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Children Growing Up Digital: Applying Bronfenbrenner's Ecological Systems Theory to Technology and Play

Jennifer Sullivan

Northern Arizona University

Jennifer Sullivan has a B.S. Early Childhood Education, M.Ed. Educational Leadership, Ph.D. Candidate in Curriculum and Instruction, and Graduate Certificate in Educational Technology. She has worked in the field of early childhood education for over thirty years, serving as a director of early childhood programs for more than twenty years and teaching graduate courses at Northern Arizona University for two years. Her research and publication interests include early childhood leadership, social-emotional learning, mobile learning technologies, and learner experience design. Grounded in Bronfenbrenner's bioecological systems theory, her work examines how digital environments can support inclusive and developmentally responsive learning.

Abstract

This paper investigates the impact of digital technology on childhood development through the lens of Bronfenbrenner's ecological systems theory and his later bioecological model. As children grow up immersed in digital environments—from smart toys to online learning platforms—their experiences of play, learning, and relationships are increasingly shaped by technology. The article examines how each layer of Bronfenbrenner's model (microsystem to chronosystem) is influenced by digital integration, highlighting both the benefits and risks of "technologized" childhoods. While technology offers opportunities for creativity, collaboration, and inclusion, it also poses challenges to traditional play, social-emotional development, and cultural diversity. The paper advocates for a balanced approach that preserves essential elements of unstructured, sensory-rich play while embracing the educational and developmental potential of digital tools.

Keywords: play, technology, systems theory

Introduction

In 1962, an outlandish and far-reaching cartoon called *The Jetsons* first debuted. It had flying cars, talking houses, and a robot housekeeper. At the time, this kind of technology was only a dream of science fiction with no basis in reality. However, the modern world is fully integrated with technology that rivals and even surpasses that which was displayed on *The Jetsons*. There is

not an aspect of modern-day life that does not involve some form of technology. However, the conveniences of technology may be coming with a steep price for one of our most vulnerable populations – children.

Children's lives are saturated with connectivity, from tablets at school to smart toys at home. The immersion of technology has changed how they learn, play, and build relationships. To better understand how technology affects children's growth and development, this paper uses Bronfenbrenner's ecological systems theory (Bronfenbrenner, 1979) and his later bioecological model of development (Bronfenbrenner & Morris, 2006). His models explain how children grow and develop within connected systems. This process begins at home and evolves when children reach school; it also expands to include social and cultural influences. This paper explores the impact of technology on children's relationships, play, and learning across all levels of development within a whole-child perspective.

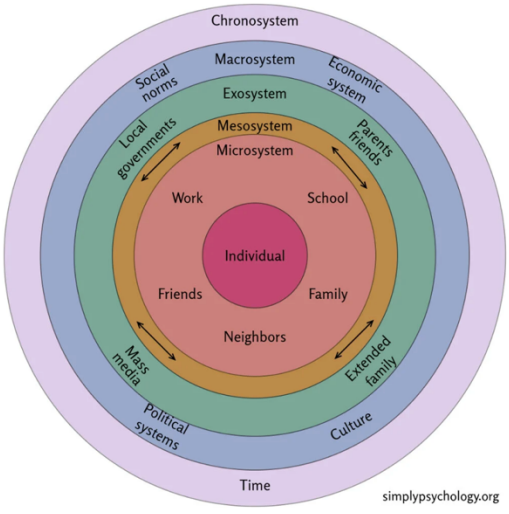
Bronfenbrenner's Ecological Systems Theory and Technology

Bronfenbrenner's ecological systems theory (see **Figure 1**) can provide a framework for understanding how technology influences a child's development. First introduced in *The Ecology of Human Development* (1979), Bronfenbrenner's model places children within interconnected systems, including: microsystem (child's immediate surroundings), mesosystem (connections between child's various microsystems), exosystem (indirect influences on the child), macrosystem (cultural contexts), and chronosystem (time and life transitions).

Bronfenbrenner's later expanded theory, called the Process–Person–Context–Time (PPCT) model (Bronfenbrenner & Morris, 2006), provides a deeper understanding of ways people evolve and mature over time. The model explains that development happens through back-and-forth interactions between a person and their environment—like talking, playing, or learning from others. These everyday interactions, called proximal processes, are what drive growth and learning.

Figure 1

Bronfenbrenner's Ecological Systems Theory



How a person develops also depends on who they are—their personality, motivation, and abilities, and on the contexts in which they live, such as family, school, community, and culture. The model also includes time, recognizing that both people and their environments change. Time encompasses both short-term experiences and long-term changes.

