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Exploring the Digital Divide

Internet Connectedness and Age

The existence of a digital divide between old and young Americans has been well documented. It is usually defined as access or lack of access to the Internet. This study adds context to the understanding of the digital divide by demonstrating differences in Internet connectedness, a multidimensional concept that includes consideration of the scope and intensity of the relationship that people develop with the Internet. Age is shown to be significantly associated not just with access, but with a tendency to pursue a more narrow range of personal goals online and with a pattern of connecting to the Internet from a smaller range of places. Nonetheless, older respondents evaluate the Internet to be as central to their lives as younger people do. Some support is offered for the idea that the digital divide is not merely a generational effect.

The potential for the Internet to play a larger role in the lives of older Americans than it presently does has recently received attention from researchers. Some research has focused on the potential for receiving social support online (White et al., 1999; Wright, 2000), some on the possibility of computer training to open Internet resources to senior citizens (Cody, Dunn, Hoppin, & Wendt, 1999; White et al., 1999), and some on the reasons why a digital divide has emerged between younger and older Americans (Lenhart, Rainie, Fox, Horrigan, & Spooner, 2000; National Telecommunications and Information Administration [NTIA], 2000). Underlying much of this research is a presumption that seniors who do not gain Internet access are deprived of a resource for enhancing their lives, a resource to which others (e.g., other

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seniors or younger people) have access. Often this presumption is untested, because many projects do not directly compare those with and without Internet access (e.g., Cody et al., 1999; Wright, 2000) or do not compare seniors with Internet access to younger people (e.g., Cody et al., 1999; White et al., 1999; Wright, 2000).

This article explores the digital divide between old and young using an ecological approach that takes into account the goals, resources, and communication environment of old and young respondents to a telephone survey. We examine the relative extent to which older and younger people are likely to integrate Internet use into their day-to-day lives and the importance they attach to the Internet as a resource that helps them meet their goals. We also examine the influence of variables that characterize the media ecology, such as access to computers at work, school, and other out-of-the-home locations, on the levels of Internet connectedness older people report.

Internet Connectedness

Internet connectedness is a multidimensional conceptualization of the importance of the Internet in a person's everyday life. Connectedness suggests a relationship between a person and the Internet not captured or described adequately by traditional use measures—particularly measures based on time, such as hours of use per week (Jung, Qiu, & Kim, 2001). Much of the previous research based on the concept of Internet use has tried to give microfunctional and instrumental explanations of the relationship between the computer network and individual users.

Internet connectedness implies dynamic and ecological relations between individuals and the Internet, which are embedded in a larger communication environment composed of multi-level relationships among individuals, institutions, organizations, and various storytellers, including all available communication media forms (Ball-Rokeach & Reardon, 1988). Individuals are regarded as goal-seeking entities residing in a larger communication infrastructure where various communication resources and opportunities exist (Ball-Rokeach, 1998; Ball-Rokeach, Kim, & Matei, 2001 [this issue]). Different communication environments and different communication infrastructures may either facilitate or restrict members' communication opportunities for social, cultural, and economic activities.

For individuals and groups to take advantage of communication opportunities and resources, they have to be connected to the communication infrastructure available in their communication environment. From the communication infrastructure approach, this connectedness is not defined as individuals' uses of the communication media available to them but as

socially structured relations between individuals and the communication environment.

From this way of thinking, we stress that the digital divide issue is an ecological and multi-level phenomenon. It is not just a problem of individuals' choices of having or not having connections to the technological network, nor is it the economic affordability of Internet services. It is an issue about how central the Internet is or could be in achieving various essential goals in individuals' everyday lives, and how embedded the Internet is in the existing communication infrastructure of older and younger people. The issue of the digital divide cannot be separated from such issues as how a society deals with the problem of difference in life opportunity based on age, as well as class, ethnicity, gender, geography, or cultural preferences. The Internet may be a different resource for older people who may have different media experiences, different goals, or different social opportunities for connecting to the Internet.

We propose that connectedness is composed of three dimensions: (a) history and context, (b) scope and intensity, and (c) centrality in one's life. The history and context dimension refers to the time one has had to acquire Internet skills and integrate the Internet into his or her everyday life, as well as the places in which one has access to the Internet. People may have long or short histories of Internet access. People may have broad contexts in which the Internet is used, including tasks such as work, gaming, and shopping, with access at home, the office, and a local library; others may use the Internet only for play and only at home, a relatively narrow context.

The scope and intensity dimension of connectedness includes the range of personal goals one seeks to attain through Internet connection, the range of applications online one uses (such as e-mail, browsing, and chat), and the amount of time one spends on these activities. By adding consideration of goals and activities to the usual measure of time spent online, this dimension more fully describes the nature of the media relationship engendered by Internet use. Opportunities to enter into the relationship described by Internet connectedness are contingent on a variety of factors, including access to the basic hardware and the possession of goals that the Internet can help one attain. Such concepts as access and goals are variables. Each varies in terms of intensity and scope; that is, a person may have an amount of access (intensity) and access in a variety of places (scope); a person may have goals that he or she feels more or less strongly about achieving (intensity) and a relatively wide or narrow range of goals (scope).

The centrality dimension of Internet connectedness refers to a person's subjective evaluation of the Internet's impact on his or her personal life, and

the extent to which a person would miss the Internet if it were no longer available. Those whose jobs or education require steady Internet connectedness may not be comfortable with the role the Internet plays in their lives. Some who have Internet access may be indifferent to it or even regret having it. Lenhart et al. (2000) reported that a small minority of their respondents dropped out of the Internet because they didn't find it interesting or useful, and another small portion left the Internet out of concerns for their privacy. These are indications that it is possible to have Internet access, and perhaps even a wide scope of activities and access sites, but still not feel that the Internet is central to one's life.

Internet connectedness is thus conceived as a multidimensional indicator of a person's overall relationship to the Internet. Although the concept may add layers of complexity to the traditional notion of media use, the truth is that the role of media in people's lives is more complex than that of electrical appliances. The concept of connectedness allows more thorough appreciation of different relationships people may have with media, and allows for greater appreciation of the nature of any divide between those with and those without connections (Jung, Qiu, & Kim, 2001 [this issue]).

