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Telecommunications Policy 27 (2003) 597–623

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Comparing internet and mobile phone usage: digital divides of usage, adoption, and dropouts

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Abstract

Results from a national representative telephone survey of Americans in 2000 show that Internet and mobile phone usage was very similar, and that several digital divides exist with respect to both Internet and mobile phone usage. The study identifies and analyzes three kinds of digital divides for both the Internet and mobile phones—users/nonuser, veteran/recent, and continuing/dropout—and similarities and differences among those digital divides based on demographic variables. The gap between Internet users and nonusers is associated with income and age, but no longer with gender and race, once other variables are controlled. The gap between mobile phone users and nonusers is associated with income, work status, and marital status. The veteran/recent Internet gap is predicted by income, age, education, phone user, membership in community religious organizations, having children, and gender; for mobile phones, age, work status and marital status are predictors. The gap between continuing and dropout users is predicted by education for Internet usage and income for mobile phone usage. Finally, cross-categorization of Internet and mobile phone usage/nonusage is distinguished (significantly though weakly) primarily by income and education. Thus, there are several digital divides, each predicted by somewhat different variables; and while Internet and mobile phone usage levels in 2000 were about the same, their users overlap but do not constitute completely equivalent populations.

Keywords: Digital divide; Social impacts of new media; Internet; Mobile phones

1. Introduction

Access is the major public policy arena for those who see the Internet and other new media as a universal service and a significant component of political and economic equity concerning access to information and resources (Rice, McCreadie, & Chang, 2001). The usual term for this

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0308-5961/$ - see front matter
doi:10.1016/S0308-5961(03)00068-5

differential access to and use of the Internet in particular and new media in general according to gender, income, race and location is the *digital divide* (Cooper & Kimmelman, 1999; Hoffman & Novak, 1998; Hoffman, Kalsbeek, & Novak, 1996; Katz, 2002; Katz & Aspden, 1997; McConnaughey & Lader, 1998). Precisely because access and usage differs by socioeconomic status, and not because of personal preferences, and because many crucial social and economic benefits may accrue from greater access to and usage of communication technologies, such communication disparities constitute a serious "divide" between segments of society. Because much of this new technology involves computers as either processors, network switching, or digital packets, it is referred to as a "digital" divide. Overcoming the digital divide is a particular manifestation of the general universal service tradition of US telecommunications policy (Napoli, 2001). The question of the digital divide commands great attention worldwide, and fits neatly within perennial rhetorical schemata addressing enduring social and economic development and equity issues.

US Department of Commerce statistics show that information technology in general provides significant economic benefits, such as reducing inflation and increasing productivity, and constitutes a major section of the economy (McConnaughey, 2001). The Internet and other communication and information technologies can enhance human capital by increasing access to education and training. Information-intensive labor markets prefer individuals who have experience with—and upgradeable skills for continuing to perform in—a communication network-based environment. For instance, employees who used computers in their jobs are paid typically 10–15% higher than non-computer users who hold similar positions (Bikson & Panis, 1999, p. 156). Besides economic benefits, communication technologies have the potential to increase participation in decision-making and use of resources at work (Carrier, 1998), in communities (McNutt, 1998), and with government representatives and agencies (Neu, Anderson, & Bikson, 1999). Thus, those who have insufficient resources from or experience with new communication technology will be further excluded from human and social capital (McNutt, 1998). Some also contend that even if those currently without access later become users, their disadvantage will remain (Carrier, 1998).

Although there has been detailed national research on the Internet covering social aspects of users compared to nonusers beginning in 1995 (Katz & Rice, 2002; Katz, Rice, & Aspden, 2001) and the field has been joined recently by a host of others (Haythornthwaite & Wellman, 2001), only quite recently has much attention been given to mobile phone users. The first international comparative forum on mobile phone use occurred at the "Perpetual Contact" conference at Rutgers University in 1999 (Katz & Aakhus, 2001), followed by other regional meetings and publications (Brown, Green, & Harper, 2001; Katz, 2002, 2003; Ling & Helmersen, 2000). It seems appropriate to analyze mobile phone usage with vigor comparable to that given to the Internet. Mobile phone adoption appears to be surpassing, on a worldwide basis, the popularity of TV sets. It is a technology that has been given credit for—*inter alia*—saving lives, organizing terrorist efforts, and overthrowing dictators (Katz & Aakhus, 2001). In the latter instance, the ouster of the Philippines' President Estrada is often chalked up to "People Power" demonstrations organized via mobile phones (Ramilo, 2001).