Building on this theory, Navarro and Trudge (2022) suggest the "technosphere," which integrates technology across all levels of children's environments. Likewise, Johnson and Puplampu (2008) describe a "techno-subsystem," explaining that "this subsystem mediates children's proximal processes with

parents, peers, and teachers through the use of ICT [Information and Communication Technology]" (p. 10). In simple terms, this means technology shapes how children communicate, play, and learn from the people closest to them. These ideas show that technology has become an inseparable part of children's everyday life, shaping how they learn, play, and think about the world.

Applying the Ecological Systems Theory to Children's Digital Environments

Referencing the model, the microsystem level is the most intimate relationship influencing a child. Technology has replaced some of those influences and has become a more substantial part of their daily routines. Livingstone and Blum-Ross (2020) note, "digital media have become interwoven with family life in ways that make them difficult to separate from broader parenting practices" (p. 3). For example, children may have screen time before bed instead of a parent reading a book. At the mesosystem level, schools and families can stay connected through digital platforms like Google Classroom or ClassDojo.

Parents' use of technology can indirectly affect children at the exosystem level. When families choose social media or scroll on their phones instead of playing with their children, they are less responsive and may disrupt family bonds. This situation is called "technoference." McDaniel and Radesky (2018) found that "parental problematic digital technology use predicted greater technoference in mother–child and father–child interactions." In Bronfenbrenner's model, this shows how factors outside of a child's direct control, like parents' work demands or media habits, can still shape what happens in their closest relationships and daily learning experiences.

The macrosystem level represents societal beliefs about children and technology. Many adults today describe kids as "digital natives," meaning they believe children are naturally good with technology because they have grown up surrounded by it (Prensky, 2001). This idea has become a familiar narrative; however, that is not always the case. Parents and educators still need to ensure that children understand basic skills like online safety and digital literacy. In Bronfenbrenner's framework, these societal beliefs directly influence how technology is integrated into children's everyday lives.

The chronosystem examines significant changes in society, such as the digital revolution. Bronfenbrenner and Morris (2006) suggest "the chronosystem encompasses change or consistency over time, not only in the characteristics of the person but also of the environment in which that person is living" (p. 820). The chronosystem draws attention to the influence of time and change on a child's growth. Young children today have never known a life without smartphones and constant internet access. These devices have a direct impact on how they interact with others and build relationships. Children now develop many of their communication skills, such as language and emotional expression, through digital tools, often blurring the lines between online and real-world experiences. As Navarro and Tudge (2022) explain, "technology has become an integral part of the ecology of human development, influencing processes at every level of the system" (p. 19339).

The Technologisation of Childhood

In modern society, technology is not just a tool we use but an essential part of our daily lives. This is known as the "technologisation of childhood," where digital devices shape children's experiences of learning, play, and socialization (Plowman, McPake, & Stephen, 2010). From smart speakers in our homes to tablets at schools, technology is integrated into childhood in ways that were unimaginable just twenty years ago. The normalization of technology becomes especially clear when it suddenly disappears. For example, when technology is turned off, children's reactions often reveal how dependent their social routines have become on connectivity.

This growing reliance on technology reminds us that children's environments should remain balanced across the different layers of influence described by Bronfenbrenner. Each system—from family and school to the broader community—plays a role in shaping how children learn and grow, both online and offline. Within the microsystem, children need regular opportunities for hands-on, sensory experiences, such as reading books, engaging in sensory play, and exploring outdoor spaces, which spark curiosity and support physical, cognitive, and emotional development. As Burdette and Whitaker (2005) emphasize, "time for free play may be an important, but often overlooked, part of optimizing children's social-emotional health" (p. 47).

At the ecosystem level, communities play a role in maintaining spaces for unstructured play, such as parks, libraries, and nature centers that encourage social connection and creativity beyond screens. Children can run and use their imagination without being hindered by technology. Within the mesosystem, partnerships between families and early childhood programs can balance non-digital forms of play and exploration with the integration of technology. The macrosystem creates the structures for cultural and societal views of technology and the importance of play. Often, technological readiness is valued more than unstructured play.

Finally, the chronosystem reminds us that these dynamics are evolving; the normalization of digital childhood represents a recent historical shift. This perspective shows that as technology continues to evolve, it also changes the way children grow up and interact with the world.

