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Internet Connectedness and Inequality

Beyond the "Divide"

This article presents the Internet Connectedness Index (ICI), a measure for monitoring long-term inequalities in the quality of Internet connections among users, especially in terms of whether Internet connections will enhance the chances of people's upward mobility. This index is preferable to more established digital divide measures (e.g., gadgetry ownership or time online) for research on how the Internet is being incorporated into a world of structural inequalities. The ICI utilizes conventional time, history, and context measures, but goes beyond them to capture the scope and centrality of Internet incorporation into the everyday lives of diverse social groups. The validity and robustness of ICI vis-à-vis conventional ownership and time online measures are demonstrated in this article. In addition, the authors discuss theoretical, methodological, and policy implications based on the results. The analytical data are drawn from the Communication Technology and Community Program's Metamorphosis Project, an inquiry into the communication infrastructures of seven ethnically marked residential areas in Los Angeles.

How is the digital divide in access to Internet technology different from the divide in owning a Mercedes Benz? Is the digital divide a problem? The debate about the size and shape of a digital divide in access to the Internet is

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contradictory, with one side claiming that the disparity is inevitable and will narrow in the process of increasing levels of adoption (Birdsell, Muzzio, Krane, & Cottreau, 1998; Nie & Erbring, 2000; Powell, 2001; Thierer, 2000), and the other side finding that various kinds of inequities persist or may increase in the process of diffusion (Goslee, 1998; Lenhart, 2000; National Telecommunication and Information Administration [NTIA], 1999, 2000; Norris, 2001; Papadakis, 2000; UCLA Internet Report, 2000; Wilhelm, 2000). How the digital divide issue is perceived will surely lead to different diagnoses and prescriptions.

What is the digital divide? Does it mean that mere ownership of Internet connections, such as if we achieved a 90% diffusion, will make the digital divide a historical problem? Or does the digital divide describe more fundamental inequalities in people's connections to communication technologies? The digital divide is a metaphor for a large and persistent problem of unequal access to new communication technologies that is unlikely to be resolved by sheer diffusion of Internet or related technologies. The failure to own a Mercedes does not lead to the impediment in job, educational, and civic opportunities, whereas the failure to obtain appropriate Internet-related skills is likely to limit these opportunities. Even when compared with other resource-rich media, such as television, radio, or newspapers, computer technologies and the Internet vastly expand the available resources that are central to career development. When a technology becomes a resource for attaining or maintaining higher status in society, as computer-based technologies have increasingly become, unequal access to such technology becomes more than a question of ownership: The question of unequal access must address whether there is an ability to maximize the utility of the technology for pursuit of various goals. For example, an individual can own a computer with an Internet connection but not know how to utilize it as a way of getting (or keeping) a high-tech job. Similarly, if a technology is marketed to particular racial, gender, or age groups as a toy rather than a tool, the technology, although being successfully employed for entertainment purposes, may not necessarily contribute to the career enhancement of these groups.

Our purpose is to present a measure to gauge the postadoption aspects of Internet diffusion. In other words, the measure goes beyond the conceptualization of digital divide as it has been studied to date. Specifically, we have developed a measure called the Internet Connectedness Index (ICI) that incorporates conventional time, history, and context measures but goes beyond them to capture the goals, activities, and centrality of Internet incorporation into the everyday lives of diverse social groups. In presenting the ICI, we begin with a brief review of recent reports and studies on the digital

divide, and then present the theoretical rationale that underlies our concept and measurement of Internet connectedness. In the following sections of the article, we present the ICI and demonstrate its validity and robustness vis-à-vis conventional ownership and time-based measures. We apply the ICI to a data set that is drawn from the Communication Technology and Community Program's Metamorphosis Project,[1] an inquiry into communication environments of seven ethnically marked residential areas in Los Angeles.

Limitations of Established Measures Employed in Research on the Digital Divide

Research on the digital divide follows a long tradition of research on the diffusion and effects of other communication technologies (Douglas, 1987; Fischer, 1992; Marvin, 1988; Rogers, 1983; Rogers & Shoemaker, 1971), as well as early personal computer diffusion studies (Dutton, Rogers, & Jun, 1987; Dutton, Sweet, & Rogers, 1989). The majority of studies on the digital divide, especially earlier ones, have used binary measure (access/nonaccess) or a time-based measure (number of hours spent on certain media) as indicators of the gap between haves and have-nots, which have been widely used in media and technology studies (Kraut, Scherlis, Patterson, Kiesler, & Mukhopadhyay, 1998; Nie & Erbring, 2000; Robinson, Kestnbaum, Neustadtl, & Alvarez, 2000).

Limitations of Dichotomous Conceptions and Measures of the Digital Divide

The digital divide metaphor affords an opportunity to identify the inequalities between the technological haves and have-nots. Translation of the metaphor into a dichotomous comparison between computer owners and nonowners, or a comparison of those with and without Internet access, is appropriate for studies concerned only with the diffusion of the technology. Such dichotomous comparisons, however, are not sufficient when discussing the social consequences of the technology's diffusion. When exclusive emphasis is placed on owning or having access by using these dichotomous have/have-not comparisons, the assumption is that either all haves will incorporate the technology into their everyday lives in the same manner and to the same degree or that the difference in the quality of Internet connection among the haves is unimportant. In other words, these measures introduce an element of technological determinism that ignores the social context in which the technology is incorporated.

Limitations of Time-Based Measures

As the Internet diffusion process gathered momentum, research on the digital divide began to shift its focus from simple access to measuring the amount of time spent online (Kraut et al., 1998; Nie & Erbring, 2000; Robinson et al., 2000). Nie and Erbring (2000) compared characteristics of regular Internet users with those of nonregular Internet users, and concluded that the more time people spend online (a) the more they lose social contact, (b) the less time they spend with traditional media, (c) the more time they spend working at home, and (d) the less time they spend shopping in "brick and mortar" stores. Nie and Erbring categorized users who are online for 5 hours or more each week as "regular users." Most time-based measures use frequency distributions from the data to distinguish between frequent and infrequent connectors, which result in difficulty of defending the cutoff line in a theoretical manner.

In addition, there is a dynamic relationship between time and established proficiency in computer media. A novice may need more time to accomplish what an experienced user can do quickly, and a certain level of proficiency may encourage further use and development of more skills. To fully understand a person's connection to the Internet, it is necessary to know what the person intends to accomplish by going online and what the person does on the Internet beyond the amount of time spent online.