The Internet and the Goals of Seniors

Cody et al. (1999) explain the importance of providing computer skills to seniors:

> Training adult learners is important because of the increasing numbers of this segment of the population and because providing Internet access to this group theoretically provides a number of significant benefits including the ability to enroll in distance learning courses on-line for life-long education, increased knowledge of news, current events, and medical/health breakthroughs, increased connectivity with family members who may live far away, increased intergenerational communication, increased perceptions of social support, and the ability to feel mentally alert, challenged, useful and to feel "younger" (Czaja, 1992; Eilers, 1989; Furlong, 1989). (pp. 269-270)

The sorts of advantages Cody et al. (1999) describe fall into a relatively narrow range of media-related goals. Social and self-understanding predominate (news and current events, health breakthroughs, feelings of alertness, challenge, usefulness, and youth), with interaction orientation included in some measure (connectivity, intergenerational communication, social support) (Ball-Rokeach, 1985). White et al. (1999) offer a similar list of goals that

may underlie Internet use by seniors, although they focus more on interaction orientation for purposes of social support and increased quality of life. Wright (2000), too, is concerned primarily with interaction orientation goals, particularly social support and coping. What is striking about these authors' emphases is the lack of play as a goal in itself (i.e., apart from its relation to health or coping) and task-oriented goals (such as work, shopping, banking, and travel reservations).

Certainly, the comments above are not meant to minimize the importance of health and social support goals as matters of research interest where seniors are concerned. To appreciate the extent of Internet connectedness in the general public, however, one would surely include action orientation and play goals as central to that connectedness; it is also advisable to include such goals in an exploration of older people's Internet connectedness. Connectedness is understood to be the result of a variety of goals, notably including action orientation and play. For instance, Lenhart et al. (2000), in their study of people's motivations to get online or stay offline, note that about 41% of those without Internet access in the spring of 2000 were eager to get online. The "Eagers" cited a feeling of "missing out" and a belief "that the Net would help them find information." In spring 1999 the controversy over downloading and sharing music in the form of MP3 files led to the widely reported observation that the term *MP3* had replaced *sex* as the most frequently used search term in the top Internet search engines (Dennis, 2000; Jones & Sullivan, 1999; Wice, 1999). Commerce, recreation, and work are important elements of Internet use for most people, but do not appear to be central to the attractions of the Internet to researchers interested in the communication goals of seniors.

Although it may seem intuitively sensible that older people would seek out social support online (or anywhere else), there is a substantial body of literature that suggests that it may be normal for seniors to undergo a process of disengagement (Cumming & Henry, 1961; Larson, Zuzanek, & Mannell, 1985; Streib & Schneider, 1971). What may appear to younger people to be needless isolation may in fact be "a natural and normal withdrawal from social roles and activities, an increasing preoccupation with self, and decreasing involvement with others" (Atchley, 1997, p. 167). Disengagement may take many forms and varies in its intensity. If it is, in fact, normal and desirable, it may be counterproductive to encourage seniors to gain Internet access to reanimate their social lives. Antonucci, Sherman, and Akiyama (1996) note that social ties play a complex role in older people's lives. On one hand, "Substantial evidence has accumulated over the years indicating that people who have larger social networks, more social supports, and are better integrated into the social fiber of their community are less likely to die" (p. 513),

but the sheer size of one's social network may not be as important as its quality. An older person's satisfaction with relationships has "a greater inhibiting effect on depression than more objective measures, such as number of social ties" (p. 513). As their oldest friends and relatives, with whom they have cultivated their most rewarding relationships, pass away, seniors often eschew attempts to develop new friendships of equal depth. There is insufficient time for such relationships to mature (Antonucci et al., 1996).

Shah, McLeod, and Yoon (2001 [this issue]) show that where the Internet is concerned, older people are less likely to exchange information than younger people. What information exchange does take place among young people is associated with increased trust and civic participation. But Shah et al. find that information exchange does not lead to trust and civic participation among older respondents. Older people appear to use their Internet connections for different purposes than younger people and with different outcomes.

The Digital Divide

The digital divide between old and young is documented by Lenhart et al. (2000) and the U.S. Department of Commerce (NTIA, 2000). In their national survey of over 12,000 respondents between March and August 2000, Lenhart et al. found that only 13% of respondents older than 65 had Internet access, whereas 65% of those younger than 30 had Internet access. The divide persists, albeit to a smaller extent, after controlling for education and income. People older than 65 report much less agreement with some attitude- and goal-related questions regarding the Internet than do people younger than 30. Seniors are about half as likely as younger respondents to agree with such statements as, "The Internet would help me find things" and, "I'm missing out by not being online" (Lenhart et al., 2000). Cost does not appear to explain much of the divide. When asked if the Internet is too expensive, only 29% of seniors agree, compared with 47% of those younger than 30. Older Americans also tend to report more fears regarding privacy online than do younger Americans.

It does not appear from Lenhart et al.'s (2000) data that Americans are particularly likely to give up Internet access as they age, at least not due to age per se. In fact, Net dropouts, people who once had Internet access but did not at the time they were interviewed, are relatively young (Lenhart et al., 2000). Losing ownership of a computer or a job that provided a computer explains the dropout status of more than one third of those who drop off the Internet. Only 11% cite cost as the reason they lost access. The pattern of responses from dropouts does not suggest a tendency for people to drop out as they get old. The Department of Commerce (NTIA, 2000) reports that

individuals older than 50 "are among the least likely to be Internet users. . . . However, individuals in this age group were almost three times as likely to be Internet users if they were in the labor force than if they were not" (p. xvii). For many, losing access appears due to relatively temporary or involuntary statuses.

Changes in life goals that correlate with aging may not lead seniors to give up Internet access. The divide is more likely the result of this particular generation of seniors not having integrated Internet use into their work and school lives before retiring. In fact, Lenhart et al. (2000) note that 81% of those who say they will never go online are older than 50, and more than half of respondents older than 65 say they will never go online. These numbers must diminish in the next generation, because Lenhart et al. report that Internet access among those less than 40 years old is more than 60%, and the Commerce Department reports that Internet adoption is rising for those older than 50 at a rate of 53% compared with 35% for the population as a whole (NTIA, 2000, p. xvi).