Thus, in light of an obvious digital divide among Internet users, but also a divide between the attention applied to the two media, the present research identifies salient characteristics of the Internet and mobile phone digital divides in the United States as of 2000, as well as extending

the conceptualization of the digital divide to include three kinds of differences in usage. It looks at the characteristics of each technology's digital divides as well as compare between them. The following section summarizes recent research on the extent and distinctions of the Internet and mobile phone digital divides. The subsequent section analyzes differences, separately and jointly, in the kinds of digital divides for both the Internet and the mobile phone.

2. The (primarily internet) digital divide a consequential but changing digital divide between internet users and nonusers

The fiscal year 2003 United States budget indicates that the federal government has concluded that the digital divide is no longer a governmental concern, as it has removed over $100 million previously allocated toward information technology training programs and community technology grants (Benton Foundation, 2002). Indeed, the US administration recently released an analysis of the most recent federal study of nationwide Internet use (based on responses from 57,000 households and more than 137,000 individuals across the United States)—*A nation online: How Americans are expanding their use of the Internet* (US Commerce, 2002)—that interprets the results as indicating that the Internet digital divide is no longer cause for concern.

Yet Armando Valdez, chair of the California Telecommunications Policy Forum, a group of leaders from ethnic communities who examine the impact of telecommunications policies, has warned: "We are witnessing the fracturing of the democratic institutions that hold us together… . The possibility of an information underclass is growing" (Goslee, 1998). Many surveys have reinforced this concern. Studies such as Bikson and Panis' (1999) analysis of the "Current Population Survey" conducted by the Bureau of the Census in 1993 (143,129 respondents) and 1997 (123,249 respondents) found large disparities in use of network services by age, income, and education. They did note that those gaps generally decreased over the 4-year period, and even more so when other variables were statistically controlled, except for the income gap, which rose. However, the US Department of Commerce survey (2000) of over 48,000 households reported that usage by low and middle-income groups increased the most (over 70%) even though their overall usage levels were still significantly below that of higher-income groups. The 2002 report (US Department of Commerce) shows that the usage gap between those in the top and bottom levels of household income increased dramatically between 1997 and 2001, and that rural communities had only half as much access to high-speed broadband Internet access (though overall Internet usage rates are essentially equal (53% for rural, 54% for urban). Large gaps in Internet usage associated with respondents' education level are consistently found in various studies (AOL, 2000; Miller, 2001; UCLA Center for Communication Policy, 2000, US Department of Commerce, 2000). The gender gap is lowest for younger people, and increases considerably in the highest age groups (UCLA, 2000). Gender differences are still present within other demographic categories; for example, use by Asian American and Pacific Islander women is 87.4% of the usage rate by Asian American and Pacific Islander men (McConnaughey, 2001). Men do use the Internet a bit more, about 10.5 h per week compared to 9 h per week, and view about 31% more web pages than do women (Net users, 2001), and the proportion of men grew as users had been online for more years (AOL, 2000; Katz et al., 2001).

Minorities such as blacks and nonwhite Hispanics are much less likely to possess home computers and have less access to networks than whites and Asians and therefore miss the opportunity to participate in Internet activities (Bikson & Panis, 1999; Neu et al., 1999). A representative postal mail survey of 80,000 US households conducted by Forrester research in January 2000 (Walsh, Gazala, & Ham, 2001) found that Asian Americans have the highest Internet penetration rate, and Hispanic Americans have a higher adoption rate than Caucasians. Connection to the Internet grew for all ethnic groups who bought personal computers. This survey showed that consumers of all ethnicities use the Internet for the same general reasons: communicating with others, accessing information, having fun, and shopping.

