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11

HUMAN DEVELOPMENT IN THE AGE OF THE INTERNET: CONCEPTUAL AND METHODOLOGICAL HORIZONS

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The 1970s gave rise to a new and innovative paradigm in human development research—the *ecology of human development* (Bronfenbrenner, 1977, 1979; cf. Wapner, 1987, and Wohlwill & Heft, 1987). This evolving *bioecological* paradigm is broadly concerned with the environmental conditions and transactional processes that occur in multiple settings and that exert a cumulative influence on the course of individuals' development over the life span (Bronfenbrenner, chapter 1 this volume). If developmental psychology prior to the early 1970s focused on “the strange behavior of children in strange situations with strange adults for the briefest periods of time” (Bronfenbrenner, 1977, p. 513), the chapters in this volume demonstrate the profound changes in conceptual and methodological orientation that have occurred over the past two decades in human development research. In contrast to earlier developmental studies, the research programs described in these chapters reveal the broader contextual

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scope of ecological analyses by encompassing the multiple environmental settings—homes, neighborhoods, child-care settings, schools, workplaces, institutional environments, and whole communities—that make up the ecology of development and the multiple life stages in which developmental processes unfold—infancy, childhood, adolescence, young and middle adulthood, and older adulthood.

The goals of the present chapter are twofold. The first goal is to identify convergent theoretical, methodological, and empirical themes reflected in the preceding chapters. The research programs outlined in these chapters reveal critical environmental conditions and transactional processes that significantly affect developmental outcomes within particular settings and stages of the life course. The concepts and research findings discussed in these chapters have important practical implications for environmental design, community planning, and public policy. The second goal of the chapter is to consider conceptual and methodological issues that have been neglected in prior developmental studies. These research “gaps” pose important questions and directions for future research on the ecology of human development.

The discussion of conceptual and methodological “horizons” in the latter portion of the chapter is organized around a topic that has received scant attention in earlier developmental research, that is, the impact of the Internet on the ecology of human development. This topic raises fundamental questions about the conceptualization and measurement of environment–development transactions and suggests several new directions for future research. The extraordinary growth of the Internet in recent years highlights the accelerating pace of societal change and the developmental significance of macrosystemic shifts that have occurred over the past 20 years. The concluding sections of the chapter explore the ways in which these contextual transformations are likely to alter the developmental processes that take place within the major settings and stages of people’s lives.

CORE THEMES IN RESEARCH ON THE ECOLOGY OF HUMAN DEVELOPMENT

The chapters in this volume reflect certain convergent themes and assumptions. These core assumptions include the following: (a) Within each stage of the life course, an individual’s routine activity system is made up of multiple, interrelated environmental settings (Bronfenbrenner, 1979; Magnusson, 1981; Stokols, 1982); (b) the different settings and the environmental conditions that exist within them vary in their capacity to affect developmental processes and outcomes for better or for worse; (c) the effects of particular environmental conditions on developmental processes

and outcomes may be mediated by personal attributes and dispositions and moderated by contextual circumstances (Bronfenbrenner, 1992, chapter 1, this volume); (d) the environmental conditions that are spatially proximal to the individual may influence not only short-term developmental processes and outcomes but also processes and outcomes that are temporally remote; and (e) the environmental conditions that are geographically removed from an individual's immediate life situation may exert direct or indirect influence on his or her developmental processes and outcomes, both in the short run and over more extended periods.

Taken together, the chapters in this volume reflect the broad *spatial*, *temporal*, and *sociocultural scope* of ecological research on human development. That is, they consider places, processes, and events occurring within an extended rather than a narrow region of an individual's or group's geographical environment and within an expanded rather than an abbreviated period of the life span (Stokols, 1987). Accordingly, these chapters examine not only the environment–development transactions occurring within a specified setting (the microsystem) but also the ways in which functional links between two or more settings (i.e., the mesosystem, exosystem, macrosystem, and chronosystem; cf. Bronfenbrenner, 1986, 1992; Brown, chapter 3, this volume; Friedman & Amadeo, chapter 5, this volume; Talbert & McLaughlin, chapter 7, this volume) influence developmental processes and outcomes. Moreover, a number of the chapters identify developmentally relevant facets of an individual's or group's sociocultural environment and, as such, reflect broader sociocultural scope and explicit concern with macrosystem conditions than has been evident in earlier, more narrowly gauged developmental studies (Brown, chapter 3, this volume; Schooler, chapter 8, this volume; Super & Harkness, chapter 10, this volume).

The broad contextual scope of the bioecological paradigm is rarely encompassed by a single research program, because most empirical studies tend to focus (because of resource and time constraints) on developmental processes occurring within delimited categories of settings (e.g., homes, child-care settings, or workplaces) and phases of the life span (e.g., infancy, adolescence, or adulthood). Faced with practical constraints on gathering developmental data over multiple life stages and across diverse community settings, many if not most ecologically oriented research programs concentrate their attention on more fine-grained analyses of the linkages between environmental conditions, developmental processes, and outcomes as they occur within particular categories of settings. Yet, by comparing the methods and findings presented in each of the preceding chapters, it is possible to gain a broader view of the ecology of development as a whole and to identify conceptual and methodological issues that have been neglected in earlier studies and that warrant greater attention in future research.

The Effective Context of Development Within Particular Settings and Life Stages

Each of the research programs presented in this volume identifies environmental conditions that affect developmental processes and outcomes within specified settings and life stages. By revealing these psychologically significant qualities of settings, each chapter broadens our understanding of the *effective context* of development—those contextual circumstances that exert the most profound influence on developmental processes and that afford the greatest explanatory power in analyses of the relationships between environment and development (Stokols, 1987; Wachs, 1989).

The effective context for a given set of environment–development transactions is never completely specifiable, because the range of situational factors that influence those transactions is potentially infinite and the future environmental conditions that may impinge on individuals and groups can only be estimated rather than predicted unequivocally (Manicas & Secord, 1983). Nonetheless, the hypothetical notion of an effective context is useful in prompting researchers to consider the plausible range of situational factors that are likely to influence development within specified times and places and to distinguish (on the basis of prior theory, research, and intuition) among those factors in terms of their relative affect on developmental processes and outcomes.

The notion that some environmental conditions influence development more profoundly than others is reasonably straightforward. However, the process of identifying the effective context of development is a painstaking and complex endeavor. First, the developmental processes and outcomes that occur within specific settings and life stages must be identified by the researcher. Then, the environmental circumstances associated with these settings and life stages that may influence developmental processes and outcomes must be cataloged. Finally, empirical relationships among the specified environmental factors, developmental processes, and outcomes can systematically be observed.