Studies by Cody et al. (1999) and White et al. (1999) suggest that providing training to the existing generation of seniors may increase their willingness to use the Internet, and that increases in seniors' well-being can result from activity online. Cody et al. provided a 4-month training program using WebTV connections "in 11 assisted living and independent living facilities" (p. 274), offering 292 seniors a chance to acquire and sharpen computer skills. Cody et al. found that seniors who take advantage of their new skills to surf the Internet reported "increased feelings of social support, connectivity, and reduced technology-related anxiety" (p. 281). White et al., in a smaller sample but with a control group of seniors who did not receive training, found that computer use resulted in lower scores on the UCLA Loneliness Scale (Russell, Peplau, & Cutrone, 1980) in the 2 weeks immediately following training. Positive impacts of training appeared to diminish by the time the 5-month follow-up period elapsed, but given the limitations in the design of the study and the corroboration Cody et al.'s findings lend to some of the basic premises of White et al., it appears that a variety of goals important to seniors can be met online.

Cody et al. (1999) also offer some insight into seniors who decide not to go online. There was a loss of 41% of the original 292 recruits due in one way or another to their perceptions that learning WebTV would be too difficult or time consuming. Those who stayed with the training program tended to have lower levels of computer anxiety, higher levels of computer efficacy, and more positive attitudes toward aging. The authors suggest that future attempts to address the digital divide by providing training "should focus on reducing

anxiety and building efficacy (and to do so early) and feature lessons phrased optimistically and in encouraging formats" (p. 281). This is somewhat consistent with the fears of some seniors that Lenhart et al. (2000) describe, particularly regarding privacy. Reducing anxiety and providing seniors with enough skill to guard their privacy may diminish their fears of going online.

Hypotheses

The digital divide alone provides reason to believe that there is less Internet connectedness among seniors than younger people. But add to that the goals of seniors, which are often described in ways that suggest they have a relatively narrow scope of goals for which the Internet will prove helpful, and it seems increasingly plausible that connectedness, which by definition is an attribute only of seniors with access, will be lower for seniors than the young. The relative likelihood of seniors to be out of the workforce or to work in places without computers also suggests that they will have a more narrow access scope than those who can combine access from home with work or school access, thus diminishing connectedness.

Hypothesis 1: Age has a negative association with Internet access, after controlling for income, education, and gender.
Hypothesis 2: Age has a negative association with Internet connectedness, after controlling for income, education, and gender.

For seniors who are online, their relatively low connectedness may be traceable to specific factors; thus, controlling for those factors may shed light on the origins of their relatively low connectedness. For instance, because overall connectedness includes some work-related goals and access, removing these from consideration may erase any observed differences between levels of connectedness between old and young.

Hypothesis 3: The relationship between Internet connectedness and age is significantly reduced when employment status and employment-related components of connectedness are controlled.

The multidimensional nature of the concept of connectedness suggests that another difference between older and younger people may be rooted in specific dimensions of connectedness. The history and context dimension may distinguish old and young because, ironically, seniors are less likely to have had long histories of computer use. The computer was unlikely to be found in most work settings in the mid-1980s (Rice, 1984). Older people's

work careers would have been over or in their last stages as the Internet was taking off in the late 1990s, and of course the formal education of most people aged 65 in 2000 would have taken place largely before even mainframe computers were common. The literature also suggests a limited task scope for seniors, because task scope is operationalized in terms of work-related, school-related, and personal tasks.

Hypothesis 4: Age is negatively correlated with scores on the history and context dimension of Internet connectedness.

Differences in scores between old and young on the scope and intensity dimension of connectedness may not be as distinctive as those for the history and context dimension. Although previous research tends to be designed to focus on understanding goals (such as well-being or social support), the results of those studies sometimes report seniors using their Internet access for recreation. White et al. (1999) report that among the seniors they studied, "Popular Internet sites included sports pages, library pages, and tours such as the White House, the Smithsonian, and the Sistine Chapel" (p. 370). Cody et al. (1999) report that seniors who were "more highly connected spent more time investigating a range of services and functions on the Internet" (p. 278). These results suggest that when old and young computer users are compared, there is no particular reason to expect them to differ significantly in terms of "the breadth and depth of activities in which [they] engage on the Internet," as Jung, Qiu, and Kim (2001) define the scope and intensity dimension. Nonetheless, exploration of the relationship between age and the scope and intensity dimension of the Internet Connectedness Index (ICI) is worthwhile.

Research Question 1: Is there any significant correlation between age and scores on the scope and intensity dimension of Internet connectedness?

The relationship between age and the third dimension of Internet connectedness, centrality, is also difficult to predict. Some research results suggest that older people may be less comfortable with the role of the Internet in their personal life. White et al. (1999) report that a few of their respondents expressed concerns about becoming addicted to the Internet. Lenhart et al. (2000) report that older respondents were more likely than others to express high levels of concern about privacy online. Concerns about spending too much time online or about guarding one's privacy may persist even if one does indeed connect to the Internet, so there may be some reason to hypothesize at least somewhat lower scores on the centrality dimension for seniors,

as seniors report a more negative evaluation of the Internet's effects on their personal lives. However, there is no theoretical or empirical reason to believe that dependency relations (which make up two thirds of this dimension) are particularly correlated with age.

Research Question 2: Is there any significant correlation between age and the centrality dimension of Internet connectedness?