Although children are growing up in a tech-filled world, they still need a balance between technology and play. They need technology-free spaces to explore and connect with the people and world around them. They need outdoor space to run and play, explore nature, and have hands-on sensory experiences.

The Evolution of Play: From Tradition to Technology

Historically, children's play has evolved due to changing resources and cultural values. Power (2000) suggests that "play appears to be a universal feature of childhood, found in all cultures and evident throughout recorded history" (p. 5). In Native American cultures, games were used to prepare children for adult roles, such as practicing survival skills. Roberts and Sutton-Smith (1962) note that "games served as a training ground for both the skills and values required by the culture" (p. 167). During agrarian eras, play was connected with work. Children turned chores into games, combining imagination with necessity. With industrialization, manufactured toys emerged, shifting play toward a more consumer-driven focus. By the mid-20th century, play

became a ritualized form of independence. Children roamed their neighborhoods freely, playing outside "from sun-up to sun-down" and returning only when streetlights came on. This type of unstructured play encouraged resilience, social skills, and creativity.

Currently, much of children's play has shifted indoors and online. From video games to streaming media, technology provides new ways for children to connect and engage, yet it also limits their opportunities for physical fitness, imaginative play, and social experiences. As Frost (2010) cautions, "commercialized play environments threaten to replace children's self-directed play with adult-directed experiences" (p. 84). Within Bronfenbrenner's ecological framework, this shift represents a disruption to the microsystem. When digital media begins to mediate these relationships, children's development becomes shaped more by technological and commercial influences than by genuine human interaction. Over time, the mesosystem and exosystem—the links between home, school, and community—are also affected, as technology reduces opportunities for outdoor exploration, collaborative play, and creative engagement with the natural world.

Gains of Technology for Early Childhood Development

The benefits of technology in childhood are evident. The internet enables access to an infinite amount of knowledge, such as interactive field trips to the other side of the world and connections with students from different cultures. Online games like Minecraft can promote collaboration, problem-solving, and creativity. As Gray (2011) states, "Even video game play can provide children with opportunities to practice problem solving, persistence, and collaboration" (p. 448).

Technology also prepares children for a rapidly evolving workforce. Voogt and Roblin (2012) emphasize that "information literacy, media literacy and ICT literacy are considered essential skills for living and working in the 21st century" (p. 305). Digital fluency is now seen as essential. Some scholars point out that "digital technologies afford ample opportunities for children's development, identity formation, imagination, and sociability through free play" (Livingstone & Pothong, 2022), suggesting digital play can still support autonomy and imaginative play in new forms.

Technology is preparing children for the fast-changing world in which they will grow and develop. Children are expected to know how to use technology to find information, think critically, and do basic coding (Voogt & Roblin, 2012). For example, platforms like Minecraft and Roblox let children build their own virtual worlds, work with friends, and solve problems together —activities that are very similar to traditional play (Dezuanni, 2020; Donoughue & Mesoudi, 2023).

In Bronfenbrenner's model, this type of play demonstrates how technology now shapes everyday interactions where learning occurs. So, even though play looks different today, it still helps children grow through imagination, cooperation, and self-expression. Additionally, technology can help promote inclusion. With the support of assistive devices, children with disabilities can participate more fully in both learning and play. Alper and Goggin (2017) emphasize that "for many children with disabilities, digital media provide new opportunities for expression, connection, and participation" (p. 728).

Sacrifices and Risks

At the same time, the costs can be considerable. The decline in unstructured outdoor play has increased childhood obesity. Burdette and Whitaker (2005) suggest, “play that involves free outdoor activity is essential not only for physical health but also for social and emotional development” (p. 47).

Social skills are at risk as well. Screens now mediate conflict resolution and face-to-face collaboration. Turkle (2015) warns that “we expect more from technology and less from each other” (p. 11), pointing out how dependence on devices diminishes empathy and relational depth.

Imaginative play, which is key to many developmental domains — including cognitive, language and communication, and social and emotional —is declining because children have constant entertainment and stimulation from digital devices. As Lester and Russell (2008) explain, “boredom creates space for imaginative play to emerge” (p. 33). Children have fewer moments to daydream, invent games, or use their imagination.

Culturally, digital play risks homogenizing children’s experiences across the globe. As Frost (2010) points out, the commercialization of play “narrows the scope of children’s cultural imagination” (p. 112). In the past, children’s games were often based on their local traditions, helping them feel connected to their communities. Today, however, digital play is mainly created by large global companies that design the same games and toys for kids everywhere. These toys are enjoyed worldwide, but they often do not differentiate between cultures and limit self-expression and imagination. Frost (2010) points out, “commercialized play environments threaten to replace children’s self-directed play with adult-directed experiences” (p. 84).