The practice of measuring an individual's relationship with media in terms of time has dominated mass media research since the 1930s and 1940s, when universities and commercial research organizations began to conduct systematic surveys. In the past, time-based measures provided useful information because the inquiries focused on simple direct effects models and the research area was broadcast media—television and radio—whose programming was delivered in discrete blocks of time. With the emergence of more complex and indirect effects models, however, time-based measures have lost much of their implicit logic. Several scholars have pointed out that the same amount of time does not mean that people are using the media in the same way (Hawkins & Pingree, 1981; Moy, Scheufele, & Holbert, 1999; Norris, 1996; Shah, McLeod, & Yoon, 2001 [this issue]). If we reject the idea that simple exposure leads directly to the same effect, then what is the theoretical rationale for the assumption that the more time people spend on the Internet or with any other media channel, the more they will be affected by it?

Conventional time-based measures of Internet connectedness cannot tell us why people are connecting or how they shape their connections. Yet most would agree that these dimensions are just as (if not more) important as the

amount of connection time. This is particularly the case when the focus is on the personal and social effects of Internet connections, which must be considered in comprehending the more subtle aspects of the digital divide. When people have access to the Internet, the question becomes how they can and do construct the meaning and utility of their being connected to the Internet. Existing inequalities, even after gaining access to the Internet, can directly affect the capacity and the desire of people to utilize their connections for purposes of social mobility.

There are at least two practical, not theoretical, reasons for the persistence of time-based measures. First, they are relatively cheap to administer in the context of survey research. A single question may be employed, such as, "How many hours did you spend yesterday watching television?" Second, researchers who need to compare their findings with those reported in the literature feel compelled to employ comparable time-based measures. The inertia evidenced in the persistence of time-based measures when there is little theoretical basis for their use is understandable but not defensible. Even when the effect at issue relates to time displacement of some form, it is questionable whether the traditional time-based measures are adequate.

Multiple and Qualitative Dimensions of Media Connectedness

There is much complexity in everyday media environments, particularly in this multitasking era when people connect to more than one media channel at a time. The well-known phenomenon of having the television set on while reading, being online, or talking with other people makes it difficult to interpret measures of contact with a single medium. Moreover, the old-fashioned portrayal of an individual relating to one channel at a time becomes even more problematic as we move to communication environments where the same platform—for example, the personal computer—serves as a multimedia site (Flanagin & Metzger, 2001; Morley, 1992; Silverstone, 1999). Such changes in our communication habits and environments prod us to develop measures of contact that pose the problem of connection in relative rather than absolute terms—in this case, measures that contextualize Internet connections.

Several studies go beyond dichotomous and time-based measures to examine multiple ways in which people use the Internet. Reports (Neu, Anderson, & Bikson, 1998) from RAND (Anderson, Bikson, Law, & Mitchell, 1995; Bikson & Panis, 1999) used a network services variable representing use of a computer either at home or at work to connect to an electronic network. This variable receives a positive value if an individual uses a computer

in any one of the following ways: at home or at work for e-mail, at home to connect to bulletin boards, at home to connect to a computer at work, or at work for communicating with others (Anderson et al., 1995).

Wilhelm (2000, pp. 73-76) categorized information and telecommunication have-nots into three categories: immune to progress, who either never heard of the Internet or never used a computer before; peripheral access, who either have public computer and Internet access or own computer without the Internet access; and peripheral users, who use online services but not primarily as information and communication tools. He argues that these groups are distinguished by the different ability to participate in social and economic life of the larger community. Norris (1998) classified the Internet users into four categories: researchers, who use the Internet for e-mail and investigative purposes; consumers, who use the Internet for shopping and financial resource; expressives, who express views and opinions in newsgroups, bulletin boards, and chat rooms; and party animals, who go online to play games or for entertainment purposes. She found that the researchers have higher political knowledge than other groups.

Although research on the digital divide has begun to approach the issue with multivariate measures, few studies have developed an instrument that encompasses people's subjective and objective perceptions about their goals and orientations in using the Internet. Also, the categories used in the past measures do not have a firm theoretical ground. In sum, an empirical measure that stems from a theoretical conceptualization and reflects the multiple dimension of the relationship between people and the Internet has not been developed in past studies on the digital divide.

From Internet Use to Internet Connectedness

Our preference for the term *connectedness* rather than *use* reflects our theoretical orientation. Our orientation derives from media system dependency theory, which is presently being modified and expanded to communication infrastructure theory (Ball-Rokeach, 1985, 1998; Ball-Rokeach et al., 2000; Ball-Rokeach, Kim, & Matei, 2001 [this issue]). This is not the appropriate venue to explicate communication infrastructure theory, but it is necessary to comment briefly on the important conceptual distinctions between uses and connections because they enter into the rationale for how we constructed the ICI.

Although there are many variations among researchers who employ the term *use*, those who employ this term in research on the digital divide generally

share an implicit, if not explicit, conception of computer-based technologies as tools that autonomous individuals use to gratify their needs. The technology-society relationship is reduced to a technology-individual relationship couched in largely microfunctionalist or instrumentalist ways of thinking. Research has focused on identifying the range of uses, collapsing that range into categories of uses or users and attempting to account for variations among users in terms of psychological, sociodemographic, and other characteristics.

Among the scholars who criticize such microfunctional or instrumental views, some have tried to expand the technology-individual relationship into the context of a broader social structure (Ball-Rokeach, 1998; Beniger, 1986; Bourdieu, 1990; Dutton, 1996; Fischer, 1992). Bourdieu, in his theoretical and empirical project about the reproduction of social inequalities, notes that an instrumental view on human practice limits the analysis only to economic and mechanical causes. He presents the concept of "habitus," which are "common schemes of perception, conception and action" (p. 60) serving as the precondition for understanding the world. Applying this concept in the context of the technology-individual relationship, habitus can be understood as a principle that structures the ways in which individuals connect to a communication technology with different goals, tastes, attitudes, or expectations. Cultural capital—the knowledge, competence, attitudes, or a predisposition about cultural practices (Bourdieu, 1984)—also implies types of connectedness between technology and individuals. Attitudes, tastes, or goals in the specific contexts of technology use can be understood as forms of cultural capital that can be turned into other forms of capital, such as financial capital or social capital. Different classes own different amounts of cultural capital, which results in unequal opportunity in appropriating the Internet resources available to them. People's everyday use of the Internet, therefore, is not fully characterized by the access/nonaccess or the heavy/light use categories. A more profound theoretical conceptualization is necessary to capture the individual-technology relationships within the context of larger social conditions.