The research of Cody et al. (1999), White et al. (1999), and Wright (2000) demonstrates the ability for Internet access to address specific needs of seniors related to social support and feelings of well-being. The opportunities the Internet offers to make new friends, find amusing and educational sites to visit, and keep in touch with distant relatives may make Internet access particularly attractive to seniors whose real life offers fewer opportunities for personal interaction. Seniors living alone (unlike those studied by Cody et al. and White et al., all of whom were living in communal residences), those who are widowed, and those without jobs may be most likely to crave more opportunities for social support gained online. In her discussion of seniors' reactions to the death of a spouse, Martin-Matthews (1996) notes that the kind of communication available online may be particularly desirable:

> Researchers have also questioned the assumption of the inherent value of social support. Loose, low-density networks, rather than tightly bound, all embracing networks, may be most appropriate in enabling widowed men and women to develop new social roles consistent with their new status. (p. 623)

Of course, any hypothesized need for online interaction may be mediated by inability to gain the necessary training to take advantage of the Internet. As Cody et al. (1999) found, training significantly increased their subjects' ability to take advantage of the Internet, and seniors lacking access to suitable training may not be able to take advantage of the potential the Internet offers for easing any feelings of loneliness—that is, their communication infrastructure may inhibit the pursuit of even strongly felt goals regarding social relations. We propose to examine the role of indicators of possible isolation in relation to Internet connectedness among seniors.

Research Question 3: What evidence is there that indicators of social isolation are significantly related to Internet connectedness among senior citizens?

Method

Survey Respondents

The Metamorphosis survey, in which the present data were gathered, is part of an ongoing, in-depth study of the nature of community in a changing communication ecology. The study focuses on seven major residential areas that lie within 10 miles of the Los Angeles Civic Center. Each area is studied by sampling from the ethnic group that has set the tone and character of the area. These areas and ethnic groups are: (a) Mexican-origin residents of East Los Angeles, (b) African American residents of Greater Crenshaw, (c) Korean-origin residents of Greater Koreatown, (d) Central American–origin residents of Pico Union, (e) White and predominantly Protestant residents of South Pasadena, (f) White and predominantly Jewish residents of the Westside, and (g) Chinese-origin residents of Greater Monterey Park. (For a more detailed discussion of these areas and the method see the Metamorphosis Technical Report, available at www.metamorph.org.)

Random digit dialing was used to contact survey respondents in each of the seven areas. The sampling frame included those 18 years and older who reported being of the desired ethnicity for their target area. (The Westside and South Pasadena respondents were not screened for religion, only for White ethnicity.) Between 238 and 321 adults in each study area responded to a telephone survey, producing a total of 1,812 respondents. To ensure that all eligible respondents—especially relatively new immigrants—were able to participate in the telephone survey, the survey was administered in Spanish, Korean, Mandarin, Cantonese, and English. Respondents were given their choice of any of these languages. The telephone surveys were conducted between June 1998 and December 1999.

The response rate was low (31%), calculated by dividing the number of completed interviews by the number of theoretically eligible phone numbers. This methodology, recommended by the Council of American Survey Research Organizations (Frankel, 1982), is the most conservative way of calculating response rates. It takes into account all the phone numbers called. Despite the fact that the phone interview was relatively long—40 to 45 minutes—the cooperation rate was relatively high (62%).[1]

The main reasons for a low response rate reside in the particularities of the Los Angeles telecommunication infrastructure and its clientele. For 39% of all the numbers called, eligibility to participate (by geographic location and ethnicity) could not be determined due to either no answer or an answering machine. Despite five callbacks, no actual person could be identified at the

other end of the line. In addition, the general public apprehension about telephonic surveys has lowered response rates in scientific research and in the polling industry more generally (Brady & Orren, 1992; Keeter, Kohut, Groves, & Presser, 2000). It is estimated that 40% to 50% of Los Angeles households have unlisted numbers, and this suggests a general disinclination to receive phone calls from strangers.

Although undesirable, a low response rate does not necessarily translate into response bias. Keeter et al. (2000) compared two different survey administration protocols, one employing much effort to reach respondents by phone that resulted in 60% response rate, and the other employing less effort to reach respondents that resulted in a 36% response rate. They then compared differences along 91 variables and found that the average difference was approximately 2 percentage points.

Table 1 presents a crosstabulation of respondents from the seven study areas by age and Internet connectivity.

The Internet Connectedness Index

The Internet Connectedness Index (ICI) is constructed to reflect a multidimensional and ecological approach to the relationship between the Internet and individuals (Jung, Qiu, & Kim, 2001). It is an empirical tool to measure various levels of connectedness to the Internet among individuals. This article explores three subindices derived from factor analysis of the nine items included in Jung et al.'s ICI. The ICI presumes at least minimal access to the Internet on the part of respondents, so it was only administered to respondents who claimed to have access to the Internet (43% of all respondents). The areas differed significantly in the amount of Internet connectivity within, from 63% in South Pasadena (White, Protestant) and the Westside (White, Jewish) to 16% in East Los Angeles (Mexican origin).

The three subindices of ICI include (a) the history and context of Internet connectedness, (b) the scope and intensity of Internet connectedness, and (c) the centrality of Internet connectedness.

History and context of Internet connectedness deals with external and physical circumstances in which individuals connect to the Internet. It is constituted of three items: home computer history, task scope, and site scope. Home computer history is operationalized as the number of years a person has owned a PC at home (ranging from less than 1 year to 2 years, 3 to 6 years, and more than 6 years). Task scope concerns the number of tasks for which a person connects to the Internet. Respondents were asked if they connect to the Internet for work-related, school-related, and personal-related tasks. The

Table 1
Crosstabulation of Respondents by Neighborhood, Age, and Internet Connection (in percentages)

Ethnicity	Neighborhood	Age (years) 18 to 25	26 to 35	36 to 45	46 to 59	60 or older	Total
White/Protestant	South Pasadena	84	85	71	72	25	63
White/Jewish	Westside	82	83	85	73	25	63
Chinese origin	Greater Monterey Park	93	76	52	39	8	53
African American	Crenshaw	68	51	48	49	12	44
Korean origin	Greater Koreatown	73	52	26	7	9	38
Central American origin	Pico Union	39	17	6	8	8	18
Mexican origin	East Los Angeles	40	14	2	14	0	16
Total		65	47	41	46	15	43
n		291	445	399	344	330	1,809

answers to these three questions were aggregated to indicate how many task purposes a person has (i.e., how broad task scope is). Site scope is created by adding up the number of places where a person connects to the Internet, which includes home, work, school, a community center or organization, a public library, and a cybercafe or Kinko's. Responses to the site question were capped at four or more for purposes of scale construction. The result was three items with either three or four response categories, which could be multiplied to produce a factor of 12 that was summed and divided by 3 so that the subindex could range from 1 to 12. Reliability analysis of this subindex yielded alpha = .84.