The research programs presented in the preceding chapters have begun to address these complexities of ecological research on human development in at least three important respects. First, at a conceptual level, the chapters contribute taxonomies of key environmental conditions, developmental processes, and outcomes within particular types of environmental settings and stages of the life course. Second, the chapters reveal the methodological pluralism inherent in ecological studies of human development. That is, they effectively combine multiple methods (e.g., adults' and children's self-reports, behavioral observations, time-use surveys, standardized achievement tests, and analyses of archival or ethnographic data) to yield convergent information about the form and consequences of

environment–development transactions. Third, by using these multiple methodologies, the chapters empirically document setting-specific and stage-dependent linkages among environmental conditions, developmental processes, and outcomes.

Taxonomic, Methodological, and Empirical Contributions of Earlier Research

An emphasis on descriptive and taxonomic concerns is characteristic of new scientific paradigms during their early stages of development (Altman, 1968). The definition and classification of potentially important predictor, moderator, mediating, and outcome variables provide the necessary foundation for theory development and inferential research. Over the past two decades, several useful taxonomies of environmental variables, developmental processes, and developmental outcomes have emerged. For example, Wachs (1989) contributed a classification of environmental conditions within infants' residential environments. Wachs's taxonomy incorporates three major dimensions of stimulation (background vs. focal, responsive vs. nonresponsive, and animate vs. inanimate) to identify eight prototypic clusters of physical and social conditions within infants' homes. These eight categories of environmental stimulation are arrayed along a continuum ranging from background/nonresponsive/inanimate stimulation at one extreme to focal/responsive/animate stimulation at the other. The former category characterizes primarily physical environments, whereas the latter category is more descriptive of the social qualities of home environments.

Wachs's chapter (chapter 12, this volume) offers an elaboration of his earlier taxonomy by incorporating the additional dimensions of physical stimulus modalities (visual, auditory, and tactual–kinesthetic), the complexity of the developing person's psychological environment, and the stability or variety of objective features of the individual's physical environment. These additional dimensions, in combination with those included in Wachs's (1989) earlier classification system, provide a framework for studies of environment–development transaction in which individual and environmental characteristics are integrated within the same conceptual units, rather than treated as separate and independent of each other.

The taxonomy developed by Wachs (1989) to classify the environmental conditions of infants' homes provided the conceptual framework for subsequent empirical studies documenting the adverse impact of distracting background stimulation (resulting from higher levels of crowding, traffic, and noise in the home) on parents' involvement with and responsiveness toward their infants (cf. Wachs & Camli, 1991; Wachs & Gruen, 1982). Wachs (1979) also found that the intensity and duration of background noise in the home are negatively correlated with various measures

of infants' cognitive development over a 1-year interval. Yet, the availability of a "stimulus shelter" in the home (a room or other area where the child can be alone, out of the range of noise and other people) is positively correlated with infants' cognitive development.

Wachs's (1989; Wachs & Camli, 1991; Wachs & Gruen, 1982) research is valuable in that it classifies developmentally relevant features of home environments into theoretically meaningful categories and demonstrates the ways in which distracting background stimulation can interfere with critical developmental processes (e.g., sustained parent interaction with, and parents' responsiveness toward, their children). These critical environment–development transactions exemplify what Bronfenbrenner (chapter 1, this volume) refers to as "proximal processes" (i.e., sustained patterns of interaction between the developing person and his or her surroundings that occur over extended periods).

Bradley's (chapter 2, this volume) program of research on home environments also contributes a classification of developmentally significant features of residential settings (e.g., parental responsivity and acceptance, diversity of stimulation, and presence of learning materials), in which the relative impact on development varies over the stages of infancy, early childhood, middle childhood, and adolescence. Bradley's research on the developmental effects of these variables as reported in this chapter examines four major categories of proximal processes associated with home environments: (a) *sustenance* of the child, (b) *stimulation* of developmentally enhancing activities, (c) *support* of the child's self-sustaining capacities, and (d) *control* over the amount and pattern of inputs experienced by the child. The effective context of development encompasses environmental conditions that either enhance or impair these processes (e.g., the diversity of play materials available to infants, the predictability of activity schedules in the home, and the levels of social and emotional support provided to children; Bradley & Caldwell, 1976). An especially important feature of home environments, identified by Bradley & Caldwell, is the extent to which an ambience of family cohesion and harmony (vs. conflict) prevails in the home—a contextual circumstance that exerts a highly positive influence on children's social and intellectual development.

The research described by Friedman and Amadeo (chapter 5, this volume) on child-care environments further highlights the central importance of classification systems in ecological studies of development. Even within particular categories of settings and life stages, there are striking variations in the structure and organization of child-care environments. For instance, Friedman and Amadeo define the child-care environment as "a place as well as a social milieu in which children spend time on a regular basis when their mother is unavailable" (p. 127). They also note that to assess the child-care environment, the researcher must first determine who provides the care, who is cared for, where the care is provided, and how

the care is provided (e.g., the diverse arrangements reflected in relatives' and family-based care vs. center-based care). Moreover, children's experiences of child care can be measured "in terms of the interactions the child has with the provider, peers, and objects in the child-care environment" (p. 128) as well as the duration and stability of those interactions (cf. Clarke-Stewart, Gruber, & Fitzgerald, 1994; McCartney, 1984). The researcher's decisions about which environmental features and interactional processes to focus on, and at what level of detail, depend largely on the goals of the assessment (e.g., for licensing, accreditation, or research purposes), the conceptual framework underlying the research, and the methods of measurement that are available.

To the extent that child care is provided in places located away from the child's home, the nature of the relationships between these different settings making up the home/child-care environment mesosystem must be considered—especially the ways in which multiple environments jointly influence developmental processes and outcomes. Friedman and Amadeo (chapter 5, this volume) note, for example, that it is important for parents to limit the number of different environments that they place their children in, because transitions in care from one setting to the next are difficult for children. They also suggest that developmental processes and outcomes are enhanced to the extent that functional links between the home and the child-care environment are established (e.g., parents' active involvement in and visitation of the child-care setting or child-care providers' periodical visitation of children in their homes).