The term *connectedness,* developed in the communication infrastructure theory, reflects a multilevel and contextual way of envisioning the relationship between individuals and technology (Ball-Rokeach et al., 2001). The theoretical and research focus is on the nature of individuals' connections to a technology and how those connections are embedded in and affected by the complex and multilevel communication infrastructure in which we live. The breadth, depth, and integration of a communication infrastructure is produced by internal forces and its relationships with other infrastructures (e.g., political, economic, or technological).

A communication infrastructure is a storytelling system set in its communication action context (Ball-Rokeach et al., 2001). The storytelling system has multiple levels involving macro-level actors (e.g., media, political, or religious institutions), meso-level actors (e.g., linkage organizations), and micro-level actors (e.g., individuals and their interpersonal networks). Any particular way of communicating in the storytelling system is seen as part of a matrix of communication modalities, including new media, old media, and interpersonal communication. The communication action context is the physical, psychological, sociocultural, economic, or technological preconditions that promote or constrain the storytelling system (Ball-Rokeach et al., 2001). Computer-mediated communications, including the Internet, are thus treated as one part of a much larger fabric that is constructed, maintained, and changed by actors' communicative activities and by the environments that can enable or constrain their communicative action.

From this vantage point, the introduction and diffusion of Internet technologies are seen as changes in the communication infrastructure that are instantiated through individuals' constructions of Internet connections. The Internet is woven into the established communication infrastructure by connections in the storytelling system. Our opportunity to observe how the Internet is incorporated into the existing communication infrastructure is enhanced by measures that capture these connections.

Operating from this perspective, researchers are much less likely to see the digital divide as a problem of ownership of the technology than to see it as a problem of developing a relationship with the technology. A single dimension cannot capture this relationship. Instead, the relationship must be measured in terms of multiple dimensions of people's objective and subjective connectedness to the Internet. The Internet connection cannot be examined in isolation from all other alternatives present (and active) in the communication environment, whether they are traditional media, community or public media, or interpersonal communication. Finally, Internet connections cannot be understood without inclusion of the qualitative dimensions that affect people's motivational investments in those connections. Accordingly, our research inquiry has focused on capturing disparities among different social groups across multiple dimensions of people's Internet connections.

Research Inquiry

If our critique of conventional measures has merit, it suggests that their use may conceal important differences among income, education, age, gender, and ethnic groups with regard to the quality of their relationships to the

Internet. Thus, claims of closing these digital divides may be addressing only the most superficial issues of Internet access, thereby masking larger communication technology and inequality issues. In this article, we compare our multidimensional indicator of Internet Connectedness with a conventional time-based measure. Although several studies point out the limitations of time-based measure (Hawkins & Pingree, 1981; McLeod et al., 1996; Norris, 1996; Shah et al., 2001), few studies have empirically provided the evidence of the limitation (Moy et al., 1999). By comparing the time-based measure and the Internet connectedness measure, we attempt to test if our new measure is better able to capture a profound inequality in people's relationship to the Internet than the time-based measure. In particular, we focus on the different findings produced by our measure and the conventional time-based measure with respect to income, education, age, gender, and ethnic differences, and how these findings should make a difference when it comes to policy making. Our expectation is that the conventional time online measure would not correlate significantly with these demographic variables, whereas our new measure of connectedness would produce significant correlations.

Our measure, the ICI, is described below. It contains nine items, whereas the conventional measure is a single-item measure. On simple statistical grounds, a nine-item measure should have a greater likelihood than a single-item measure of producing significant outcomes. Our question, therefore, raises the practical issue of whether researchers interested in studying communication technology and inequality should go to the trouble and expense of employing multidimensional indicators of Internet relationships or whether they can save those costs by continuing to employ unidimensional indicators.

The ICI

The present version of the ICI is a revision of an earlier version designed to explore the globalization of everyday life, a thematic inquiry explored in the larger Metamorphosis Project (Ball-Rokeach, Gibbs, Jung, Kim, & Qiu, 2000; Gibbs, Ball-Rokeach, Jung, Kim, & Qiu, in press).

The ICI is composed of the following nine items:

- Home computer history is operationalized as the number of years a person has owned a personal computer at home (less than 1 year, 1 to 2 years, 3 to 6 years, more than 6 years).
- Task scope concerns the number of tasks for which a person connects to the Internet. Respondents were asked whether they connect to the Internet for work-related, school-related, and personal-related tasks. Responses to these were aggregated to indicate the breadth of tasks.

- 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.
- Goal scope was derived by asking respondents how many of the six media-system dependency goals (Ball-Rokeach, 1985, 1998) they pursue through online activities. The six response categories included: two understanding goals, (a) to stay on top of events and groups that you care about (social understanding), and (b) to express yourself or your opinions (self-understanding); two orientation goals, (c) to accomplish business, financial, or work tasks (action orientation), and (d) to get advice on how to deal with other people, such as doctors and other health professionals (interaction-orientation); and two play goals, (e) to play or amuse yourself (solitary play), and (f) for social reasons like making new friends (social play) (Ball-Rokeach, 1985, 1998; Loges, 1994). These goal dimensions have been employed in previous studies of television, radio, magazines, and movies (Ball-Rokeach, Rokeach, & Grube, 1984; Grant, Guthrie, & Ball-Rokeach, 1991; Loges, 1994; Skumanich & Kintsfather, 1998). Due to low response variance, a dichotomous variable was constructed where choosing none of the goals was coded as 1 and choosing one or more goals was coded as 2.
- Activity scope was measured by asking, "What Internet or Web activities do you participate in, other than e-mail?" Response categories included 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. The total number of responses (0 to 10) indicates breadth of participation. This variable was also dichotomously coded, where choosing none of the activities was coded as 1 and choosing one or more activities was coded as 2.
- Time spent on interactive online activities 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)?" (Choosing no activities indicated using the Internet only for e-mail.) Those who do not participate in online activities were coded as 1 and the rest of respondents who participate were coded as 2.
- Evaluation of how the Internet affects personal life is assessed by the question, "Thinking about all the pros and cons of the Internet, would you say it has an overall positive or negative effect on your life?" Correcting for positive skew in responses was done on a 5-point Likert-scale ranging from 1 (*negative and neutral*), 2 (*somewhat positive*), to 3 (*very positive*).
- Computer dependency relations is a unique operationalization of individuals' connectedness. Respondents were asked, "Imagine that you woke up tomorrow to find that the computer 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?" 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 recoded as 1, original responses from 6 to 9 were recoded as 2, and responses of 10 were recoded as 3.