Scope and intensity of Internet connectedness examines people's goals for connecting to the Internet, and the breadth and depth of activities in which people engage on the Internet. The three items that constitute this subindex are (a) goal scope, (b) activity scope, and (c) time spent on interactive online activities. Goal scope was derived by asking how many of six goals respondents pursued by participating in online activities. The six response categories included two understanding goals, to stay on top of events and groups that you care about (social understanding) and to express yourself or your opinions (self-understanding); two orientation goals, to accomplish business, financial, or work tasks (action orientation) and to get advice on how to deal with other people such as doctors and other health professionals (interaction

orientation); and two play goals, to play or amuse yourself (self-play) and for social reasons like making new friends (social play) (Ball-Rokeach, 1985; Loges, 1994). These goals form bases for variations in individual-media connectedness in previous studies of television, radio, magazines, and movies (Ball-Rokeach, Rokeach, & Grube, 1984; Grant, Guthrie, & Ball-Rokeach, 1991; Loges, 1994; Skumanich & Kintsfather, 1998).

Activity scope was measured by asking how many of 10 activities the respondents mentioned in response to the question, "What Internet or Web activities do you participate in, other than e-mail?" Response categories were bulletin boards (BBS), chat rooms or IRC, MUDs/MOOs/MUSHs, game playing/online gaming, mailing lists, newsgroups/USENET, research/information, shopping, and surfing the Web. This item was included to see how broadly individuals participate in various online activities.

Time spent on interactive online activities was included to see how much a person incorporates the unique feature of the Internet, which is to interact with other people online. It indicates the intensity of people's connectedness to interactive online activity based on the question, "Not counting personal e-mail, how often do you participate in any online activities interacting with other people (such as newsgroups, bulletin boards, chat rooms, MUDs, game-playing)?"

Little variance in response to these items was observed, and each of these items had to be coded as binary variables, where choosing none of the goals or none of the activities or spending no time in interactive online activities was coded as 1, and choosing one or more goal or activity or spending at least some time in interactive online activity was coded as 2. (Choosing no activities indicated using the Internet only for e-mail.) To produce items compatible in scale with the other subindices, binary responses were multiplied by 6 (to produce a factor of 12), summed, and divided by 3 so scores could range from 1 to 12. Reliability analysis of the scope and intensity subindex produced alpha = .94.

The third subindex is the centrality of Internet connectedness. Centrality is the degree to which a certain medium is embedded into one's everyday life in the context of other coexisting communication media. In the case of Internet connectedness, centrality of the Internet indicates the relative embeddedness of the Internet in a person's communication matrix within a larger communication infrastructure. The centrality dimension of the ICI included (a) evaluation of the Internet's effects on one's personal life, (b) computer dependency relations, and (c) Internet dependency relations. These items measure people's subjective evaluations and perceptions of the Internet. The first item, the evaluation of Internet effects on personal life, is based on the survey question of whether the Internet has a positive or

negative effect on the respondent's life. Responses were originally on a 5-point Likert-type scale ranging from *very negative* to *very positive*, with a neutral midpoint. Responses clustered in the positive end of the scale, so responses were collapsed such that *negative* and *neutral* were scored 1, *somewhat positive* scored 2, and *very positive* scored 3.

The second and third items, computer dependency relations and Internet dependency relations, are derived from a unique operationalization of the individuals' connectedness. Respondents were asked, "Imagine that you woke up tomorrow to find that the computer/Internet had vanished. Using the 10-point scale where 1 means you wouldn't miss it at all because your daily life could proceed as normal and 10 means you would miss it an extreme amount, how much would you miss being able to use your computer/go online?" This item encompasses people's cognitive, affective, and evaluative perceptions about the Internet, and directly captures the subjective centrality of computers or the Internet in people's everyday lives. The distribution of responses to the computer dependency item was skewed such that responses were collapsed into three categories, where original responses from 1 to 5 were coded as 1, original responses from 6 to 9 were coded as 2, and responses of 10 were coded as 3. Internet dependency was also skewed, but not quite so dramatically. An original response of 1 was not recoded, but 2 to 4 was recoded as 2, 5 to 7 was coded as 3, and 8 to 10 was coded as 4. The recoded responses were multiplied into multiples of 12, summed, and divided by 3. Reliability analysis of the items in this subindex produced a marginally acceptable alpha of .66.

To further test the dimensional structure of the ICI, factor analysis was performed. Three factors emerged (with eigenvalues greater than 1), accounting collectively for 70% of the variance in the factor solution. Table 2 presents rotated factor loadings for the nine items. An oblique factor analysis, in which factors are allowed to correlate with one another, is reasonable in this case, where it is expected that the three subdimensions of Internet connectedness are related to each other (i.e., as parts of a larger concept). Allowing the factors to rotate clarifies the distinction between the factor loadings of items in each factor. Each item loaded in its predicted factor, with rotated factor loadings in excess of .6 in all cases.

Scores for the entire nine-item ICI were calculated by summing the multiples of 12 and dividing by 9, so that scores on the overall ICI could range from 1 to 12. The reliability is .71 for all nine items, and average inter-item correlation was .23. Factor analysis and reliability analysis demonstrate that Internet connectedness is a multidimensional concept and as presently measured is best considered in its dimensions.

Table 2
*Factor Analysis of Internet Connectedness Items (*n = *765)*

Theoretical Dimension	Item	Rotated Factor Loading
History and context	Years own PC	.78
	Task scope	.84
	Site scope	.68
Scope and intensity	Goal scope	.98
	Activity scope	.90
	Time online	.98
Centrality	Evaluation	–.79
	Miss PC	–.70
	Miss Internet	–.83

Note. Rotated factor loadings are derived from oblique rotation with Kaiser normalization.