The chapters by Talbert and McLaughlin (chapter 7, this volume) on assessing school environments, Vandell and Posner (chapter 6, this volume) on conceptualizing after-school settings, and Brown (chapter 3, this volume) on the measurement of adolescent peer environments also examine the ways in which multiple settings outside the home influence developmental processes and outcomes. For example, Talbert and McLaughlin use a bottom-up approach to analyze the ways in which children's classroom settings and proximal educational processes, in combination with the more distal qualities of school administrative structures and institutional cultures, jointly affect students' academic performance (e.g., their effort and achievement in math classes). They report that schools and school districts in which teachers report a strong sense of community and commitment to professionalism in their work effectively enhance students' educational experiences and academic achievement. This research reveals the strong exosystem influence of teachers' involvement in cohesive professional communities on their students' intellectual development.

Vandell and Posner (chapter 6, this volume) examine the links between children's homes, schools, neighborhoods, and after-school environments and document the ways in which these mesosystem relationships

can influence the developmental effects of participation in after-school settings. They distinguish between different after-school arrangements (e.g., self-care, formal after-school programs, and informal after-school settings) and suggest that the developmental outcomes associated with these arrangements depend largely on the contextual circumstances present in children's homes, neighborhoods, and schools. For example, the self-care that occurs when children are left by their parents at home alone, or in the company of unsupervised peers, is less likely to have a positive influence on development than that which occurs when children remain at home under the supervision of a responsible older sibling. Also, the developmental benefits associated with children's participation in self-care or formal after-school programs may depend on the extent to which their neighborhoods have high or low rates of crime. Moreover, highly formalized after-school programs when combined with very structured and demanding curricula at school may exert a negative influence on children's social and emotional development by curtailing their opportunities to engage in self-initiated recreational and exploratory activities.

Brown's (chapter 3, this volume) conceptualization of peer environments reveals the complex ways in which adolescents' homes, neighborhoods, and cultural milieus are intertwined and jointly influence their emotional, social, and intellectual development (cf. Super & Harkness, chapter 10, this volume). Brown distinguishes among the adolescents' friendship groups on the basis of frequent face-to-face contact, the reputational "crowds" that they identify with at school or in their neighborhoods, and the more pervasive aspects of youth culture conveyed through the mass media and societal (generational) norms. The influence of these different facets of peer environments on adolescents' socioemotional and intellectual development can vary widely in relation to other contextual circumstances, such as authoritative versus nonauthoritative parenting styles, family educational values, school policies and curricula, ethnic composition of the childrens' neighborhood, adolescents' involvement in part-time employment settings, and community norms regarding cultural diversity (cf. Greenberger & Steinberg, 1986; Steinberg, Darling, Fletcher, Brown, & Dornbusch, 1995).

As individuals progress from childhood through adolescence and into adulthood, the geographic range of their routine activities widens as their personal autonomy and independence increase. Ecologically oriented studies of adults and older adults, thus, must grapple not only with the joint effects of multiple life settings on contemporaneous developmental processes and outcomes but also with the cumulative influence of environmental conditions experienced in earlier life stages on more recent developmental sequelae (Bronfenbrenner, 1992). In the research summarized by Schooler (chapter 8, this volume; Kohn & Schooler, 1982), he uses time

series data to evaluate the links between the substantive complexity of adult workers' jobs (the extent to which a job requires thought and independent judgment), on the one hand, and their ideational flexibility and self-directed (vs. conformist) orientations, on the other. Schooler reports significant lagged correlations between job complexity and measures of intellectual flexibility and personal autonomy gathered 10 years later. Moreover, his analyses reveal that children's exposure to complex school work and family settings that encourage autonomy enhances their intellectual development and increases the likelihood that they will choose careers later in life involving complex work and independent judgment (cf. Schooler, 1984).

A recurring theme in several of the preceding chapters is that certain age groups and socioeconomic strata of the population are more vulnerable than others to the potentially harmful effects of environmental demands and stressors (Bronfenbrenner, chapter 1, this volume; Friedman & Amadeo, chapter 5, this volume; Vandell & Posner, chapter 6, this volume). For example, very young individuals and infirm older individuals may be especially susceptible to developmental disturbances caused by chronic exposure to noise, overcrowding, and inadequate housing (Evans, chapter 9, this volume; Lawton, chapter 4, this volume; Wachs, 1989). Moreover, individuals living in poverty are more likely to experience these stressors on a regular basis than are those who are economically and socially advantaged (Bullock, 1990; Huston, 1993). On the other hand, children raised in affluent households and older individuals who are in good health and psychologically proactive cope more effectively with complex environments and are better able to avoid the adverse health and developmental impacts of exposure to environmental stressors. Thus, the evidence from several research programs suggests that the level of congruence, or "fit," between an individual's environmental arrangements and his or her personal dispositions and resources may be a more crucial determinant of developmental outcomes than either environmental or personal factors considered separately (Caplan & Harrison, 1993; Kahana, 1982; Lawton, chapter 4, this volume; Michelson, 1985).

In summary, the preceding chapters contribute valuable taxonomic schemes for categorizing key environmental conditions, developmental processes, and outcomes associated with particular life settings and stages. Moreover, the chapter authors used in their research a variety of measurement strategies to assess the interrelations among these variables and the ways in which multiple settings influence development over the life course. Finally, the findings reported in these chapters suggest a variety of environmental design strategies to enhance developmental processes and outcomes over the life course. Some of these strategies are outlined in the following paragraphs.

Environmental Design Strategies to Enhance Human Development

Wachs' (1979, 1989) and Bradley's (chapter 2, this volume) studies of residential environments indicate that children's cognitive development is hindered by high levels of noise and other distracting stimuli in the home (cf. Wohlwill & Heft, 1987). Similarly, a field-experimental study conducted by Cohen, Glass, and Singer (1973) demonstrated the negative effects of chronic exposure to traffic noise on the development of children's reading and auditory discrimination skills, especially among those living in apartments closest to the highway. Together, these findings suggest the developmental value of incorporating adequate sound insulation materials in the design of home environments, providing secluded interior spaces (or stimulus shelters) that are separated from noisier family areas, and locating homes and apartments away from airports, freeways, and other sources of noise in the community.