- Internet dependency relations asked the same computer dependency question above, but instead awaking to find that the Internet had vanished. Internet dependency was also skewed. Original responses of 1 were not recoded, but responses of 2 to 4 were recoded as 2, responses of 5 to 7 were coded as 3, and responses of 8 to 10 were coded as 4.

To produce compatible scale items, each variable was multiplied by a value to create a common factor of 12. For example, home computer history, a 4-point scale, was multiplied by 3, whereas goal scope, a binary scale, was multiplied by 6. ICI scores were then calculated by taking an overall average, with ICI scores ranging from 1 to 12. The reliability alpha was .71 for this nine-item scale.

Method

Data Collection

The Metamorphosis Project, a multimethod and multilingual inquiry into 21st century urban community and communication technology, provided the data analyzed in this article. At the core of the study is a random digit telephone survey of seven neighborhoods in Los Angeles, sampling from certain ethnic groups that have set the tone and character of the area.[2] The ethnicities represented in the study sample constitute 90% of the Los Angeles county population (Matei, Ball-Rokeach, Wilson, Gibbs, & Gutierrez Hoyt, in press). This ethnogeographic approach for recruiting respondents is a uniqueness of the Metamorphosis methodology. It reflects our larger communication infrastructure orientation to studying individuals' communication connections in context of their communication environments (Ball-Rokeach et al., 2001). In contrast, studies based on national samples dislocate people from their residential places, thus treating respondents as separate and independent entities, mainly characterized by income, education, age, gender, ethnicity, or urban/rural residence. Our methodological approach embeds respondents within their residential communities, emphasizing that place does still matter.

This ethnogeographic research approach resulted in a response rate of 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, which takes into account all the phone numbers called. Despite the fact that the phone interview was lengthy—averaging 40 to 45 minutes—the cooperation rate was relatively high (62%).[3]

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 receiving no answer or always contacting an answering machine. Despite five callbacks, no actual person could be identified at the other end of the line. In addition, the general public's apprehension about telephone surveys has lowered response rates in scientific research and in the polling industry more generally (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.[4]

Although there are, of course, sample biases, they appear to be within the normal ranges for a survey of this complexity. From the comparison of our sample respondents with the respective ethnic population characteristics (based on the 1990 Census) for each area,[5] our best estimates of sample bias are not substantially different from outcomes obtained in more conventional and less complex sampling designs. The biases are in the direction of females, higher income, higher education, and higher age. With these cautions in mind, we note that we have relatively large numbers of ethnically and residentially homogeneous study samples that, due to our unusual multilingual data collection procedures, include non-English-speaking people often excluded in survey research.

Instruments

The telephone survey was made accessible to non-English speakers in their native languages, being translated (and back translated) and administered in Spanish (with Mexican and Central American colloquialisms), Chinese (both Mandarin and Cantonese), and Korean. A survey research firm, using trained bilingual interviewers, conducted the telephone interviews. The survey was programmed for Computer Assisted Telephone Interview (CATI) administration.

Conventional Time Online Measure

Time online was measured by responses to the question, "Counting all of your online sessions, how much time did you spend online last week?" Response options included: none, less than 1 hour, 1 to 2 hours, 3 to 6 hours, 7 to 10 hours, 11 to 20 hours, 21 to 30 hours, and more than 30 hours. The distribution was normal; therefore, the original categories were kept.

Demographic Variables

Information about respondents' education, income, age, and gender was collected. The highest grade or year of school that the respondents completed was used to indicate educational level. Seven response categories were provided: eighth grade or less, some high school, high school graduate, some college or technical school, college graduate, some graduate study, and graduate degree. Income data were obtained by asking the household income for the previous year. The seven response categories were as follows: less than $20,000, $20,000 to $35,000, $35,000 to $45,000, $45,000 to $60,000, $60,000 to $75,000, $75,000 to $100,000 and more than $100,000. The respondent's age on his or her last birthday was asked in an open-ended format. Male gender was coded as 1 and female was coded as 2.

Results

The area-level characteristics of our respondents in the seven study areas are summarized in Table 1. Two Caucasian study samples from the Westside (primarily Jewish) and South Pasadena (primarily Protestant) showed the highest level of annual income, followed by the African American sample from Greater Crenshaw, Korean origin from Greater Koreatown, and Chinese origins (Mainland, Hong Kong, and Taiwan) from Greater Monterey Park. Two Latino areas—Pico Union (Central American origin) and East Los Angeles (Mexican origin)—showed the lowest level of annual income. Large differences were found in the educational levels as well. More than 60% of respondents from Caucasian areas had college degrees, and 53% of Korean origin, 41% of Chinese origin, and 37% of African American respondents in our survey had college degrees, whereas less than 10% of the Latino respondents had college degrees.

Computer ownership reflected disparities as well. Differences in computer ownership among the respondents in the seven study areas are

Table 1
Demographic Characteristics: Seven Study Areas

	East Los Angeles: Mexican Origin (n = 250)	Pico Union: Central American Origin (n = 250)	Greater Crenshaw: African American (n = 252)	Greater Koreatown: Korean Origin (n = 238)	Greater Monterey Park: Chinese Origin (n = 321)	South Pasadena: Protestant Caucasian (n = 251)	Westside: Jewish Caucasian (n = 250)
Household income							
Mean ($)	27,500	20,000	42,000	35,000	30,950	61,000	72,000
$35,000 (%)	81	90	47	59	57	17	11
$75,000 (%)	2	1	16	9	12	38	52
Level of education							
High school (%)	75	79	28	34	40	8	8
College graduate (%)	8	6	37	53	41	66	69
Median age (years)	34	33	42	35	41	45	47
Female (%)	60	55	60	52	51	57	55