Independent Variables

Respondents were asked their age on their last birthday, their household income from the previous year (in ranges staggered from less than $20,000 to more than $100,000), their employment status (responses included working 35 or more hours per week, working fewer than 35 hours per week, temporarily out of work, a homemaker, a student, retired, not currently employed, permanently disabled, or a volunteer), and their education (in levels from eighth grade or less to graduate degree). The telephone interviewer recorded the gender of the respondent.

Results

Respondents from the 7 study areas differed significantly in their rates of Internet connection (see Table 1). The older White residents of South Pasadena and the Westside, particularly those older than 35, were more likely than those of any other neighborhood or ethnicity to have some sort of connection to the Internet. Of the oldest age group, those older than 60, only 51 respondents (about 15% of this group) from all neighborhoods had Internet access. The small number of non-White respondents older than 60 with Internet access makes further analysis of the relationship between ethnicity and access difficult, and calls for caution in drawing conclusions from other analyses of age.

Digital Divide

To test the hypothesis that the likelihood of having Internet access decreases as the age of respondents increases, a logistic regression analysis was per-

Table 3
*Logistic Regression Analysis of Predictors of Internet Access (*n = *1,774)*

Variable	*B*	*SE*	Wald	*p*	*R*	Exp(*B*)
Age	–.06	.00	201.63	.00	–.29	.94
Income	.30	.04	70.44	.00	.17	1.35
Education	.60	.04	181.08	.00	.27	1.83
Gender (male = 0)	–.37	.12	9.48	.00	–.06	.69
Constant	–.65	.27	5.60	.02		

Note. Nagelkerke *R*-squared = .44.

formed, controlling for income, education, and gender (three variables that have been shown to correlate with Internet access). Each independent variable in the logistic regression equation was significantly related to Internet access, including age in the predicted direction (see Table 3). Age produced the highest magnitude partial coefficient of all independent variables in the equation ($R = -.29$), and the log odds of not having Internet access as one's age increases by a year were .94. Because the relationship between age and Internet access may not be linear, two nonlinear models were also tested in which the square of age and its cube were tested. Neither nonlinear model produced a better fit to the data. The first hypothesis is supported. Figure 1 illustrates the digital divide by age in three Metamorphosis samples.

Internet Connectedness

Scores on the ICI (as a whole and in its three dimensions) were regressed on age, controlling for income, education, gender, and study area (South Pasadena was the omitted reference category) to test the second, third, and fourth hypotheses and to explore Research Questions 1 and 2. Age is a highly significant predictor of ICI in all but the centrality dimension, in the (predicted) negative direction (see Table 4). The differences in mean ICI scores for people in different age ranges are illustrated in Figure 2.

Hypothesis 3 was that the differences in Internet connectedness associated with age demonstrated in Table 4 are in part due to the different employment circumstances of older people, which deprive them of some opportunities and incentives to gain Internet access. When employment status was added to the regression equations in Table 4 (as a dummy variable in which having a full- or part-time job was coded as 1), it proves to be nonsignificant as a predictor of ICI scores overall and has no apparent effect on the magnitude of the standardized beta coefficients for age in any model to which employment status is added. Differences in Internet connectedness between the old

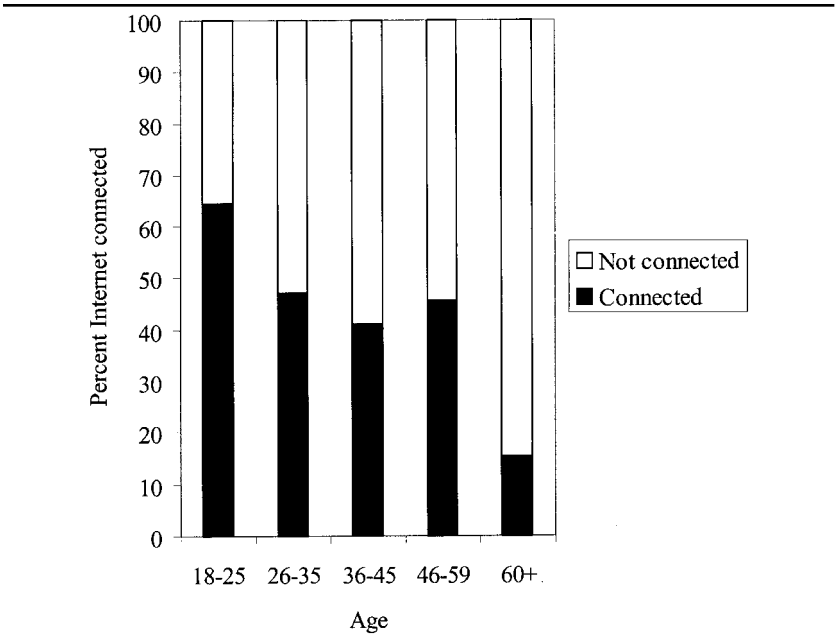

Figure 1. Age by Internet Connection (*N* = 1,809)

and young do not appear to be the result of different employment statuses. Employment contributes to higher scores on the context and scope of Internet connectedness, but is otherwise not significantly related to the dimensions of connectedness.

Dimensions of Connectedness

Hypothesis 4 predicted that age would be negatively correlated with the history and context dimension of the ICI. This hypothesis is supported by the regression results in Table 4.

Research Question 1 asked if there was a significant relationship between age and the scope and intensity dimension of the ICI scale. In fact, regressing scope and intensity scores on age reveals a highly significant negative relationship. Older respondents appear to use the Internet for a more narrow range of goals than younger respondents.

Research Question 2 asked if there was a significant relationship between age and the centrality dimension of the ICI. The results of regressing centrality scores on age, controlling as usual for income, education, and gender, produce a nonsignificant regression coefficient of –.05.