The negative impacts of noise and distraction on developmental processes have also been documented in child-care and school settings. For instance, Moore's (1986; Moore & Lackney, 1993) research suggested that the provision of architecturally well-defined study spaces (or "activity pockets") in preschool and elementary school settings helps reduce children's susceptibility to noise distraction and, thereby, significantly increases their engagement with learning activities, attention span, exploratory behavior, and cooperation with peers in the classroom (Moore & Hart, 1989). Also, field experiments conducted by Cohen, Evans, Stokols, and Krantz (1986) and Evans, Hygge, and Bullinger (1995) reveal the adverse effects of chronic noise exposure (on short-term attentional tasks, reading comprehension, long-term memory, tolerance for frustration, and blood pressure) among third and fourth graders attending schools under the flight paths of major metropolitan airports and underscore the importance of locating schools and child-care environments in areas that are sufficiently distant from community noise sources.

At the neighborhood level, design strategies aimed at reducing traffic volume and noise can reduce or prevent environmental conditions that have the capacity to disrupt developmental processes and outcomes. For instance, Appleyard's (1981) field-experimental study of vehicular traffic in residential neighborhoods demonstrates the profoundly negative impact of exposure to heavy traffic volume and excessive traffic noise on social contacts among neighbors, neighbors' collective sense of community, and parents' concerns about children's exposure to traffic hazards when they venture outside their homes or apartments. Appleyard's findings suggested that urban planning strategies aimed at diverting heavy vehicular traffic away from residential neighborhoods will, in the long run, effectively promote a

variety of positive developmental consequences for residents and their children.

The negative effects of ambient noise and distraction on developmental processes and outcomes have been observed across a variety of environmental settings and life stages. Thus, the empirical evidence for designing homes, neighborhoods, child-care environments, and schools in ways that protect children from unwanted noise and distraction is quite strong. There is also considerable evidence that the ability to avoid unwanted distraction and to regulate privacy in social settings is psychologically important to adults working in offices and factories (Sundstrom, 1986), patients in health-care settings (Carpman & Grant, 1993), and older adults residing in urban neighborhoods (Carp & Carp, 1987; Lawton, chapter 4, this volume). However, the empirical links between chronic noise exposure in these settings and impaired developmental outcomes (other than stress and environmental satisfaction indices) are less well established for these populations than among noise-exposed children in home, school, child-care, and neighborhood settings.

The developmental outcomes associated with exposure to alternative design arrangements warrant further study in future research. In addition to documenting the developmental benefits of environmental designs that reduce individuals' exposure to noise and other distracting stimuli, future studies also should evaluate the developmental value of design arrangements that (a) enhance the responsivity and informational quality of children's home, day-care, and school settings (Bradley, chapter 2, this volume; Friedman & Amadeo, chapter 5, this volume; Vandell & Posner, chapter 6, this volume); (b) incorporate flexible design elements (e.g., adjustable interior partitions) to facilitate privacy regulation and environmental controllability in residential and work settings (cf. Altman, 1975; Stokols, 1998; Sundstrom, 1986); (c) enhance residents' sense of security and "defensible space" in their homes and neighborhoods (cf. Newman, 1973; Taylor, 1987; Taylor, Shumaker, & Gottfredson, 1985); (d) increase older residents' opportunities for environmental "proactivity" by providing them ready access to commercial and transit services in their neighborhoods (cf. Carp & Carp, 1987; Lawton, chapter 4, this volume; Parmelee & Lawton, 1990); (e) afford children and adults access to natural elements (e.g., plants, water, views of parks, and wooded areas) and opportunities to participate in "restorative" settings (cf. Hartig, Mang, & Evans, 1991; Kaplan & Kaplan, 1989); and (f) provide symbolic elements in residential and community settings to enhance individuals' sense of personal and collective identity (Carr, Francis, Rivlin, & Stone, 1992; Rochberg-Halton & Csikszentmihalyi, 1981; Rowles, 1981; Stokols, 1990).

CONCEPTUAL AND METHODOLOGICAL HORIZONS OF HUMAN DEVELOPMENT RESEARCH

The articulation (and validation) of environmental design strategies to enhance human development over the life course is but one of several important directions for future research. The remaining sections of the chapter examine additional issues that warrant greater attention in future research on the ecology of human development. The discussion of conceptual and methodological horizons of developmental research is organized around the emergence and rapid growth of the Internet, because the advent of modern telecommunication technologies highlights the growing importance and influence of macrosystem changes on developmental processes and outcomes over the life course.

Implications of the Internet for the Ecology of Human Development

During the past 5 years, the World Wide Web and the Internet have grown exponentially. According to a recent survey of Web usage, the number of recorded sites on the World Wide Web grew from 10,022 to 650,000 between December, 1993, and January, 1997—a 65-fold increase (Gray, 1996). Moreover, between January, 1993, and July, 1997, the number of Internet hosts (i.e., machine addresses on the Internet reported by name servers) expanded from 1.3 million to 19.5 million (Network Wizards, 1997). The number of American households using the Internet grew from 3.1 million in 1994 to an estimated 28 million by 1998 (Emerging Technologies Research Group, 1997). Although it is impossible to measure precisely the number of individual Internet users, a recent survey estimated that in the United States alone, nearly 40 million adults now use the Internet, as compared with 8.4 million adult Internet users in 1995, and more than 9.8 million American children presently use the Internet—a 444% increase since 1995 (Find/SVP, 1997a, 1997b).

The rapid growth of the Internet during the 1990s has dramatically altered the ecology of human development and raises profound questions about the conceptualization and measurement of environment–development transactions in the foreseeable future. On the one hand, the Internet might appear to be an exotic and limited influence on human development, considering that its use is confined to relatively affluent populations and to regions of the world where the requisite equipment and telecommunication infrastructure for Internet access (e.g., phone lines, desktop computers, and high-speed modems) are available (U.S. Department of Commerce, 1995). Moreover, the developmental influence of the Internet would seem to be confined to those age groups most frequently exposed to this new technology—especially older children, adolescents, and working adults (Yankelovich Partners, 1995).

On the other hand, it is conceivable that the Internet will also exert a profound, albeit indirect, influence on those populations and age groups that are least likely to use it. For example, developmental deficits among children living in poverty may become more severe as the Internet widens the rift between information-rich and information-poor segments of the world's population. Also, parents' use of desktop computers in the home may have either positive or negative developmental consequences for their infants and toddlers, depending on whether the time they spend on the Internet enhances the educational quality of the home or, alternatively, diminishes their responsiveness to their children during the hours they are on-line.