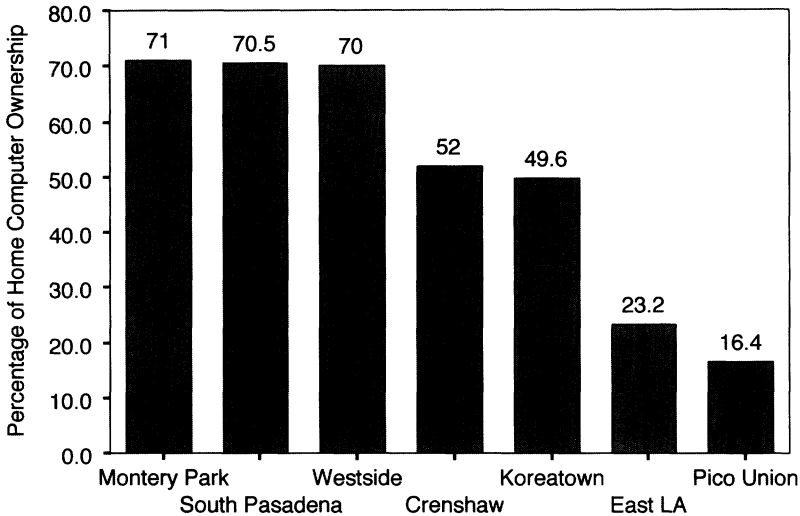

Figure 1. Percentage of Home Computer Ownership in Each Study Area

summarized in Figure 1. More than 70% of the Chinese origin and Caucasian respondents (Protestant and Jewish) had computers at home, and 52% of African Americans and 50% of Korean origin respondents had computers at home. The number decreases to 23% for the Mexican origin and 16% for the Central American origin respondents. Having an Internet connection follows a similar pattern: 63% in both the Caucasian samples, 52% in the Chinese origin, 44% in the African American, and 38% in the Korean origin study sample (see Figure 2). In the two Latino areas, lesPs than 20% of respondents (18% of Central American origin and 16% of Mexican origin) had Internet connections.

The disparate income and educational levels in the different study areas suggest that the variations in computer ownership and Internet access may be due simply to these differences in socioeconomic status. Previous research has confirmed that ethnicity plays a role in people's Internet access when socioeconomic status is held constant (Hoffman & Novak, 1998; NTIA, 1999, 2000; Wilhelm, 2000). Kim (2000), in a related Metamorphosis Project article, compared computer ownership and Internet connections in the seven areas, controlling for income, education, age, and gender (ANCOVA), and found significant differences in computer ownership and Internet access between the seven study areas. This indicates that area/ethnic differences still play roles over and above socioeconomic differences.

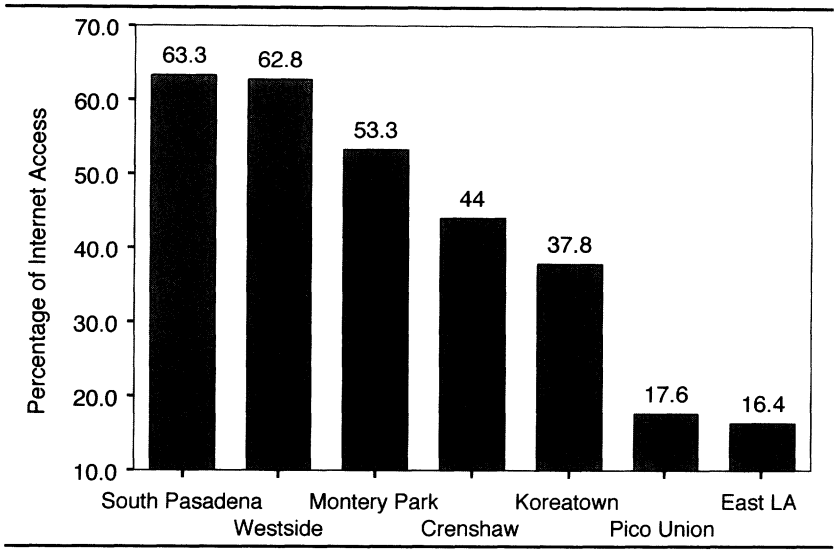

Figure 2. Percentage With Internet Access in Each Study Area

Mean Area Differences: ICI Versus Time Online

We now turn our attention to the comparison between our ICI measure and traditional time online measures. The mean ICI differences across the seven study areas are presented in Figure 3. Only respondents who had Internet access (n = 770, 42.5%) were included in these analyses. The highest mean ICI was found in the Caucasian (South Pasadena and Westside) and the Chinese origin (Greater Monterey Park) study samples. The lowest mean levels of connectedness were found in the Korean origin (Greater Koreatown), Mexican origin (East Los Angeles), and Central American origin (Pico Union) study areas, with the African American study sample falling in between high and low ICI groups. As reported in Table 2, area differences are significant, $F(4.50, 758), p < .001$.

When the same analyses are conducted employing the conventional time online measure (see Figure 4 and Table 2), only the Chinese origin respondents stand out as notably different. This may be due to the gap in time with respect to the collection of data. The data from the Greater Monterey Park area were collected most recently, over one year after the first data collection period.[6] Among the other six areas, there were no significant differences (see Table 2) in time online, $F(1.02, 5{,}592), p > .05$. Mean differences alone indicate

Table 2
Internet Connectedness Index (ICI) and Mean Time Online in Seven Study Areas

	ICI		Time Online	
	M	*SD*	*M*	*SD*
East Los Angeles (Mexican origin)	7.74	1.67	2.37	1.32
Pico Union (Central American origin)	7.71	1.84	2.42	1.67
Greater Crenshaw (African American)	7.99	1.61	2.59	1.91
Greater Koreatown (Korean origin)	7.74	1.60	2.46	1.91
Greater Monterey Park (Chinese origin)	8.37	1.66	3.49	1.90
South Pasadena (Caucasian)	8.47	1.40	2.81	1.72
Westside (Caucasian)	8.43	1.60	2.77	1.32

Note. For the ICI, $F = .495, p < .001$. For time online for the seven-area comparison, $F = 5.778, p < .001$; for the six-area comparison (after excluding Greater Monterey Park), $F = 1.057, p = ns$.

that there are significant area differences when we employ the ICI measure, but there is no consistent pattern of difference when we employ the time online measure.