Balancing Technology and Play: A Bronfenbrenner Perspective

The goal with technology should be to find a balance within the ecological systems of childhood. At the microsystem level, families can create tech-free routines, such as mealtimes or bedtime. At the mesosystem level, teachers can use technology time to incorporate physical activity through interactive lessons. At the macrosystem level, society should advocate for play over technology. Bronfenbrenner (1979) reminds us that development thrives when children experience diverse contexts. Technology can enhance childhood, but it cannot replace the unstructured and imaginative play that has shaped human growth and development throughout history. The challenge is not to reject technology but to ensure that, in embracing it, we do not lose the relationships within the ecological system. Technology is only one of many systems, and children needs a balance among all of them.

References

Alper, M., & Goggin, G. (2017). Digital technology and rights in the lives of children With disabilities. *New Media & Society, 19*(5), 726–740. https://doi.org/10.1177/1461444816686323

Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design.* Harvard University Press.

Bronfenbrenner, U., & Morris, P. A. (2006). The bioecological model of human development. In W. Damon & R. M. Lerner (Eds.), *Handbook of child psychology* (6th ed., Vol. 1, pp. 793–828). John Wiley & Sons.

Burdette, H. L., & Whitaker, R. C. (2005). Resurrecting free play in young children: Looking beyond fitness and fatness to attention, affiliation, and affect. *Archives of Pediatrics & Adolescent Medicine, 159*(1), 46–50. https://doi.org/10.1001/archpedi.159.1.46

Dezuanni, M. (2020). *Minecraft and education: An exploration of possibilities.* Springer.

Donoughue, T., & Mesoudi, A. (2023). Collaborative creativity in Minecraft: Children's social learning through cooperative digital play. *Computers in Human Behavior, 139*, 107523. https://doi.org/10.1016/j.chb.2022.107523

Frost, J. L. (2010). *A history of children's play and play environments: Toward a contemporary child-saving movement.* Routledge.

Gray, P. (2011). The decline of play and the rise of psychopathology in children and adolescents. *American Journal of Play, 3*(4), 443–463. https://files.eric.ed.gov/fulltext/EJ985541.pdf

Johnson, G. M., & Puplampu, K. P. (2008). Internet use during childhood and the ecological techno-subsystem. *Canadian Journal of Learning and Technology, 34*(1), 9–24. https://doi.org/10.21432/T2859X

Lester, S., & Russell, W. (2008). *Play for a change: Play, policy and practice: A review of contemporary perspectives.* Play England. https://doi.org/10.13140/RG.2.1.1452.9687

Livingstone, S., & Blum-Ross, A. (2020). *Parenting for a digital future: How hopes and fears about technology shape children's lives.* Oxford University Press.

Livingstone, S., & Pothong, K. (2022). Imaginative play in digital environments: Affordances for identity, creativity and connection. *Journal of Children and Media, 16*(2), 243–259. https://doi.org/10.1080/17482798.2022.2034785

McDaniel, B. T., & Radesky, J. S. (2018). Technoference: Parent distraction with technology and associations with child behavior problems. *Child Development, 89*(1), 100–109. https://doi.org/10.1111/cdev.12822

Navarro, J. L., & Tudge, J. (2022). Technologizing Bronfenbrenner: Neo-ecological theory. *Current Psychology, 42*(31), 19338–19354. https://doi.org/10.1007/s12144-022-02738-3

Plowman, L., McPake, J., & Stephen, C. (2010). The technologisation of childhood? Young children and technology in the home. *Children & Society, 24*(1), 63–74. https://doi.org/10.1111/j.1099-0860.2008.00180.x

Power, T. G. (2000). *Play and exploration in children and animals.* Lawrence Erlbaum Associates.

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon, 9*(5), 1–6. https://doi.org/10.1108/10748120110424816

Roberts, J. M., & Sutton-Smith, B. (1962). Child training and game involvement. *Ethnology, 1*(2), 166–185. https://doi.org/10.2307/3772916

Turkle, S. (2015). *Reclaiming conversation: The power of talk in a digital age.* Penguin Press.

Voogt, J., & Roblin, N. P. (2012). A comparative analysis of international frameworks for 21st century competences: Implications for national curriculum policies. *Journal of Curriculum Studies, 44*(3), 299–321. https://doi.org/10.1080/00220272.2012.668938