The preceding observations suggest that the capacity of the Internet to influence developmental processes and outcomes depends largely on the context surrounding its use and availability. In the context of affluence, access to the Internet can engender positive developmental processes and outcomes by exposing individuals to new information and stimulation, thereby fostering a more active and structuring orientation toward the environment. Under these circumstances, the Internet functions as a "developmentally instigative" feature of the individual's environment (Bronfenbrenner, 1992; cf. Schooler, 1984, chapter 8, this volume). In the context of poverty, however, restricted opportunities to learn about and use the Internet can impede children's developmental progress, in contrast to that of more affluent children who have ready access to this increasingly prevalent and powerful technology.

The bivalent nature of the Internet (i.e., its capacity to either support or constrain developmental processes and outcomes depending on contextual circumstances) is evident even among relatively affluent groups. For instance, the Internet and the World Wide Web afford convenient access to a tremendous amount of information, "distance learning" opportunities, and the capacity to communicate regularly and informally with an ever-widening circle of friends, colleagues, and on-line acquaintances. Yet, daily exposure to a surfeit of information and the demands of on-line communication can lead to stimulation overload, distraction from important tasks, and, ultimately, chronic stress and fatigue among working parents and professionally oriented adults (cf. Davidson, 1996; Glass & Singer, 1972; Hartig et al., 1991; Kaplan & Kaplan, 1989). Moreover, concerns have been raised about the questionable authenticity of information posted on the Web (much of which is designed for quick consumption and marketing purposes) and the potentially negative impacts of excessive Internet use on the depth and quality of individuals' thinking and research skills (cf. Noam, 1995; Postman, 1992; Rothenberg, 1997; Stoll, 1995).

Also, as was noted earlier, parents' frequent use of home-based computers may interfere with developmental processes by constraining opportunities for parent-child interaction, thereby promoting an ambience of

nonresponsiveness in family environments (cf. Bradley, chapter 2, this volume; Wachs, 1989). However, when families are geographically dispersed for prolonged periods, the Internet can facilitate information exchange and mutual support by enabling parents, grandparents, children, and siblings to stay in frequent contact with one another through the use of electronic mail. Thus, the developmentally instigative and socially supportive qualities of the Internet are likely moderated by the socioeconomic and situation-specific circumstances surrounding its use.

The burgeoning growth of the Internet and the World Wide Web and their capacity to exert both positive and negative effects on developmental processes and outcomes suggest that these telecommunication technologies be given more thorough consideration in future research. The next sections of the chapter identify important theoretical and methodological questions that remain to be examined in ecologically oriented studies of human development over the life span.

Theoretical Questions Concerning the Impact of the Internet and the World Wide Web on Human Development

The Internet encompasses the vast array of electronic connections that links millions of computers and their users throughout the world. The Internet is a highly diversified technology in that it supports several different forms of computer-mediated communication (CMC), such as electronic mail, electronic mail list serves (groups of electronic mail users organized around certain topics), electronic bulletin boards and newsgroups, and sites on the World Wide Web that range from noninteractive to interactive displays of textual, graphical, and auditory information and media. Among the most interactive of these Web sites are the multiuser domains (MUDs), which offer visitors and members opportunities to enter chat rooms, communicate with each other in real time, and manipulate graphical objects displayed at the site.

Individuals gain access to the Internet through either their desktop computers or their cable television systems. However, in contrast to television programming, which is passively received by viewers once a particular channel is selected, the Internet offers unprecedented opportunities for interactive exploration of electronic Web sites, MUDs, bulletin boards, and data archives (cf. Rheingold, 1993; Schuler, 1996). Under the best of circumstances, an individual's engagement with the Internet can function as a "developmentally instigative" proximal process—a sustained pattern of interaction between the person and his or her surroundings that fosters a more active and structuring orientation toward the environment (cf. Bradley, chapter 2, this volume; Bronfenbrenner, 1992, chapter 1, this volume; Schooler, 1984, chapter 8, this volume).

Yet, the capacity of the Internet to bring geographically distant in-

formation sources and electronically simulated, virtual places to one's computer or television screen raises several intriguing questions about the ecology of human development. These questions pertain to (a) the relative influence of proximal versus distal processes on human development, (b) the extent to which one's participation in a virtual environment via the Internet constitutes a mesosystem (spanning two or more settings in which the person is directly involved) or simply a microsystem (a particular place where one's computer is located and to which symbolic information is delivered electronically), (c) the circumstances under which an individual's participation in the Internet is likely to promote either positive or negative developmental processes and outcomes, and (d) the developmental implications of the Internet's exponential growth in light of humans' limited capacities for coping with information overload and accelerating rates of environmental change or "turbulence" (Emery & Trist, 1965).

Proximal and Distal Influences on Human Development

Studies of environment–development transactions typically focus on the conditions in one's immediate environment that influence his or her developmental processes and outcomes. This explicit focus on the developmental impacts of the perceptually salient, proximal environment is rooted in Lewin's (1936) conceptualization of the *psychological life space*—the totality of psychobiological conditions (e.g., perceptions, motivations, and salient features of the environment) that determines one's behavior at a specific moment within a particular place. Lewin referred to the non-salient (nonperceived) features of the sociophysical environment as the *foreign hull* of the life space—those contextual circumstances located beyond the boundaries of the life space that, according to Lewin, are more amenable to sociological and biophysical studies than to psychological research.

Prior to the Internet's emergence as a powerful and pervasive force in society, the relative salience and developmental impact of environmental conditions were generally correlated with their geographic proximity and immediacy to the individual. With the advent of the Internet and the World Wide Web, however, individuals' opportunities to experience distant places and events are now much less bounded by spatial and temporal constraints (cf. Meyrowitz, 1985; Mitchell, 1995). Although non-Internet forms of communication (e.g., reading a book, watching television, talking with others on the telephone, or corresponding with them by surface or air mail) can bring geographically distant people and places psychologically closer to the individual, the Internet differs from these other media in some important respects.

First, electronic mail and the World Wide Web make it possible for an individual to communicate simultaneously and interactively with scores,

and even hundreds, of other people (e.g., by participating in virtual chat rooms or through "instant messaging" among acquaintances who find themselves on-line at the same time). By contrast, television programs are experienced more passively than interactively, and telephone conversations are usually restricted to dyads (or to slightly larger groups participating in conference calls). In addition to affording simultaneous contact with a large number of other people, Internet-based communications often combine textual, graphic, and auditory modalities (e.g., real-time video images of the people one is communicating with as well as dynamic views of their physical surroundings). Printed media are quite capable of depicting far-away people and places through photographs, drawings, and text, but they do not provide real-time, interactive views of distant people and events, nor can they deliver nearly instantaneous, multimodal communications, as exemplified by electronic mailings that contain document, voice, and video attachments. Finally, in addition to the instantaneous, interactive, and multimodal qualities of electronic communications, the Internet and the World Wide Web also afford serendipitous encounters with large numbers of strangers in cyberspace and opportunities to explore hundreds and even thousands of communication channels (or Web sites) within relatively short intervals of time.