With each year, however, general access to and use of the Internet increases, reducing at least some of the sociodemographic gaps (Katz & Rice, 2002; US Department of Commerce, 2002). Howard, Rainie, and Jones (2001) reported recent analyses of the Pew Internet and American Life Project surveys, which were collected daily from March through August in 2000 from over 12,000 respondents. Over half had access to the Internet, and over half of those with Internet access go online every day (57% males and 52% females). Recent studies (AOL, 2000; ECRL, 1999; Jupiter Communications, 2000; Net users…, 2001; Katz et al., 2001; Yahoo!News, 2001, reporting on Pew Internet and American Life Project surveys), have been finding that at least racial and gender differences in Internet use disappear after other socioeconomic variables (such as income and education) are taken into account statistically. Users are becoming more like the US population, except for income, education and age.

2.1. *Barriers, influences, motivations and consequences*

Clearly, there are many physical and socioeconomic barriers to equal access that contribute to the digital divides. Keller (1995) expands the concept of public access to the Internet from not just a technical connection to a public network, to include the principle that those connections should be easy to use, affordable and provide useful information resources. Barriers to using the Internet reported by the UCLA (2000) study respondents include: no computer or terminal available (37.7%), no interest (33.3%), do not know how to use (18.9%), too expensive (9.1%), and various other factors.

Cultural, rather than strict economic, education and racial, differences are receiving increased attention, from both government and commercial studies (Cultural Access Group, 2001). For example, Neu et al. (1999) report that the network use gap between whites vs. Hispanics and blacks of *similar* socioeconomic status widened from 1993 to 1997, implying that some of the digital divide may be due to differences in interests and priorities among individuals in the same ethnic and socioeconomic group. The learning process, as well as resistance to change, seems important in explaining why there is such low Internet access by older age groups (Neu et al., 1999, Chapter 6). Similarly, Haddon (2001) argues that "social exclusion" is context-dependent (neither necessarily economically based nor equivalent across all domains of a person's life), involves not only political and civic involvement but also people's ability to occupy social roles, and may also involve rejection of or lack of interest in new technologies and pressing issues such as day care. Further, differences in access become more pronounced for some variables depending on whether the user has general access or has online access from the home (Corrado, 2000, p. 5). For example, home access is associated with regular Internet use by whites with higher education

and incomes. There are other aspects of access than just equal distribution across demographic and national boundaries. People who have hearing, sight, movement and other disabilities may also be disadvantaged by limitations on their ability to access information, contacts and opportunities for expression on the Internet (McConnaughey, 2001).

2.2. Other internet digital divides

The simple distinction of the digital divide as consisting only between usage and nonusage is just that—only the simplest of several relevant distinctions.

There are some data on other distinctions than the familiar Internet user or nonuser. The nonprofit Consumer Federation of America (Cooper, 2000) collected responses from a single statistically balanced panel ($n=1902$) measured at two time periods (February 1999 and June 2000) drawn from respondents agreeing to participate in a large-scale "Life Styles Study." They compared the *fully* connected (36% of population, with Internet Service Providers or high speed Internet access at home), the *partially* connected (17%, with basic Internet or e-mail service at home), the *potentially* connected (21%, no home Internet service, but do have home computer or cell phone), and the *disconnected* (26%, neither Internet service, computer, or cell phone). The disconnected earn less than half the income of the fully connected ($25.5 K vs. $45.2 K), are much less likely to have a college degree (13% vs. 46%), are more likely to be black (12% vs. 7%), be older (53 vs. 44 years), and have smaller households (2.1 vs. 2.8). Each of these significantly predicts differences across the four levels of connectedness, with income being the most powerful predictor. Overall, the study concludes that there is about a three to five year lag in penetration between those with above-median and below-median income. The UCLA study (2000) also notes that 58.6% of current nonusers (32.1%) are somewhat likely or very likely to not gain access within a year, and this lower access worsens for older respondents.

The UCLA study (2000) also reports that in mid-2000, 10.3% of nonusers were actually Internet dropouts (formerly used the Internet at least once a month, but no longer). Katz and Rice (2002) and Katz et al. (2001) report a fairly consistent 10% Internet dropout rate in surveys they conducted in 1995, 1996, 1997 and 2000. The US Department of Commerce report (2000), extrapolating to the entire nation, estimated there were about 4 million Internet dropouts in both 1998 and 2000. The three primary reasons given in 2000 for discontinuing were "no longer owns a computer" (17%), "can use it elsewhere" (13%), and "cost, too expensive" (12%). Other reasons were "don't want it" (10.3%), "not enough time" (10%), "computer requires repair" (9.7%), "moved" (6.1%), "not useful" (4.2%), "problems with ISP" (2.9%), "concern with children" (2.3%), "not user friendly" (1.5%) and "computer capacity issues" (1.2%). The report notes that these reasons differ from the primary reason given by nonusers for never connecting at all with the Internet, which is "don't want it."