Demographic Differences: ICI Versus Time Online

Sociodemographic Differences

The ICI scores of the respondents reflect existing income and education gaps. Analysis of Variance (ANOVA) was conducted to see how the mean ICI and time online scores differ for different groups of income and educational level. Table 3 indicates that group variances of ICI are significant for income ($F = 3.34, p < .001$) and education ($F = 3.09, p < .05$), whereas the group variances of time online are significant only for income ($F = 2.24, p < .05$). In addition to the significance, the patterns of mean scores in Figures 5, 6, 7, and 8 indicate that the mean scores of ICI increase consistently as the income and educational level increase, whereas the mean time online fluctuates.

Correlational Differences

Employing Pearson's r and Spearman's rho correlations, significant correlations were found between the ICI score and the level of education, income, age, and gender, although only gender was significantly correlated with time online (see Tables 4 and 5). The higher the ICI, the more educated ($r = .15, p < .001$), affluent ($r = .19, p < .001$), younger ($r = -.10, p < .001$), and likely to be

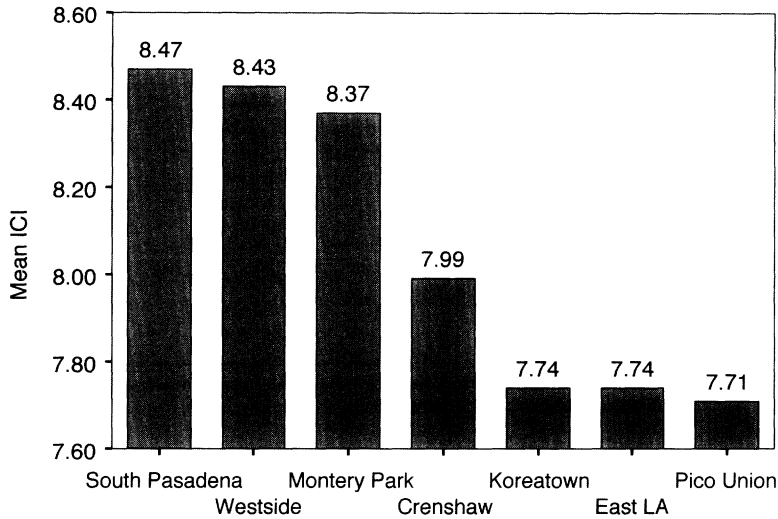

Figure 3. Mean Internet Connectedness Index (ICI) Scores in Seven Study Areas

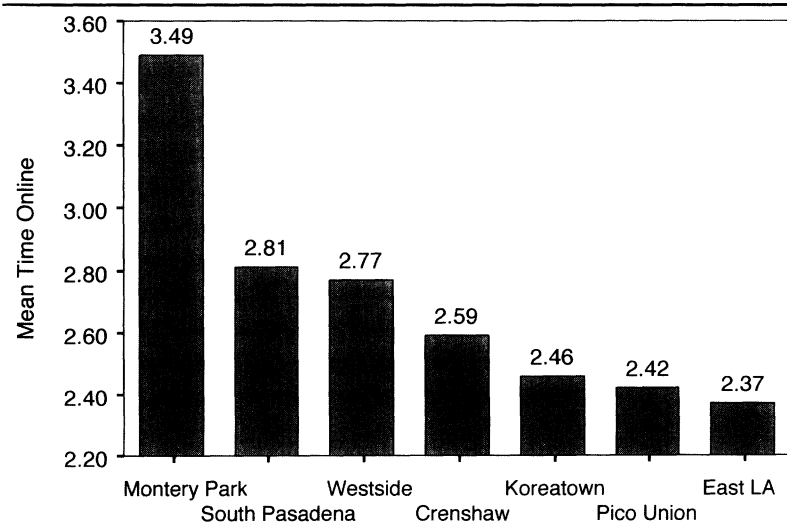

Figure 4. Mean Time Online in Each Study Area
Note. The scale ranges from 1 (*none*), 2 (*less than 1 hour*), 3 (*1 to 2 hours*), 4 (*3 to 6 hours*), 5 (*7 to 10 hours*), 6 (*11 to 20 hours*), 7 (*21 to 30 hours*), to 8 (*more than 30 hours*).

Table 3
ANOVA of Internet Connectedness Index (ICI) and Time Online on Income and Education

	ICI		Time Online	
	F	*p*	*F*	*p*
Income	3.34	< .001	2.24	< .05
Education	3.09	< .05	1.05	*ns*

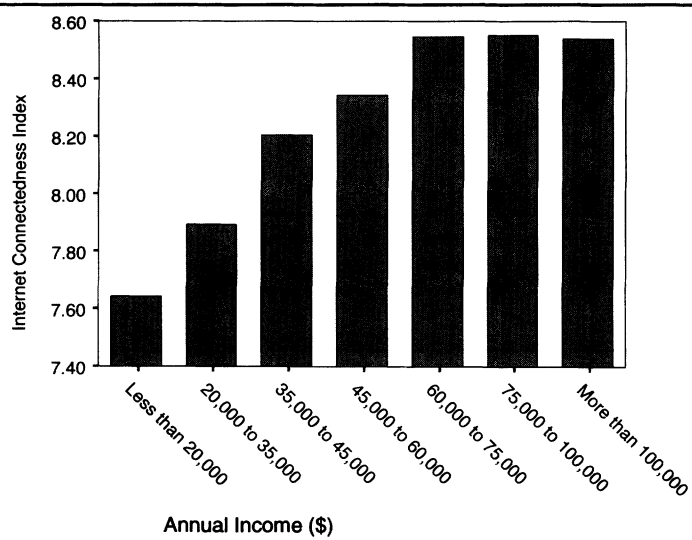

Figure 5. Mean Internet Connectedness Index (ICI) Score by Different Income Groups

male ($r = -.08, p < .05$) the connector. Taken together, the mean differences and the correlation outcomes suggest the persistence of various socio-demographic inequalities in utilizing the Internet when employing the ICI measure, but, at most, a gender divide when employing the conventional time online measure.

