

Internet use during childhood and the ecological techno-subsystem

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Abstract: Research findings suggest both positive and negative developmental consequences of Internet use during childhood (e.g., playing video games have been associated with enhanced visual skills as well as increased aggression). Several studies have concluded that environmental factors mediate the developmental impact of childhood online behaviour. From an ecological perspective, we propose the techno-subsystem, a dimension of the microsystem (i.e., immediate environments). The techno-subsystem includes child interaction with both living (e.g., peers) and nonliving (e.g., hardware) elements of communication, information, and recreation technologies in direct environments. By emphasizing the role of technology in child development, the ecological techno-subsystem encourages holistic exploration of the developmental consequences of Internet use (and future technological advances) during childhood.

L'usage d'Internet chez les enfants et le sous-système Techno écologique

Résumé : Les résultats de recherche semblent indiquer que l'usage d'Internet chez les enfants aurait des conséquences développementales qui soit à la fois positives et négatives (ex. : l'usage des jeux vidéo auraient été associés à un accroissement des habileté visuelles ainsi qu'à un accroissement de l'agressivité). Plusieurs études ont aussi conclue que l'impact du comportement des enfants quand il sont en ligne sur leur développement serait affecté par des facteurs environnementaux. Dans une perspective écologique, nous proposons le sous-système Techno, une dimension du microsystème (ex :. les environnements immédiats). Le sous-système Techno comprend l'interaction de l'enfant avec des éléments vivants (e. : les paires) et non vivants (ex; les ordinateurs) de communication, d'information et de technologie de jeux dans des environnements directes.

Introduction

All societies focus on nurturing the up-coming generation. On the one hand, children must be protected from potential sources of harm; on the other hand, children must experience all aspects of the culture in order to, eventually, fully participate in that culture. Increasingly complex social, economic, and technical forces create public anxiety,

particularly in relation to children and youth. For example, in the 19th century, “the telegraph enabled a young woman, against her father’s wishes, to maintain a flirtation with a number of men on the wire” (Quigley & Blashki, 2003, p. 311).

Currently, school age children are online an average of 16.7 hours per week—more time than they spend watching television (Abelman, 2007). A national research project, *Young Canadians in a Wired World*, reported that 94% of school children access the Internet from home (Media Awareness Network, 2006). There is public concern that excessive and unsupervised use of the Internet may harm children, for example, by exposure to sexual predators (Canada Safety Council, 2007). And yet, there is increasing evidence that Internet use actually facilitates certain aspects of development during childhood (Greenfield & Yan, 2006).

Internet Use and Child Development

Internet use during childhood is meaningfully organized in terms of common online activities such as playing games, communicating, and visiting websites (Johnson, 2006). Child development refers to the processes by which children becoming increasingly capable of complex social (e.g., friendship), emotional (e.g., anxiety), and cognitive (e.g., problem solving) behaviour. Jackson et al. (2006) provided low income children with home-based Internet access and continuously recorded time online. “Findings indicated that children who used the Internet more had higher scores on standardized tests of reading achievement and higher grade point averages 6 months, 1 year, and 16 months later than did children who used the Internet less” (p. 429). Alternatively, Sanders, Field, Diego, and Kaplan (2000) surveyed adolescents and correlated behavioural and psychological aspects of adolescent life with response to the item, how many hours per day you spend on the Internet? Reportedly, those who used the Internet the most had the weakest interpersonal connections.

Approximately one-third of the time that children are online, they report playing games (Livingston & Bober, 2005; Media Awareness Network, 2006; Roberts, Foehr, & Rideout, 2004). Van Deventer and White (2002) observed highly proficient 10- and 11-year-old video gamers and noted extremely high levels of self-monitoring, pattern recognition, and visual memory. DeBell and Chapman (2006) concluded that Internet use promotes cognitive development in children, “specifically in the area of visual intelligence, where certain computer activities—particularly games—may enhance the ability to monitor several visual stimuli at once, to read diagrams, recognize icons, and visualize spatial relationships” (p. 3). In a comprehensive review of the literature, Subrahmanyam, Kraut, Greenfield, and Gross (2000) concluded that “children who play computer games can improve their visual intelligence” (p. 128).