2.3. Mobile phone digital divides

When the term "digital divide" is used in the US, it almost exclusively refers to the use of computers. This interpretation contrasts in an interesting way to the rest of the world, where the term by no means has this narrow meaning. Instead, mobile communication plays an integral part in considerations of a digital divide in most countries save the US.

This level of concern may be seen a series of on-going reports from various international and non-governmental organizations (NGOs). For example, in a December 2, 2002, presentation, Jan Servaes, president of the European Consortium of Communication Research, argued that the digital divide is a not a technological problem, but rather a social one. He saw that for many people whose basic needs and approach to life were not easily integrated with a personal computer, the mobile phone could offer a good, and sometimes better, alternative. He noted that there was considerable variation in the uptake of information and communication technologies (ICTs), and that these variations could not be attributable solely to price and regulatory schemes. Servaes identified instead demographic and cultural themes as being strong factors associated with the use of ICTs. In particular, mobile phones offer notable advantages for the poor and elderly (Servaes, 2002). In this manner, the mobile phone may be a boon to addressing some of the policy-level concerns about the inequitable distribution of power that stems from differential access to ITC resources. However, as Katz and Aakhus (2001) have shown, it is difficult to estimate the improvements in life quality that can be achieved with mobile phones.

This question of digital divides has particular relevance as the gap between Internet have and have-not's is closing only slowly while, at the same time, the telephone is gaining still more significance as it is becoming mobile. Indeed, there are now more mobile phone subscribers than landline ones, worldwide. As of this writing, approximately 95% of all nations have mobile phone networks, and the majority of the world's countries have more mobile phone subscribers than fixed landline ones, and there likely exist today more mobile phones than TVs. Many households in both the developed and developing world have only mobile phone service, and in some cases, well-to-do people in the United States are foregoing their landline service and keeping only mobile. In the US, people who have only mobile phones amount to about 4% of all telephone subscribers (Katz, 2002). To show the change in the way people communicate, and its potential implications for a digital divide, one can consider the above figures in contrast to the situation in 1990. In that year, less than 1% of the world's population had a mobile phone, and only a third of the world's countries had a public wireless network at all.

It is also worth pointing out that in the developing world, it is the poorest segment of the population that is often the earliest adopter of mobile telephones. It seems when the motive is there, the prices of the ICTs do not serve as a substantial barrier, a finding of surprising import when considering the subsidy policies of many Western governments relative to the internet.

Beyond the macro-economic indicators, through, the social indicators and even the individual life stories show the importance of mobile phone technology. The national surveys of Vershinskaya (2003), who has looked at the mobile phone explosion in post-communist Russia, and the micro-social capital analysis of Ling and Hadden (2003), who looks at the use of mobile phone in helping teens (and sub-teens) get their homework done and upwardly manage their household moral economies, highlight these dimensions.

Even as the mobile phone is reducing telecommunications disparities in some countries and regions, the inexorable advance (or from the perspective of the post dot-com bust, the plodding advance) of the level of publicly available services has led to a new wave of anxiety. As the promised benefits of 3-G services become apparent, some have begun worrying anew about a

digital divide. This time, the gap of concern, rather than being between "haves" and "have-nots," is becoming between those who have rudimentary services and advanced ones.

The policy concerns surrounding issues of the Internet digital divide both converge and diverge with the digital divide of mobile phones. A communication technology that is heavily used by minorities in the US, the mobile phone, has not attracted the attention of the scholarly community or policy-makers to a significant degree, unlike the Internet. Yet there are a variety of concerns that can be addressed equally, if not uniquely, by the telephone in general and the mobile phone in particular. These topics in which the mobile phone has some similar capabilities to the Internet include contacting government representatives and resources, seeking job opportunities, citizen mobilization, social integration, and spreading messages of social concern. Many of these goals were part of the original rationale for universal service (Napoli, 2001).

