstances or work schedules don't allow for any alternative, screen time may allow a parent to keep a child occupied while they are engaged in other essential activities (e.g., working, household chores, etc).

A final issue with respect to digital technology is what has been referred to as the digital divide. To the extent research is able to identify how prescribed use of digital technology in both home and early care and education settings may confer salutary effects in areas such as early literacy and numeracy, access to such assistive technology is unequal across different demographic groups—especially based on income and geography (urban vs. rural). This is true not only of hardware (tablets, computers) but also access to high-speed internet. Ongoing efforts to bridge this divide are necessary to reduce opportunity gaps for young children.

A Common Mechanism Underlying Impacts on Young Children in the New Ecology: Increasing Unpredictability and Uncertainty

It is difficult to specify a single unifying theme or set of themes that fully encompasses the scope of changes in young children's ecosystems in recent decades. However, there are some common features of the specific early childhood ecologies we have identified above. The most salient of these is a substantial increase in the lived experience of unpredictability. Events like global pandemics, geopolitical conflicts, extreme climate events, and even mass shootings (with their concomitant mass media coverage) serve as disruptors to children's development. They do so by impacting within and across every level of children's ecosystems. To illustrate this, we return to our example.

If the child in our example was born just before the pandemic, it is likely that the onset of the pandemic resulted in major changes in her microsystems, including the high probability that she would have spent time exclusively with her family, and been disconnected from her other microsystems, during periods of shelter-in-place directives. This would have produced mesosystem effects in terms of the connections between these settings. Her mother's work and school would also probably have been impacted, thereby affecting household schedules at a minimum (a macrosystem impact). And the child's connection to culture via her local community may have been challenging to maintain for periods of time (an exosystem impact). It is also possible to imagine many reciprocal impacts in this context as well—for example, weakening of the bonds among members of the community due to lack of participation in activities or alterations in the mesosystem of home-child care relationships as families kept their children at home and child care providers were forced to close their businesses.

It is also apparent that for young children, many aspects of the external chronosystems in which they live day to day are accelerating. For example, climate events are occurring more frequently and with greater intensity, and the impact of these events on early childhood development will grow concomitantly. Technology continues to move at a faster pace than many can keep up with. These issues pose threats to the continuity of services as children move from infancy to toddlerhood to preschool and beyond.

There is an extensive (and growing) scientific knowledge base examining the growing prevalence of unpredictability and uncertainty (Cooper & Pugh, 2020) in our daily lives. This research has documented that chronic unpredictability has lasting impacts on development (Xu et al., 2023; Smith & Pollak, 2022; Liu & Fisher, 2022), including alterations in trajectories of learning, difficulties forming prosocial relationships, lower academic achievement, and risk for psychological disorders. Moreover, these impacts can also be observed at a biological level in terms of such indicators as alterations in brain structure (Wang et al., 2024) and function (Davis et al., 2017), in areas associated with self-control and threat detection, gene expression (Short et al., 2024), and both elevated and diminished levels of the stress hormone cortisol (Noroña-Zhou et al., 2020).

In decades past, developmental psychology researchers often turned to subgroups who had experienced extremely dire early environments (children reared in institutional care, abused and neglected children who ended up in foster care) to understand how adverse experiences impact the early years of life. In recent years, the focus of this work has broadened to examine how more common experiences, such as low income, might produce similar, if less significant, adaptations and alterations in development. One of the primary conclusions emerging from this work is that a common thread of experience across these different contexts is that of chronic and extreme unpredictability.

It is important to note that unpredictability in the short term is by no means deleterious, just as not all stress is toxic to children. In fact, healthy development is promoted by some degree of

uncertainty in the day-to-day lives of young children. The challenges to development occur when the unpredictability is prolonged and more acute such that it limits a child's ability to learn from their environment. There is no clear threshold for this, because of the infinite variability of individuals. But it is undoubtedly possible to identify levels of unpredictability that lead to challenges in the majority of children.

Recommendations for Supporting Children and Families in the New Ecology of Early Childhood

We have discussed four contemporary realities facing young children and their caregivers and considered their potential impact through the lens of Ecological Systems Theory. There are no simple answers to addressing the fast-changing, interrelated, and complex nature of contemporary society on its youngest children. This is particularly true when seen within a set of values and a cultural context that are both changing and heterogenous and may be particularly sensitive given that these issues involve our most intimate and important resource: our children.

Below we outline five recommendations for both public and private action: (1) Elevate parent and provider voices to raise public awareness; (2) promote new programming; (3) invest in communities; (4) establish family support policies; and (5) accelerate innovation and research. We acknowledge that, just like the ecology of early childhood itself, each of these recommendations is complex, rather than discrete to each condition, and highly intersectional. Yet, we believe that a crosscutting approach is needed to address inequalities and expand quality child care as well as to respond to the changing climate and the influence of technology. In this way these recommendations mirror the interactive nature of Bronfenbrenner's theories; they represent a start, a way to launch a dialogue about the contemporary realities of early childhood today and what must be done to assure healthy child development and strong families. As with our prior invitation for others to identify additional domains in which the ecology of early childhood is changing, we encourage additional ideas regarding recommendations for supporting children and families.