To measure the significance of the scope and intensity of goals and activities and the centrality of people's Internet connectedness, the task scope was held constant. This was done to partial out the possibility that merely having a wider scope of tasks—work, school, and personal tasks—might correlate with income, education, age, and gender. The partial correlations between ICI and income, education, age, and gender, controlling for task scope, indicate

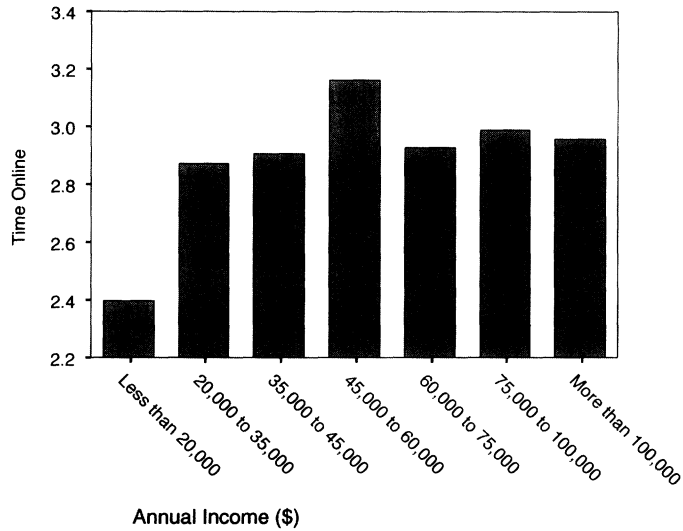

Figure 6. Mean Time Online by Different Income Groups
Note. The scale ranges from 1 (*none*), 2 (*less than 1 hour*), 3 (*1 to 2 hours*), 4 (*3 to 6 hours*), 5 (*7 to 10 hours*), 6 (*11 to 20 hours*), 7 (*21 to 30 hours*), to 8 (*more than 30 hours*).

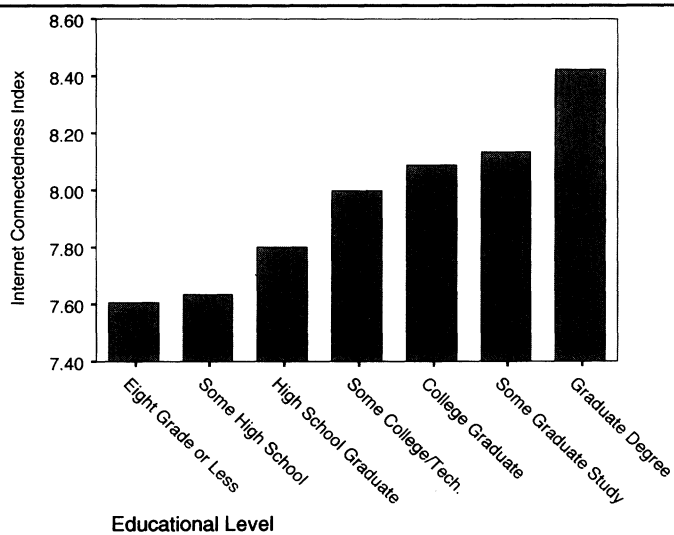

Figure 7. Mean Internet Connectedness Index (ICI) by Different Levels of Education

that ICI is still significantly correlated with income ($r = .09, p < .05$), age ($r = -.10, p < .01$), and gender ($r = .08, p < .05$), but not with education ($r = .02$, *ns*). The result indicates that the positive correlations between ICI and social

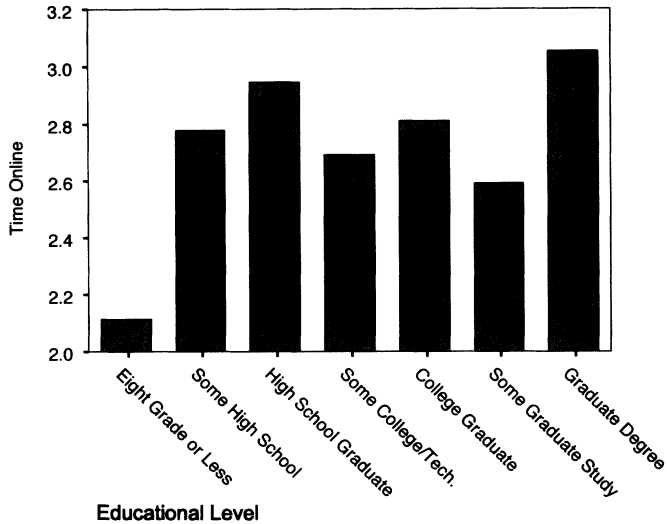

Figure 8. Mean Time Online by Different Levels of Education
Note. The scale ranges from 1 (*none*), 2 (*less than 1 hour*), 3 (*1 to 2 hours*), 4 (*3 to 6 hours*), 5 (*7 to 10 hours*), 6 (*11 to 20 hours*), 7 (*21 to 30 hours*), to 8 (*more than 30 hours*).

Table 4
Pearson's r *Correlations: Demographic Variables and Internet Connectedness Index (ICI) / Time Online*

Correlations	ICI	Time Online
Education	.15**	.05[a]
Income	.19**	.06[a]
Age	–.10**	–.06[a]
Gender	–.08*	–.21**

a. Not significant.
*$p < .05$. **$p < .001$.

Table 5
Spearman's rho Correlations: Demographic Variables and Internet Connectedness Index (ICI) / Time Online

Spearman's rho Correlations	ICI	Time Online
Education	.14**	.04[a]
Income	.18**	.06[a]
Age	–.10**	–.07[a]
Gender	–.08*	–.20**

a. Not significant.
*$p < .05$. **$p < .001$.

Table 6
Partial Correlations: Internet Connectedness Index (ICI) and Demographic Variables

	ICI
Education	.15**
Income	.18**
Age	–.09*
Gender	.03[a]

a. Data are not significant.
*$p < .05$. **$p < .001$.

inequality measures are not reflecting merely people's work or school status, but also the scope and intensity of people's goals and activities, as well as the centrality of the Internet and computers in their everyday lives.

To further clarify the validity of ICI, we conducted partial correlation analyses of ICI and demographic variables, controlling for time online (see Table 6). The significant correlation between the ICI and time online ($r = .49$, $p < .05$) made this analysis all the more necessary. The results reported in Table 5 are clear; that is, even when controlling for time online, significant correlations persist between the ICI and education ($r = .15, p < .01$), income ($r = .18, p < .01$), and age ($r = -.09, p < .05$).

Discussion

We have introduced the ICI as a measure that captures the multidimensional nature of the relationship between individuals and the Internet after the individuals gain access to the Internet. ICI is distinct and valuable in two ways. First, it is a theory-driven measure. Originated from the critical reconceptualization of the digital divide, ICI is a tool that links the theoretical conceptualization with the actual empirical evidence. In proposing the concept of connectedness, the digital divide is textualized with different goals, activities, and communication means in people's everyday lives.