Table 4
*Regression Analysis of Internet Connectedness (*n = *760)*

Variable	Model 1	Model 2	Model 3
Internet Connectedness Index (all dimensions)			
Age	–.21***	–.24***	–.23***
Income	.20***	.17***	.16***
Education	.15***	.12**	.11**
Gender (0 = male)	–.07*	–.08*	–.07*
Westside		–.04	–.04
Monterey Park		–.01	.00
Crenshaw		–.07	–.07
Koreatown		–.14***	–.13**
East Los Angeles		–.09*	–.09*
Pico Union		–.08	–.08*
Employment (0 = not employed)			.06
Constant	8.04***	8.64***	8.51***
R-squared	.09	.11	.11
History and context			
Age	–.27***	–.33***	–.31***
Income	.29***	.23***	.22***
Education	.39***	.28***	.28***
Gender (0 = male)	–.05*	–.05**	–.04*
Westside		–.05*	–.05*
Monterey Park		.04	.05
Crenshaw		–.09***	–.10***
Koreatown		–.16***	–.16***
East Los Angeles		–.23***	–.23***
Pico Union		–.24***	–.24***
Employment (0 = not employed)			.06**
Constant	4.85***	7.17***	6.76***
R-squared	.40	.46	.47
Scope and intensity			
Age	–.26***	–.26***	–.26***
Income	.07	.08	.08
Education	–.08*	–.07	–.07
Gender (0 = male)	–.05	–.05	–.05
Westside		–.02	–.02
Monterey Park		.00	.00
Crenshaw		.06	.06
Koreatown		–.05	–.05
East Los Angeles		.04	.04
Pico Union		.02	.02
Employment (0 = not employed)			.00
Constant	11.29***	11.13***	11.13***
R-squared	.08	.09	.09
Centrality			
Age	–.05	–.06	–.06
Income	.10*	.07	.06
Education	.18***	.15***	.14***
Gender (0 = male)	–.03	–.03	–.03
Westside		.00	.00

Table 4 continued

Variable	Model 1	Model 2	Model 3
Centrality			
Monterey Park		–.05	–.04
Crenshaw		–.10*	–.10*
Koreatown		–.09*	–.08
East Los Angeles		–.07	–.07
Pico Union		–.02	–.02
Employment (0 = not employed)			.08*
Constant	6.57***	7.34***	7.03***
R-squared	.05	.06	.07

Note. Coefficients are standardized betas. Table includes only respondents with Internet access. *$p < .05$. **$p < .01$. ***$p < .001$.

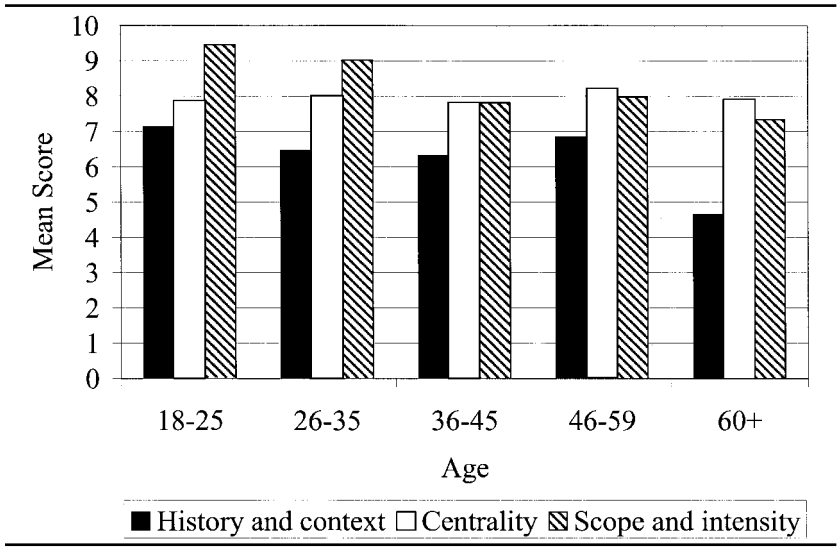

Figure 2. Age by Internet Connectedness (n = 760)

Figure 2 illustrates that scores on the scope and intensity dimension fall precipitously across five age categories, and scores on the centrality dimension stay within a narrow range. Scores on history and context rise until the oldest age group, in which the average score is roughly equal to that of the youngest group.

The effect of ethnicity (reflected by the study area in which a respondent lives) is most pronounced in the history and context dimension of Internet

connectedness. The unequal distribution of Internet access shown in Table 1 is most telling in its effect on the ability of residents to develop a history of computer experience and a variety of places from which to gain access. Controlling for these substantial inequalities by neighborhood does not substantially affect the beta for age in the history and context dimension.

Social Isolation

Our third research question concerned the possible relationship between indicators of social isolation correlated with age and people's Internet connectedness. We explored this question in a number of ways. We found no significant relationships between age, connectedness, and social isolation indicators such as marital status, number of people in the household, organizational membership, feelings of belongingness in one's residential neighborhood, and location of close friends or family members.

Discussion

This study demonstrates that the digital divide between old and young people extends beyond questions of access. Once online, older respondents differ from their juniors in the nature and context of their Internet use, indicated by support for our general hypothesis (Hypothesis 2) that older people would report lower overall Internet connectedness. That difference in connectedness is specifically due to older people's pursuing a narrower scope of goals and activities online, using fewer Internet applications, and using the Internet in fewer places than younger people. The relationship between age and Internet connectedness remains, even controlling for substantial inequalities of access by ethnicity. Despite these differences in scope and intensity of Internet connectedness, however, older people subjectively evaluate their Internet connection to be as central to their lives as younger people do.

The age divide in Internet connectedness due to differences in goal scope may be subject to change. The scope of goals on which research to date has focused seems to exclude play. Expanding the goal scope of older Internet users may involve the development of computer games suitable for seniors. Taub (2000) describes seniors playing bridge with people across the globe and other forms of social play. Solitary play is also not unusual online, nor is it unusual for seniors. Larson et al. (1985) found that older people spend a considerable amount of time alone but not lonely. Particularly in the case of married seniors, "Solitude was clearly not a condition of unmanageable loneliness or misanthrope. Rather it was a positive opportunity, a chance for focused thought and absorption" (p. 380). Future research might focus on the

development of entertainment sites online tailored to the expressed interests of seniors—such as Seniornet, studied by Furlong (1989), but much changed since then—to test for increases in the goal and activity scope of older people when they find opportunities to play as well as to understand their world.