The capacity of the Internet to make remote places and events psychologically salient to those who use this new technology has important developmental implications for various age groups. Young children and adults with regular access to the Web, for example, are likely to be exposed to diverse cultural influences and vast stores of information, thereby broadening their understanding of the world and strengthening their sense of connection with remote people and places. Similarly, working adults can use the Internet to expand their personal skills and knowledge so that they are better equipped to perform effectively in their jobs. Also, older adults can now use the Internet to maintain a proactive orientation toward other people and places and their symbolic ties to the outside world and to counter feelings of loneliness and isolation, even as their physical mobility becomes more constrained with the passage of time (cf. Lawton, chapter 4, this volume; Rook, 1984; Rowles, 1981; SeniorNet, 1998; Seniors Computer Information Project, 1998).

In short, the rise of the Internet has altered the relative significance of proximal and distal features of the ecology of human development. A much broader array of remote places and events can now be brought squarely into the individual's consciousness or life space, through multimodal electronic simulations of virtual places and seemingly unlimited opportunities to experience those places and events via the Internet and the World Wide Web (cf. Mitchell, 1995; Rheingold, 1993; Stokols, 1995).

Delimiting the Micro-, Meso-, and Exosystem Contexts of Development

According to the bioecological paradigm, the ecology of development includes the major settings that make up an individual's micro-, meso-, exo-, and macrosystems within each stage of the life course. Before the Internet was established, the number and range of micro-, meso-, and exosystems making up a person's ecological environment at each stage of the life course were, for the most part, limited by the geographic and temporal boundaries of the individual's routine (e.g., daily, weekly, and monthly) activity system. With the rapid growth of the Internet in recent years, however, these earlier assumptions have become outmoded. Today, people with access to the Internet can explore and participate in a vast array of virtual places. Also, as these opportunities for involvement in virtual environments have expanded, the boundaries among one's micro-, meso-, and exosystems have become increasingly blurred.

Children, adolescents, and adults can now go to chat rooms, MUDs, and other electronic environments to interact with other people in real time. Is the contextual unit of these interactive processes the microsystem in which one's computer happens to be located or is it a new category of mesosystems that encompasses a particular sociophysical environment (e.g., a residence, classroom, day-care setting, and work site) and the virtual places that are experienced in that environment through computer-based access to the Internet? Similarly, when a parent or teacher accesses the Internet from a home office or classroom, do the electronic linkages between these real and virtual places constitute a new type of exosystem that has developmental consequences for the children participating in those residential and classroom environments?

Blanchard (1997), drawing on the principles of behavior setting analysis developed by Barker (1968) and Wicker (1987), defined *virtual behavior settings* as electronic sites on the Internet that are created through the shared interactions of members and that develop a symbolic sense of space or place through sustained computer-mediated communications among the participants in those sites (cf. Mitchell, 1995; Rheingold, 1993). The fact that virtual behavior settings are nested within face-to-face behavior settings (i.e., those from which the individual accesses the Internet and the World Wide Web via computer or cable television) raises further questions about the psychological and interpersonal tensions that can arise from a person's concurrent involvement in real and virtual behavior settings and the circumstances under which participation in the Internet either fosters or impedes positive developmental processes and outcomes.

Positive and Negative Effects of the Internet on Development

It might be assumed that the presence of a desktop computer wired to the Internet within a particular home, classroom, or work site is anal-

ogous to having a standard television set (one that is not connected to the Internet) available in those same environments. That is, both the computer and the television are inanimate objects that can transmit large amounts of symbolic information to those individuals participating in a particular environment—information that can be either educational and developmentally enhancing, on the one hand, or inane and distracting, on the other. This line of thinking would suggest that it is unnecessary, and even misleading, to invent new units of ecological analysis, such as virtual places and behavior settings, and pseudo meso- and exosystems that are defined in terms of the electronic and ephemeral links between virtual places nested within real ones.

Yet, in contrast to the more passive medium of television, it is the capacity of interactive Web sites to engage the exploratory tendencies of children and adults and to facilitate real-time communication between so many geographically dispersed people that makes the experience of virtual environments so similar to participating in real environments. In these respects, participating in the Internet and the World Wide Web via a desktop computer located in a particular place is tantamount to being in two or more places at the same time. Also, it is these highly engaging qualities of the Web that can lead to either detrimental conflicts or developmentally enhancing complementarities between one's simultaneous experiences of real and virtual environments.

To better understand the ways in which simulated electronic environments on the World Wide Web can influence developmental processes and outcomes, it is useful to differentiate between (a) meso- and exosystems that involve links between two or more real (sociophysical) settings and (b) those that involve a link between an actual environmental setting and at least one virtual setting on the Internet. The former categories of meso- and exosystems can be designated as $(r-r)$ units that span two or more real settings and the latter as $(r-v)$ units encompassing one or more real settings and at least one virtual environment.

For both $(r-r)$ and $(r-v)$ contextual units, the relationships between the different settings included in the specified meso- or exosystem can be characterized as complementary, neutral, or conflicting. *Complementary settings* are those in which the organizational goals and activities are consistent with each other and are mutually reinforcing. *Neutrally linked settings* are those in which the respective goals and activities neither reinforce nor interfere with each other. *Conflicting settings* are those in which the goals and activities are noncomplementary and are in opposition with each other.

Accordingly, *complementary $(r-v)$ units* are those meso- and exosystems in which the virtual setting supports the goals and activities of the *host setting* (i.e., the sociophysical environment from which the Internet is accessed via computer or cable television). In terms of the bioecological

perspective on development, the virtual setting in a complementary (r-v) unit enriches and supports the developmentally instigative qualities of the host setting. *Neutral (r-v) units* are those in which the virtual setting neither supports nor detracts from the activities and developmental resources of the host setting. Finally, *conflicting (r-v) units* are those in which the virtual setting disrupts or interferes with the activities and developmentally instigative qualities of the host setting.