Second, the ICI enables the empirical assessment of how people are connecting to the Internet in the context of their everyday lives. Rather than merely preaching the importance of the theoretical conceptualization of the digital divide at an abstract level, the results in our study support that this new measure is capable of capturing the multidimensional disparities persisting between different income, education, age, and gender groups. Our interpretation of these differences is that people of different ethnic backgrounds who are already advantaged with respect to their education, income,

age (younger), and gender (male) are more likely to be connected to the Internet in ways that will preserve or increase their advantage.

Methodological Limitations and Implications

Although the ICI is presented as a preferable alternative to the conventional measures, it is still in the process of development and can be improved in future research. First, although we attempt to measure the quality of Internet connectedness, ICI does not include the substance of people's connections. The scope measures—task scope, site scope, goal scope, and activity scope—indicate breadth, but do not directly capture specific tasks, sites, goals, or activities. The scope measures are, of course, derived from responses to questions assessing specific sites, tasks, goals, and activities. For example, we gave a list of online activities and counted the number of activities each person chose, but the specific kinds of activities each person chose are not considered in the index. It is thus possible to complement people's ICI scores with the additional information to further enrich the picture.

Second, the nine items in the current index are added together without any subfactors. Although the ICI is a significant step forward in accounting for the multidimensional nature of Internet connectedness, how different items in the index are clustered and how each individual item functions on its own are not further explored. We will proceed in future analyses to determine whether the nine-item scale contains theoretically sound subscales that could be meaningfully employed as alternatives to the full scale. For example, confirmatory factor analysis or cluster analysis may be used for this purpose. If we are able to observe how different subindices relate with other variables in different ways, it would add value to the application and practicability of the ICI.

Policy Implications

Although there are underlying theoretical and conceptual reasons to prefer the ICI to conventional time-based measures, there are equal, if not more important, policy reasons to prefer a multidimensional index for Internet connectedness.

Diagnostic Implications

If government, social service, or corporate entities conclude that the digital divide is no longer a problem on the basis of research that employed

single-item measures, they will cease interventions designed to provide an equal Internet playing field. Moreover, if the digital divide is defined in simple ownership and access terms that obscure critical differences in the nature of people's connections to the Internet, then the more fundamental communication technology and inequality issues will go unaddressed. Although the time online measure is an improvement in measuring the level of the digital divide (as discussed earlier), we discovered that the conventional measure and the ICI produced the different results with respect to socioeconomic differences and correlates. We found that the ICI gives us a very different picture of the state of the divide—namely, that it persists.

The persisting divide goes beyond the material objects required for Internet access. Inequalities also remain with respect to the quality of Internet connectivity, such as people's goal scope and subjective evaluations, which are not captured by the unidimensional measure of time spent online. In addition to the overall ICI score and its relationship with social inequality indicators, specific ICI items can contribute to diagnosing which specific dimensions are lacking by an individual in connecting to the Internet. By employing different items in ICI, policy makers are able to have a more inclusive and specific diagnosis of the current stage of the digital divide.

PRESCRIPTIVE IMPLICATIONS

In addition to its contribution to the diagnosis of the digital divide, ICI is also useful in the stage of developing communication policies for underdeveloped communities or underserved groups of people in a society. Lloyd Morrisett (1997), former president of the Markle Foundation, has noted that online access is only the beginning of the solution, as "there remain the far more difficult and expensive tasks of producing instructional software, training teachers, and equipping schools." Goslee (1998), Lazarus and Mora (2000), and Castells (2000) make related points when they emphasize the needs for community technology centers in low-income areas, multicultural/multilingual content services, and user-friendly software. Along this line of thinking, the ICI is applicable in two ways. First, different ICI scores will indicate where the subsidy and educational resources should be allocated in a society or in a community. Second, individual items of ICI can signal what kinds of specific interventions are necessary for certain groups of people. For example, one particular group may have a lower goal scope, in which case the intervention program can be designed to inform members of that group of the resources that can broaden their goal achievements on the Internet. Another group of people whose activity scope is low can broaden their activities by

acquiring necessary skills. This will enable a more specific and efficient policy implementation, which is more likely to bring up those who lag behind in incorporating the Internet to achieve their daily goals. If future endeavors can improve the ICI along this direction, we will not only uncover the inequalities previously undiagnosed, but also become better prepared for troubleshooting the issue of the digital divide by pinpointing the specific realms where interventions may lead to positive policy consequences most effectively.

Notes

1. This program is based at the Annenberg School for Communication at the University of Southern California. The Metamorphosis Project is funded by the Annenberg School for Communication and the Annenberg Center for Communication. Sandra J. Ball-Rokeach is both director of the program and principal investigator of the project. See http://www.metamorph.org for more information.

2. The seven neighborhoods in Los Angeles are as follows: Westside, White; Greater Crenshaw, African American; East Los Angeles, Mexican American; Pico Union, Central American; Greater Koreatown, Korean; South Pasadena, White; and Greater Monterey Park, Chinese (Allen & Turner, 1997).

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

4. Although undesirable, a low response rate does not necessarily translate into response bias. Keeter, Kohut, Groves, and Presser (2000) compared two different survey administration protocols, one employing much effort to reach respondents by phone that resulted in a 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. More important, few significant differences were found with respect to variables that parallel the Metamorphosis Project's major variables (e.g., media connectedness and social trust).

5. Briefly, these differences can be summarized as follows:

1. East Los Angeles: Study sample includes a higher percentage of women.
2. Greater Crenshaw: Study sample is better educated and has higher income.
3. Greater Monterey Park: Study sample is relatively older.
4. Pico Union: Study sample includes a higher percentage of women.
5. Koreatown: Study sample is considerably better educated and slightly younger and female.
6. South Pasadena: Study sample is better educated, older, and includes a higher percentage of women.
7. Westside: Study sample is better educated and has higher income.

6. Wave 1 (May 1998): Westside/Caucasian, South Pasadena/Caucasian, East Los Angeles/Mexican origin; Wave 2 (December 1998): Crenshaw/African American, Koreatown/Korean origin, Pico Union/Central American origin; and Wave 3 (December 1999): Greater Monterey Park/Chinese origin.

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