Further, the mobile phone would seem to have some distinct advantages in areas that might make the most difference to the digitally disadvantaged. These include remote accomplishment and pursuit of jobs (such as when a freelance photographer or day worker is notified of a potential job) and easy social interaction and quick real-time coordination of personal or household activities, such as keeping in touch with, meeting or dating people of interest. Indeed such software protocols and systems are being deployed in Japan and Europe (especially Germany) and have been experimented with elsewhere (Katz, 2003). Finally, one of the most important areas to most people is that of personal safety. Here the mobile phone would seem to be far superior to the Internet and the regular telephone in terms of being able to alert authorities to potential problems or summon police in case of an emergency. Indeed, many studies show that this concern for safety is the primary motive for women to acquire a mobile phone, and it is also an important one for men (Katz & Aakhus, 2001).

Finally, while the issue can only be touched on here, there is some interest in the way these technologies are reordering space in the home and the use of public space. For example, Andrew Townsend has demonstrated quantitatively that the atmosphere and distribution of people in urban public spaces has been altered due to the widespread use of mobile phones (included in Katz, 2003). Beyond the macro-economic indicators, through, the social indicators and even the individual life stories show the importance of mobile phone technology as a way to overcome digital divides.

For all the current and future concerns spawned by the progress of communication technology, this much is clear: the mobile phone is an important instrument in overcoming digital divides by creating social and economic capital. Further, it seems equally clear that this new technology has not received its due as a tool in addressing the digital divide, at least insofar as US policy makers and researchers are concerned.

2.4. Research questions

Based on this brief review, the conclusion is drawn here that there is no simple or singular digital divide (Van Dijk, 1999, p. 155). Thus this study considers three relevant digital divides—between users and non-users, between veteran and current users, and between current and former (dropout) users—for both the Internet and mobile phone in the United States, as of 2000.

The study reported here, then, focuses on these three research questions:

1. To what extent are there digital divides in Internet use and in mobile phone use in 2000?
2. What are the influences on and reasons for these divides?
3. To what extent are the primary digital divides of Internet usage and mobile phone usage similar, that is explained by similar influences?

3. Method

3.1. Sample

The data summarized here emerged from a national probability telephone survey conducted in March 2000, designed by us but administered by a commercial survey firm. The survey data collection procedure[1] followed rigorous sampling protocols, and used random-digit dialing, to produce a statistically representative sample of the adult US population.

3.2. Measures

As the primary response measures are dichotomous (user or nonuser, for example), logistic regression is the most relevant method of analysis. Thus explanatory variables were dichotomized at either the median, the combination of categories that came closest to splitting the distribution

[1] The survey design began with primary questions from the 1995, 1996, and 1997 surveys used by Katz and Rice (2002). The 2000 survey also included questions relating to community participation, social isolation, and information overload. The measures were pre-tested by providing the survey to 125 undergraduate students and analyzing the responses and relationships among the variables. Measures were revised or dropped based on these results. The resulting revised survey was pre-tested again on a national telephone survey of 200 respondents. A few measures were dropped based on these results. The final survey was then administered nationally by a commercial survey company. Because US Internet usage was near 50% at the time of this survey, we set a quota goal of 1000 Internet users, resulting in a total sample of approximately 1800.

As with any survey (or for that matter, any form of measurement), there are measurement errors. There are well known biases in respondents, even when using a random-digit dialing approach as we did. (See Katz, Aspden, and Reich (1997) for more information about possible response biases.) A particularly critical point is that the approximately 5% of households without telephones cannot be included in the first place. It is probable that this 5% would be drawn from the lowest socioeconomic strata (Mueller, 2001) and thus be most likely not to have heard of the Internet, and extremely unlikely to have Internet service in their home. The survey company had interviewers who spoke Spanish so that households in which that language was used could be included in our sample. On the other hand, there may be some underestimation of who is online because people who use a modem may not be reachable via phone for extended periods since they are already "on the line." Nonetheless, based on comparisons with 2000 US Census data, respondents in the 2000 sample are similar to the national average in gender, ethnic mix, and age composition.

Some, but by no means all, public opinion surveys use weighting post hoc to compensate for nonresponse bias or ineffective sampling frames. Lansing and Morgan (1971, p. 233) inter alia recommend this technique. However, many other statisticians express deep concern about applying weighting procedures to correct problems of this nature. They view weighting as highly susceptible to serious (and difficult to detect) errors. These statisticians include Kalton (1983, p. 74), Kish (1967, p. 403), and Zieschang (1990, p. 987). The data has not been weighted because the authors share these concerns. Further, most of the analyses in the paper test for any significant effects of a wide set of demographic variables, so some biases are controlled for statistically.