The preceding definitions of complementary, neutral, and conflicting (r-v) units suggest that one's participation in virtual environments is most likely to promote positive developmental processes and outcomes in the context of complementary (r-v) units and is most likely to disrupt those processes and outcomes within a conflicting (r-v) meso- or exosystem. This prediction assumes, of course, that the goals and activities of the host setting are, themselves, developmentally positive rather than negative. To the extent that the goals and activities of the host setting are developmentally negative, conflicting inputs from virtual settings may actually promote rather than impair positive developmental processes and outcomes. For purposes of the present discussion, it is assumed that the goals and activities of the host setting are developmentally positive (or neutral) rather than negative.

An example of a complementary (r-v) mesosystem is an elementary school classroom where the teacher encourages his or her students to access educational Web sites from classroom computers, as an adjunct to the information covered in assigned readings and lectures. An example of a conflicting (r-v) unit, on the other hand, is a college dormitory room where students' excessive participation in computer-based chat rooms or virtual game sites detracts from their (or their roommate's) concentration on reading assigned texts or writing term papers. Similarly, an employee's participation in recreational Web sites while at work can decrease his or her productivity, undermine team performance, and evoke resentment among coworkers and supervisors. A more neutral (r-v) context would be one in which students' or employees' participation in interactive Web sites while at home, school, or work has neither positive nor negative impacts on the functioning of the host environment and neither disrupts nor enhances developmental processes and outcomes within that setting.

Although the inclusion of virtual environments in individuals' meso- and exosystems can sometimes be distracting and developmentally disruptive, the complete lack of opportunities to participate in the Internet is especially problematic for economically disadvantaged groups in society (U.S. Department of Commerce, 1995). The relative deprivation created by restricted access to the Internet among particular segments of society and regions of the world may have important developmental consequences for both individuals and groups. These issues are addressed later.

The Internet as a Source of Macrosystem Change

A unique feature of the Internet is its capacity to initiate and amplify macrosystemic changes in the ecology of human development. For instance, the fact that people separated by thousands of miles and multiple time zones can now communicate with one another in real time via Internet-based video, voice, and textual media suggests that the rate of information exchange across cultural and national boundaries will continue to accelerate in the coming decades. The increasing scope and pace of global communications have important implications for professional collaboration in scientific research, international cooperation in environmental management, and people's conceptions of the interdependent links between their immediate environments and more remote regions of the world.

An essential starting point for considering the Internet's potential to initiate and amplify macrolevel changes in the ecology of development is Bronfenbrenner's (1992) definition of the macrosystem:

The macrosystem consists of the overarching pattern of micro-, meso-, and exosystems characteristic of a given culture, subculture, or other broader social context, with particular reference to the developmentally-institutive belief systems, resources, hazards, life styles, opportunity structures, life course options, and patterns of social exchange that are embedded in each of these systems. The macrosystem may be thought of as a societal blueprint for a particular culture, subculture, or other broader social context. (p. 228)

Consistent with this definition, the Internet and the World Wide Web are developmentally instigative resources (or opportunity structures) afforded by some macrosystems (e.g., affluent communities or cultural groups that emphasize educational values and achievement), but not others (e.g., economically disadvantaged communities or cultural groups that place less emphasis on educational attainment). Among those populations and world regions that have ready access to the Internet, the exchange of information through electronic mail and interactive Web sites is bringing diverse cultures and belief systems into closer contact with each other on a more frequent basis. This cross-pollination of cultural perspectives and world views has the potential to enhance cognitive and social development by encouraging greater ideational flexibility and a more exploratory, proactive orientation among Internet users (Schooler, chapter 8, this volume).

At the same time, the Internet and the World Wide Web are growing so quickly and are facilitating the exchange of so much information that the users of these new technologies are becoming more vulnerable to chronic distraction, stress, and stimulation overload (cf. Davidson, 1996; Glass & Singer, 1972; Kaplan & Kaplan, 1989). At societal and global levels, the exponential growth of the Internet and the rapid rate at which

information is now transmitted and received are prompting unprecedented structural changes in economies, health care systems, educational institutions, informal social networks, leisure activities, and patterns of professional and scientific collaboration. Some of these societal changes are desirable and may promote positive developmental processes and outcomes. The extremely fast pace of these changes, however, poses certain dangers for the overall stability and predictability of the macrosystem. A fundamental proposition of bioecological theory posits that

the degree of stability, consistency, and predictability over time in any element or level of the systems constituting an ecology of human development is critical for the effective operation of the system in question. Extremes either of disorganization or rigidity in structure or function represent danger signs for potential psychological growth, with some intermediate degree of system flexibility constituting the optimal condition for human development. (Bronfenbrenner, 1992, pp. 240–241)

One way in which the Internet can reduce levels of predictability in macrosystems is by facilitating individuals' spontaneous discovery of new information and their serendipitous encounters with strangers from far-flung regions of the world. As use of the Internet and the World Wide Web becomes more pervasive in society, chance encounters with other people and frequent exposure to new information are likely to have a greater influence on individuals' developmental processes and outcomes than in previous years (Stokols, 1988).

The Internet not only can reduce predictability by enabling chance encounters with other people and new information but can also amplify preexisting macrosystem conditions. This "deviation-amplifying" quality of the Internet is reflected in its capacity to magnify previously existing polarities or contradictory states within a macrosystem (Maruyama, 1963). For example, unequal access to the Internet and the World Wide Web among affluent versus low-income groups is likely to widen the rift between information-rich and information-poor segments of society—unless and until these technologies are made more available to economically deprived and underrepresented groups in future years. Similarly, preexisting tendencies in society toward racism, sexual harassment, strident political discourse, social incivilities, child abuse, and other criminal activities are now being channeled toward an increasingly large audience of Internet users (cf. Holman & Stokols, 1994; "Internet a Molester's Tool," 1997; Miller, 1995).

Finally, it is conceivable that individuals' routine use of the Internet will further restrict their participation in civic activities, thereby accelerating present trends toward the decline of "social capital"—those "features of social organization such as networks, norms, and social trust that facil-

itate coordination and cooperation for mutual benefit" (Putnam, 1995, p. 67). Alternatively, the emergence of virtual communities (Blumenstyk, 1997; Mitchell, 1995; Rheingold, 1993) may actually counter these trends by reinforcing democratic processes (Sclove, 1995) and by encouraging individuals' civic engagement and participation in communities of interest (Blanchard & Horan, 1997).