While playing online games appears to stimulate aspects of cognitive development, research also establishes a link to distractibility, over-arousal, hostility, and aggression. Based on naturalistic observation in a daycare setting, Bacigalupa (2005) concluded that when children played video games, “their interactions with others were disjointed, rushed,

and ineffective" (p. 25). Focus group interviews with children revealed the perception of over-arousal and loss of awareness of surroundings during video game playing (Funk, Chan, Brouwer, & Curtiss, 2006). Funk, Buchman, Jenks, and Bechtoldt (2003) compared aggression and empathy in children who played a violent or non-violent video game for 60 minutes. Exposure to the violent video game was associated with desensitization as reflected in lower empathy scores. Anderson, Gentile, and Buckley (2007) concluded that "no matter how many risk and protective factors the child already has, playing violent video games still adds additional risk for future increased aggressive behaviour" (p. 141).

About one-third of the time that children are online, they are using communication tools such as email, chat, and instant message (Livingston & Bober, 2005; Media Awareness Network, 2006; Roberts et al., 2005). Valkenburg and Peters (2007) surveyed children and adolescents and reported that "socially anxious respondents communicated online less than did nonsocially anxious respondents" (p. 267). Coniam and Wong (2004) compared adolescent second language learning with and without real-time text-based practice (i.e., online chat). Qualitative analysis revealed that adolescents, who communicated online, compared to those who did not, used more complex sentences or sentencing involving auxiliaries beyond expected grammar levels. Based on interviews with girls and analysis of chat room archives, Merchant (2001) concluded that female adolescent "use of popular electronic communication is resulting in linguistic innovation within new, virtual social networks in a way that reflects more wide-reaching changes in the communication landscape" (p. 293).

Children report visiting websites approximately one-third of the time that they are online, (Livingston & Bober, 2005; Media Awareness Network, 2006; Roberts et al., 2005). While primary research on the developmental consequences of visiting websites is not readily available, professional opinion suggests cognitive and learning benefits. For example, librarians refer to the Internet as a "lifeline for children" and note that "the Web keeps getting bigger and better for youngsters, with more helpful and enjoyable sites popping up every day" (McDermott, 2000, p. 36). From a cognitive-developmental perspective, websites contain text and images that require interpretation (Johnson, 2006). Visiting websites makes cognitive demands beyond those associated with simply decoding text. Cognitive processes such as planning, search strategies, and evaluation of information are exercised when accessing websites (Tarpley, 2001).

Several studies have concluded that context (i.e., home, school, and community characteristics) mediates the developmental impact of Internet use during childhood. For example, Cho and Cheon (2005) surveyed families and found that parents' perceived control, obtained through shared web activities and family cohesion, reduced children's exposure to negative Internet content. Following detailed interviews and repeated observation of six children (three boys and three girls in sixth grade), Burnett and Wilkinson (2005) concluded that creative problem solving was evident in home-based, but not necessarily school-based, use of the Internet. Lee and Kuo (2002) surveyed adolescents and reported that Internet use displaced television viewing but not socializing

with friends. The paths of influence between Internet use and child development appear complex and mediated by ecological forces; a theoretical framework is required.

Ecological Systems Theory and the Techno-Subsystem

Ecological systems theory provides a comprehensive framework of environmental influences on development by situating the child within a system of relationships affected by multiple levels of the surrounding environment. Bronfenbrenner (1989) organized the contexts of child development into five nested environmental systems, with bi-directional influences within and between systems. The microsystem refers to immediate environments and includes, most notably during middle childhood, home and school interactions. The mesosystem is comprised of connections between immediate environments (e.g., parent-teacher interactions). The exosystem includes environmental settings that indirectly affect the developing child (e.g., the parent's workplace). The macrosystem reflects overarching social ideologies and cultural values (e.g., the rights of children). The chronosystem highlights the effect of time (e.g., life transitions) on all systems and all developmental processes. Bronfenbrenner (2005) recently refined theoretical focus to the bioecology, that is, the child's own biology is conceptualized as a dimension of the microsystem. Ecological systems theory provides "a unified but highly differentiated conceptual scheme for describing and interrelating structures and processes in both the immediate and more remote environment as it shapes the course of human development" (Bronfenbrenner, 1979, p. 11).