The survey by Lenhart et al. (2000) reveals another possible reason why the goal and activity scope of seniors is narrower than younger respondents': concerns about privacy. If older people are more reluctant to divulge credit card information online, they may shop less. If they fear unsolicited e-mail, they may eschew newsgroups (where posting a message is frequently followed by a barrage of spam). If they worry about harassment or other unwelcome communication, they may stay out of open chat rooms. Internet training for seniors may take privacy concerns to heart and address those concerns more earnestly than may seem necessary to younger people.

There is nothing about the relatively narrow range of goals older respondents pursue that would suggest that the Internet or computing in general must be less important to them than to younger people. The centrality of the Internet and computing do not correlate with age. Whether one uses the Internet for a wide or narrow range of applications, it is possible to find it indispensable, easily dispensed with, or something in between. If the only thing a person uses the Internet for is to communicate with a grandchild, it seems unsurprising that he or she would report that the Internet is as central to daily life as if the person were also shopping, playing games, and entering chat rooms.

The relationship between age and Internet connectedness was constant even when controlling for the diverse ethnic backgrounds and urban residences of these respondents. Matei and Ball-Rokeach (in press) have noted that Korean residents of Los Angeles's Koreatown report the lowest level of belonging to their neighborhoods among the Metamorphosis study groups ("belonging" refers to a combination of feelings and behaviors that indicate commitment to one's neighborhood), but are more likely than other ethnic groups to have friends online. The results of the present analyses show that Koreatown residents score particularly low on the history and context dimension of connectedness, indicating fewer connection points and fewer years of home computing.

Although in fact most of the areas had significant negative coefficients in this dimension (the comparison group was the White residential area of South Pasadena), the Koreatown results are instructive when compared with those from the Chinese-origin respondents from Monterey Park, which did not follow the trend of lower scores in history and context. Monterey Park is a more suburban and affluent area, and is physically much larger than Koreatown. These differences highlight the importance of avoiding

assumptions that Asian Americans share enough in common to make their experiences in Los Angeles indistinguishable. (Another pair of ethnic groups that might ordinarily be combined in demographic studies are the Central American–origin residents of Pico Union and the Mexican-origin residents of East Los Angeles. Coefficients for these two groups are virtually identical on every dimension of ICI.)

The present study has noteworthy limitations. One is the introduction of a new scale. Although the rich concept of connectedness may be as valuable as we think it is, any first try at measuring a complicated concept must be treated carefully. The relatively low alpha of the centrality subindex particularly suggests that interpretation of the results of hypothesis tests in which that index is involved should be treated with caution. The low variance observed in responses to the goal scope item suggests that more work must be done to craft questions that more closely indicate the goals people pursue online. That is a validity problem. Low variance in the activity scope responses is less troubling from a validity standpoint, because the items referred to activities readily recognizable to those who take part in them; but it is still troubling for scale construction. Future use of the activity scope items will have to reflect technological developments that make new activities available and render others obsolete.

Also, although the sample size is large, the nature of the sample must be kept in mind. Respondents to this survey were deliberately chosen to include sizable numbers of representatives of specific ethnic backgrounds. Although in most ways this is a central strength of the Metamorphosis project as a whole, this particular analysis of the Metamorphosis data can only be cautiously generalized to the larger population, because some ethnic groups are not represented here and some are deliberately oversampled. Low levels of Internet access for older respondents outside of the White neighborhoods sampled here also minimizes our ability to generalize our findings about connectedness and age even to the ethnicities included in the Metamorphosis study. The present study adds context to valuable prior research into the different relationships older people develop with the Internet, but further work is clearly needed to fully explore the nature and significance of the digital divide between older and younger people.

Conclusion

When one considers the overall communication action context of older people in terms of their goals, available resources, communication skills, and the relationships they seek to maintain, their lower levels of Internet connectedness may be understandable and unproblematic. Their goals may

call for less social interaction, particularly with new people. Their desire to protect resources (by not exposing financial information online) and their need to preserve resources (if fixed incomes make computers and Internet fees unaffordable) may discourage Internet connections. Their desire to hone new skills, such as using communication software and the use of emoticons (i.e., the smiles and winks formed from punctuation that have become common in e-mail), may be lower than others' if the people they most wish to contact are more conveniently contacted through old media such as the telephone or a card, let alone a visit. Older people may have lower Internet connectedness because they don't want higher Internet connectedness.

It could be that the present digital divide is a generational phenomenon that will disappear in time. If so, age per se is not the relevant variable. The next generation of seniors will have spent more of their work lives surrounded by computers, honing skills and gaining confidence in commercial and personal transactions conducted online. We have reason to be cautious in ascribing the divide to a generational effect, however. Although it is true that seniors in this study who had jobs had significantly more Internet access, that access did not translate into significantly different scores on the connectedness index. An American who is older than 60 in the year 2040 may have many of the same characteristics, predispositions, and status-related constraints on Internet connectedness as our respondents reported. It is reasonable for older people to be more guarded of their privacy, particularly in financial matters. There is no reason to expect that to change. It is reasonable to expect that the lives of seniors will demand less surveillance of the social and commercial environment—in fact, the retirement communities and nursing homes that a minority of seniors live in are often characterized as remote enclaves, removed from the world the rest of us inhabit. This research does not resolve the question of whether the digital divide is a generational phenomenon, but the divide in connectedness, particularly in the scope and intensity dimension, suggests that observable differences between the ways old and young people use their Internet connections may survive this generation of seniors.

Is this digital divide a problem? It is if people transfer more and more of politics, commerce, education, and recreation to the Internet without contemplating the consequences of that change for people who, for good reasons of their own, prefer not to rely on that medium for those purposes. This study's results suggest that it may not be enough to bridge the divide by providing access through technology and training. It is not, after all, access to technology and training per se that is at stake. Those who provide technology and training are often seeking to expand access to the changing communities we are building, and access to the means of meeting familiar human goals, that

people intend to provide through technology and training. The present results suggest that solutions to the digital divide between old and young should keep the larger context of connectedness firmly in mind while the details of access are discussed.

Note

1. Cooperation rate is defined as (the completed interviews) divided by (the completed interviews + the suspended interviews + the terminated interviews + qualified but refused).

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