Table 1
Internet and Mobile phone usage, 2000

User category	Internet	Mobile phone
Current users (%)	59.7	54.4
Former users		
• Percent of respondents	10.5	9.0
• Percent of current and former users	14.9	14.2
Never used (%)	29.7	36.5
N	1305	1329
Adopted before or during 1997 (%)	53.8	53.8
Adopted after 1997 (%)	46.2	46.2
N	1000	725

of responses into two groups while also making the most conceptual sense, and/or reflected standard census dichotomous categories (such as for income and age).[2,3]

Usage for the Internet and mobile phone was measured in three ways: by whether the respondent was a current user, a former user (dropout), or never a user (in the case of mobile phone, owner), and the year each medium was first adopted (dichotomized at 1997, the median of the distribution of the initial year of usage, to create categories of "veteran" and "recent" users). Table 1 provides summary details on overall sample sizes, and numbers of Internet and Mobile phone usage.

Reasons for stopping using the Internet or using the mobile phone included cost, complexity, usefulness, interesting, and access (measured from 1 = extremely important to 5 = not at all important). Demographic variables included *gender*, *age* (dichotomized at 40 years), *income* (at $35,000), *education* (at college degree), *race* (due to sample sizes, only African–American and white non-Hispanic), *marital status* (dichotomized at other, or married), *children* (at none, or any),

[2] Almost all the variables were dichotomized. This conversion makes what might be highly complex and differing measures much easier to interpret and summarize. That is, almost all variables were converted into either "high/low" or "yes/no". While most of the variables were in fact categorical or ordinal, so that such a recoding is easily justified, some of the variables were interval or even ratio. Recoding such data into ranked (ordinal) categories, much less collapsing them into binary categories, throws away much data, reduces variance, and reduces possible variance explained and thus statistical significance. So, the tradeoff for making the many and complex analyses simpler to present and interpret is a conservative set of results. That is, such dichotomizing reduces the strength and significance of relationships, working against finding supportive results. However, given the nature, breadth and complexity of the various data sources and measures, we felt this was a worthwhile tradeoff. One anonymous reviewer agreed with this strategy, calling it "not unreasonable, and favors a principle of parsimony" which is "sufficient justification." Nonetheless, more rigorous and subtle analyses might apply methods specifically devised for categorical and ordinal analysis, such as CART (Classification and Regression Trees; see http://www-stat.stanford.edu/~jhf), FIRM (Formal Inference-based Recursive Modelling; see http://www.douglashawkins.com), and SPSS's CHAID.

[3] Even with the attempted limited analyses justified in note 2, controlling for standard socioeconomic (as well as some other appropriate) variables in the regressions, and the use of multiple-range significant tests, there may still be shared variance across some analyses, and thus over-estimates of significance. For that reason, multiple levels of significance are provided for those readers who may decide that a more stringent criterion is necessary.

and *work status* (at full time, or other). Media use measures include number of *letters* sent weekly (dichotomized at none, or any), *phone calls* made weekly (up to 9, 10 or more), and *e-mail messages* sent weekly (at none, or any). General social involvement was measured by the number of *religious* organizations, *leisure* organizations, and *community* organizations to which one belonged (each dichotomized at none, or any).

4. Results

4.1. Apparent similarity of internet and mobile phone usage

Of the 1305 respondents, 59.7% were current Internet and 54.4% current mobile phone users; 10.5% had stopped using the Internet, and 9.0% had stopped using mobile phones (relative to the total current and former users, the percentages were 14.9% and 14.2%); 29.7% had never used the Internet, and 36.5% had never had a mobile phone. For both media, 53.8% of those who indicated the year they first adopted the medium did so before or during 1997 (i.e., veteran users). On the surface, these aggregate statistics indicate that adoption, former, and nonuse of these two media were about the same in 2000. This equality of adoption rates (in 2000) might imply that Internet and mobile phone usage is indicative of similar demographic, personal and media use characteristics; that is, that their users and nonusers, and the influences on usage, are quite similar, and that the two media are quite similar in general communication function. It also implies that the only basic difference for both media is between adopters and nonadopters, the traditional criterion for identifying the "digital divide." Finally, this similarity would imply similar telecommunication and access policies for the two media.