Recommendation 1. Elevate Parent and Provider Voices to Raise Awareness.

Public awareness and understanding of these contemporary conditions and their impact are still nascent. While all of the conditions outlined have made their way from some research journals and opinion leaders into popular headlines, this process seems to be only at the early stages, with still much more to be understood. We need to document—through rapid cycle research, parent and teacher voices, and storytelling—the realities of everyday life and what families are doing to cope with current demands, lack of services and support, the changing environment, and growth of digital technology. At the same time, better formal data collection is needed to quantify the impact and implementation to better understand what is working for whom. New ways of communicating these conditions must be tailored to spread hope that solutions can be found and that families and other adults in the lives of young children have a sense of agency and self-determination in their ability to make change.

Recommendation 2. Promote New Multigenerational Programming.

Given the persistent importance of breaking the cycle of intergenerational poverty and inequality, we have to find new policies, programs, and practices that link quality early childhood care and education with health, mental health, and economic sufficiency and stability for families with young children. We also need to identify and eliminate structural and systemic inequities. This does not mean that a single program must do it all, but rather we have to be intentional in our programming so that we bundle and connect services for a family and assure continuity for children. In other words, we need to build a true system of care. We also have to think broadly, connecting the need to improve early childhood ecosystems with efforts to infuse issues of environmental sustainability in education and the need to support parents in finding greener and cleaner jobs for the future. Emerging technology and more coordinated and interoperable data systems can help promote, track, and support such initiatives.

Recommendation 3. Create Community Connections and Infrastructure.

Reducing the isolation of families today needs to be prioritized. Social networks of support and infrastructure are needed to promote holistic child development and family support. Despite political division, it is at the community level that dialogue has the greatest potential to succeed. All across the country, structures are emerging that are bringing the various sectors across health, education, and family support together. This is happening through a combination of civic participation, public agency coordination, and private sector engagement. Such efforts often begin with concerned leadership and community members creating a "north star" or goal to make the community a good place "to raise a child." This may start from concern for economic development, child care needs, the rising threat of climate change, or other local issues. This often leads to mapping assets, thinking through challenges, and creating new ideas for raising and maximizing resources. Such actions build a sense of community and the type of connections that are too often lost in contemporary life. These efforts also support the creation of state and national policies that are built from the bottom up, centering local voices and supporting the development of needed infrastructure.

Recommendation 4. Develop Policies that Invest and Support Child and Caregiver Well-being.

The United States lags behind other nations in assuring that policies and programs respond to the current realities of young children and families (UNICEF, 2023). Yet the changing conditions outlined above demand that we provide a range of supports: from giving families the opportunity to spend time with a newborn through paid leave to providing sufficient resources to meet basic needs through a Child Tax Credit; from providing comprehensive child care supports that build supply, increase caregiver wages and working conditions, and provide quality options for families, to assuring the civil rights of all children, including those with disabilities. But policy change is needed beyond these traditional family policy issues. Mitigation strategies should be accelerated to prevent further climate change, address historic environmental damage, and provide support for communities to create plans for emergencies and green communities that include education and center children. To address climate change, we must emphasize the many ways it is a child and family issue. Moreover, given the increasing

presence of technology in the lives of children, new policies are needed to support parents and teachers of young children to better understand, appropriately use, respond to, and monitor technology.

Recommendation 5. Accelerate Innovation and Research

With everything changing so fast, we need to constantly find novel ways to address these issues. We need innovative and consistent approaches to address racial and economic disparities, support child care providers, mitigate and adapt to climate change, and understand the best use of technology with parents, teachers, and young children (and when it should not be used). Federal funding during the COVID crisis helped states and communities innovate in many of these areas, yet funds often evaporated when the worst of the crisis was over. Federal, state, and local public and private funds must be invested in a new era of innovation to address each of the conditions facing young children and families. Networks of researchers working together on such innovations should be supported to share lessons, including where things are not working, without fear that their work will be dismissed as failing. Much more attention must be paid to translating research findings into policy and getting it into the hands of parents and caregivers, rather than leaving critical insights on the shelves of academia.

Conclusion

We conclude with a sense of urgency for the country and the world to address these and other conditions facing young children. Our collective experiences represent decades of work across research, policy, and practice in child development and family support. We know so much more now about the profound impact of early experiences on family well-being and later life success. While Dr. Bronfenbrenner and his colleagues knew this back in the 1960s and early ’70s, scientific advances since have reinforced the wisdom of their work. Yet unfortunately policies and practices are not keeping up with these changes. Moreover, current divisions in our values and the context of American life have created more stress and stood in the way of change. However, we believe if we collectively focus on our young children, we can find more that unites us than divides us, particularly if we bring a New Ecology of Early Childhood focus to inform state and federal action. Now is the time to try something new, to respond to change, and to prioritize our understanding and response to the conditions facing the young children and families of the United States.

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