The impact of the Internet on macrosystem stability and predictability warrants explicit attention in future developmental research, in view of the potentially crucial consequences of these societal-level changes for individuals' development at each stage of the life course. Along these lines, Bronfenbrenner (1992) stressed "the importance of assessing the degree of stability vs. instability, both with respect to characteristics of the person and of context, at each level of the ecological system" (p. 241) in future research (cf. Wachs, chapter 12, this volume). This call for focused studies of the relationships between macrosystem change, unpredictability, and human development over the life course poses complex methodological questions, as outlined in the following paragraphs.

Methodological Challenges Posed by Studies of the Internet, the World Wide Web, and the Developmental Outcomes Over the Life Course

A major methodological challenge confronted in bioecological research is the difficulty of specifying and measuring the effective context of development—those conditions within multiple settings and life stages that have the greatest cumulative impact on developmental processes and outcomes (cf. Stokols, 1987; Wachs, 1989). Specification and measurement of the effective context are complex endeavors, owing to the broad geographic, temporal, and sociocultural scope of the developing person's ecology. Children and adults are typically engaged in multiple micro- and mesosystems and are influenced by numerous exo- and macrosystem conditions as well. Thus, it is perhaps not surprising that many if not most ecologically oriented studies have focused on developmental processes and outcomes that occur within a particular type of setting (e.g., a home, school, day-care center, and work site) and during delimited phases of the life span (e.g., infancy, childhood, and middle or older adulthood).

The strategy of focusing empirical studies on delimited categories of settings and life stages yields in-depth information about the targeted contexts of development and reduces the complexities associated with ecological research—especially the challenges of documenting (a) the complex array of contextual influences on development found within an individual's micro-, meso-, exo-, and macrosystems and (b) the cumulative developmental impact of these conditions over multiple life stages. Yet, the bioecological paradigm emphasizes the importance of studying the cumulative influence of contextual factors on development across multiple settings and

stages of the life course (Schooler, chapter 8, this volume). For example, Bronfenbrenner (1992) stated the following:

The concept of macrosystem includes not only the subculture in which the person has been raised, but also the subculture in which the person lives. The latter is defined by the personal and background characteristics of those with whom the person associates in the settings of everyday life. Any research design that includes a macrosystem contrast should therefore, to the extent possible, provide for securing identifying criteria from both of these domains. (p. 237)

The challenges of specifying the effective context of development across multiple settings and life stages are compounded by the difficulty of measuring the cumulative influence of virtual (as well as real) environments on developmental processes and outcomes. During a single computer session, individuals are capable of participating in a large number of virtual behavior settings located at several different Web sites (Blanchard, 1997; Mitchell, 1995; Rheingold, 1993; Schuler, 1996). Identification of the developmentally instigative qualities of these virtual environments, let alone their cumulative effects on the individual over extended periods, is a daunting task because of the ephemeral nature of electronically simulated settings and the difficulties of recording the duration, quality, and psychological impact of one's experiences with those settings while participating in the Internet and the World Wide Web.

To address these complex issues in future studies, a variety of methodological strategies will be required. Time budget analyses, such as those developed in the field of behavioral geography, can be used to assess individuals' time allocation to both real and virtual settings (cf. Lenntorp, 1978; Michelson, 1985). Also, physical trace measures (Zeisel, 1981) of individuals' participation in MUDs on the Internet, including printed transcripts of their America Online chat room conversations, have been used to record the duration and content of people's experiences with virtual environments (Wall, 1997). Retrospective, autobiographical interviews probing individuals' experiences with real and virtual environments—especially those that are highly memorable and that are perceived to have had a significant impact on one's life—may prove particularly useful as a method for revealing the cumulative influence of environmental conditions on developmental processes and outcomes over the life course (cf., Rowles, 1981; Stokols, 1982).

Perhaps more important than recording the duration and quality of individuals' encounters with particular environments will be the measurement of complementary versus conflicting relationships between the virtual and real settings included in one's meso-, exo-, and macrosystems. These complementarities and conflicts among closely linked settings may exert a greater impact on developmental processes and outcomes than the envi-

ronmental circumstances present within each individual setting. Moreover, the creation of new measurement strategies for gauging levels of macrosystem instability and unpredictability, and the developmental consequences of these conditions, remain as a relatively neglected but important direction for future research. Finally, ethical questions raised by the study of people's encounters with the Internet and the World Wide Web (especially those pertaining to potential violations of privacy) will need to be addressed in future research on the developmental consequences of participation in virtual environments (Jones, 1994).

CONCLUSION

The chapters in this volume reflect several contributions of earlier research to the study of contextual influences on development over the life course. In particular, ecologically oriented research programs have (a) established valuable taxonomic schemes for categorizing environmental conditions, developmental processes, and outcomes associated with various life settings and stages; (b) introduced and validated multiple measurement strategies to assess the empirical links among these variables and the ways in which environmental settings influence development over the life course; and (c) suggested a variety of environmental design strategies to enhance developmental processes and outcomes over the life course.

Earlier studies also reveal some neglected areas of research on the ecology of human development. The present chapter suggested certain conceptual and methodological horizons for future ecological research, particularly in light of the rapid growth of the Internet and the World Wide Web in recent years and the developmental significance of these macro-systemic changes. These conceptual horizons present new opportunities for developing theoretical models that facilitate a broader understanding of (a) the relative influence of proximal versus distal processes on human development; (b) the emergence of new meso-, exo-, and macrosystem units that incorporate both real and virtual settings; (c) the circumstances under which individuals' participation in the Internet and the World Wide Web is associated with either positive or negative developmental processes and outcomes; and (d) the developmental ramifications of the Internet's exponential growth in light of humans' limited capacities for coping with information overload and accelerating rates of environmental change.

At a methodological level, several complex issues remain to be addressed in future studies of the ecology of development over the life course. These issues generally pertain to the challenges of specifying the effective context of development across multiple settings and life stages and the difficulty of measuring the cumulative influence of virtual (as well as real) environments on developmental processes and outcomes. Some promising

directions for future methodological research were discussed in relation to these concerns, including the following: (a) the combined use of multiple methodologies (e.g., time budget analyses, physical trace measures, and retrospective interviews) to assess individuals' time allocation to both real and virtual settings; (b) the creation of new measures to denote either complementary or conflicting relationships between real and virtual settings making up a person's meso-, exo-, and macrosystems; (c) the establishment of new measurement strategies for gauging macrosystem instability and unpredictability and the developmental consequences of those conditions; and (d) the resolution of ethical questions raised by the study of people's participation in the Internet and the World Wide Web, especially those relating to potential infringements on personal privacy.

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