From an ecological perspective, "development is defined as the person's evolving conception of the ecological environment, and his [her] relation to it, as well as the person's growing capacity to discover, sustain, or alter its properties" (Bronfenbrenner, 1979, p. 9). Influenced by a socio-cultural orientation to child development, ecological systems theory presupposes that "through participation in activities that require cognitive and communicative functions, children are drawn into the use of these functions in ways that nurture and scaffold them" (Vygotsky, 1986, pp. 6-7). Because humans are characterized by increasingly complex creation/use of increasingly complex tools (Maynard, Subrahmanyam, & Greenfield, 2005), theoretical models of child development require conceptual attention to contemporary tools, particularly those used extensively by children (e.g., the Internet).

Ecological systems theory (Bronfenbrenner, 1979) emerged prior to the Internet revolution and the developmental impact of then available technology (e.g., television) was conceptually situated in the child's microsystem. Given the continuously increasing complexity and availability of childhood technology, we propose the ecological techno-subsystem, a dimension of the microsystem. As illustrated in Figure 1, the techno-subsystem includes child interaction with both living (e.g., peers) and nonliving (e.g., hardware) elements of communication, information, and recreation technologies in immediate or direct environments. From an ecological perspective, the techno-subsystem mediates bidirectional interaction between the child and the microsystem.

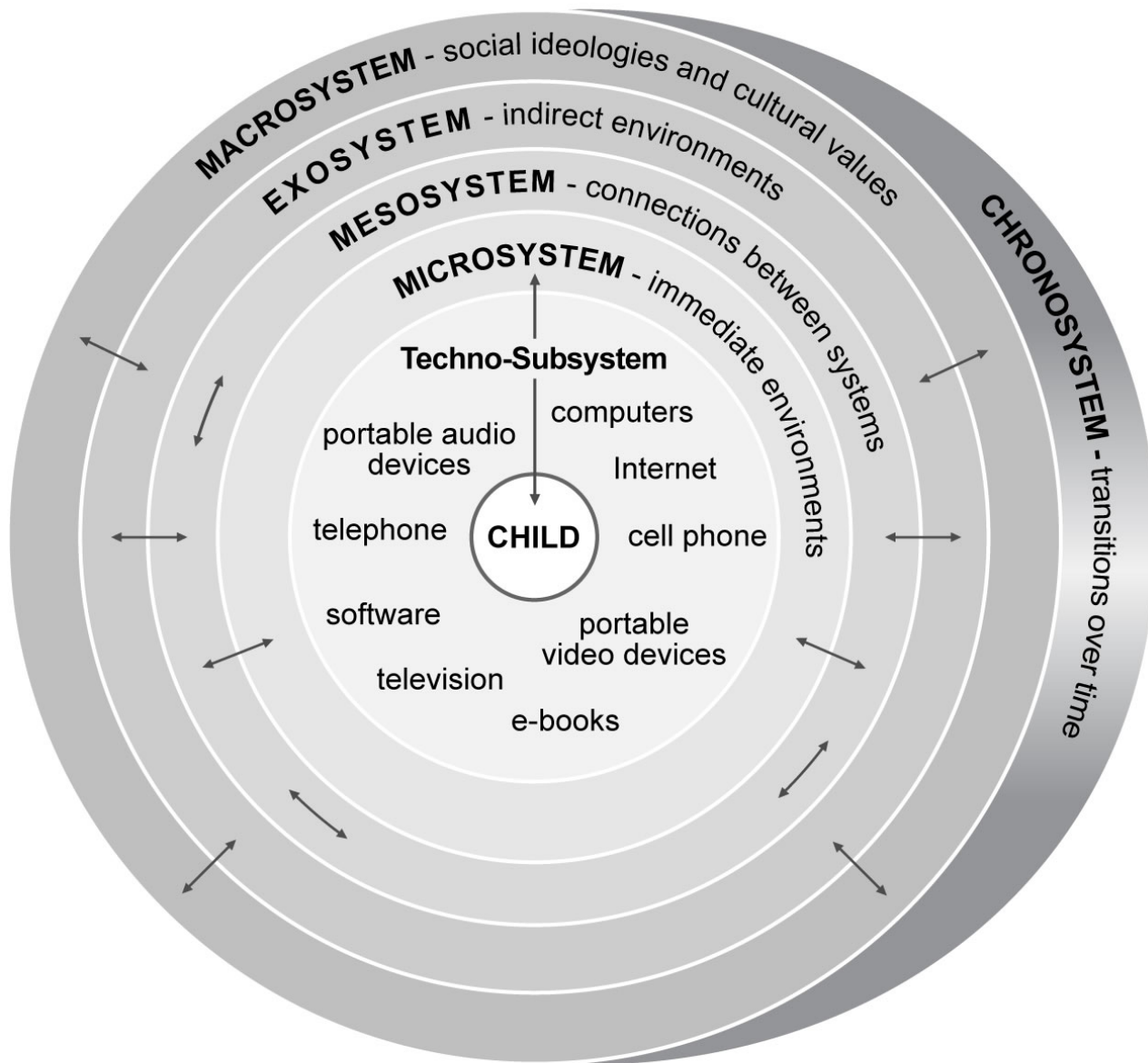


Figure 1. The Ecological Techno-Subsystem

Ecological analysis of children's use of the Internet reflects conceptual recognition of reciprocal influences among and within systems. For example, in technologically-advanced nations such as Canada, aspects of the child's microsystem are affected by aspects of Internet use (e.g., online communication with peers). Parental use of the Internet at work, an element of the exosystem, may indirectly affect children's home Internet access. School Internet portals are mesosystemic, allowing parents online access to their children's homework assignments, attendance records, and grades. Macro-analysis establishes the cultural value of some uses of the Internet (e.g., as a tool for learning) and the social devaluation of other uses (e.g., as a tool for social deviance). Internet applications and social expectations of Internet competence change in relation to life transitions such as starting school (e.g., the chronosystem). In this regard, ecological systems theory provides a comprehensive conceptual framework by which to organize and understand the potential impact of the Internet of child development. Such a framework is

prerequisite to exploration of the techno-subsystem, generally, and Internet use during childhood, specifically.

Ecological Research and the Techno-Subsystem

Ecological research involves "the scientific study of the progressive, mutual accommodation between an active, growing human being and the changing properties of the immediate settings in which the developing person lives, as this process is affected by relations between these settings and by the larger contexts in which the settings are embedded (Bronfenbrenner, 1979, p. 21). Bronfenbrenner noted that research in child psychology attends "to the properties of the person and only the most rudimentary conception and characterization of the environment in which the person is found" (p. 16). Because such research seeks to impose controls in an effort to extrapolate probabilities, contextual complexity receives minimal consideration. In contrast, ecological analysis requires description and comparison of Internet use across immediate childhood environments (i.e., home, school, and community) and in relation to a variety of uses (i.e., information, communication, and recreation).

Recent research conclusions support the ecological assumption that childhood Internet use varies as a function of context. For example, Murphy and Beggs (2003) concluded that home-based computer use was child-directed, allowed time for exploration, resulted in incidental learning, celebrated expertise, and occurred in a context with consistent access to technology (e.g., home Internet availability). School-based computer use, in contrast, was teacher-directed, did not allow time for exploration, focused on purposeful learning, did not celebrate nor accept expertise, and occurred in a context with limited access to technology (e.g., classroom Internet availability). Kerawalla and Crook (2002) compared elementary school children's home and school computer use. At home, "parents took few steps to orchestrate the content or motive of children's computer activity and they rarely became directly involved in that activity themselves" (p. 751). At school, teachers controlled and directed children's use of the computer. Sandvig (2003) examined community-based library Internet access and noted that children actively avoided explicit educational content. While such research conclusions support theoretical assumptions, ecological analysis requires simultaneous consideration of all contexts of child development and Internet use (i.e., home, school, and community).

In addition to comprehensive consideration of context, ecological analysis requires consideration of the nature of children's online behaviour. Theoretically, differing patterns of Internet use differently impact development during childhood (Johnson, 2006). Jackson et al. (2007) reported relationships between the type of websites visited by children and academic achievement (e.g., accessing technology and corporate sites was associated with increased mathematics achievement). In a study by Johnson, Code, and Zaparyniuk (2007), parent response to the open-ended item what does your child do when he/she uses the Internet at home was thematically organized into four types of Internet behaviour: learn, play, browse, and communicate. Children who engaged in online learning demonstrated better expressive language, better metacognitive planning, and better

auditory memory than children whose parents did not report online learning. Children who engaged in online communication demonstrated better expressive language and better metacognitive planning than children whose parents did not report online communication. Online playing and browsing were unrelated to any measure of cognitive development.

The ecological techno-subsystem, by emphasizing the role of technology in child development, encourages holistic exploration of the developmental consequences of Internet use during childhood. Perhaps more importantly, the ecological techno-subsystem provides a theoretical framework for examining the impact of future technological advances (inevitable and unimaginable) on the up-coming generation.

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