4.2. Different usage categories and their relation to demographic differences

The following four sections attempt to identify whether there are noticeable differences in respondents' demographic and media characteristics across these three kinds of digital divides. Table 2 portrays relationships among categories of Internet and mobile phone users. Table 3 provides the percentages, cross-tabulations, and chi-square results for Internet, and Table 4 for mobile phone, within a variety of demographics.

4.2.1. Relationships among categories of internet and mobile phone users

Relationships among categories of Internet and mobile phone users, while significantly positively associated, are not exact. Considering all three categories of current, former, and never, 43.9% of the 1241 respondents do not occupy similar categories across the two media (for example 68 current mobile phone users have never used the Internet, while 62 former mobile phone users are current Internet users) (overall chi-square = 100, $p < 0.001$). Grouping former users with never users, the divergence drops a bit to 32.8% (236 were not current users of either medium, 155 were current mobile phone users but not Internet users, 321 were not mobile phone users but current Internet users, and 532 were current users of both media) (overall chi-square = 55.3, $p < 0.001$).

Table 2
Relationship of Internet and Mobile phone usage categories

Internet Use	Mobile phone use		
	Never	Former	Current
Never (%)	146/60.6	27/11.2	68/28.2
Former (%)	41/27.3	22/14.7	87/58.0
Current (%)	259/30.5	62/7.3	529/62.2
Chi-square = 100.0***			

Internet use	Mobile phone use	
	Non (never and former)	Current
Non (never & former) (%)	236/60.4	155/39.6
Current (%)	321/37.8	529/62.2
Chi-square = 55.3***		

When started using internet	Mobile phone use	
	Veteran: 1997 or before	Recent: 1998 or after
Veteran: 1997 or before (%)	211/62.6	126/37.4
Recent: 1998 or after (%)	136/48.7	143/51.3
Chi-square = 11.9***		

*** $p < 0.001$.

Time of adoption (grouped as through 1997 or after 1997) shows a similar divergence: of the 616 respondents who reported their year of first adoption, 42.5% adopted each medium in different time periods (211 were veteran users of both, 126 recent mobile phone but veteran Internet users, 136 veteran mobile phone users but recent Internet users, and 143 recent users of both Internet and mobile phone) (overall chi-square = 11.9, $p < 0.001$). So while these two media appear quite similar in terms of aggregate usage and adoption as of 2000, there are still substantial percentages of respondents who represent different categories of users or adopters for the two media, and these differences are statistically significant.

4.2.2. *The traditional digital divide: nonusers compared to current users*

As detailed in Tables 3 and 4, *Internet* nonusers were more likely to be female, older, have lower income, have less education, be slightly disproportionately African–American, have no children, and work fulltime, (obviously) send no e-mails, and belong to fewer community organizations. Compared to current *mobile phone* users, mobile phone nonusers had lower income, less education, were more likely to be never married or not have a partner, not have children, not work full time, and belong to fewer community organizations.

4.2.3. *Veteran users compared to recent users*

Compared to veteran Internet users, recent *Internet* users are more likely to be female, have lower income, have less education, have more children, make fewer phone calls, and send fewer

Table 3
Demographics of Internet usage categories

Demographic	Nonusers (never, former)	Current users	Veteran: 1997 or before	Recent: 1998 or after	Dropouts	Current users
Overall percent (%)	34.9	65.1	53.8	46.2	15.0	85.0
N	455	850	538	462	150	850
Gender						
Male (%)	41.8	49.4	51.4	45.2	44.0	49.4
Female (%)	58.2	50.6	48.6	54.8	56.0	50.6
N/Chi-square	455	850/7.0**	538	462/3.9*	150	850/1.5
Age						
<40 yrs (%)	38.9	55.6	59.6	54.8	67.1	55.6
⩾40 yrs (%)	61.1	44.4	40.4	45.2	32.9	44.4
N/Chi-square	440	827/32.3***	525	451/2.3	149	827/6.8**
Income						
<$35 K (%)	54.1	23.0	22.7	31.1	45.7	23.0
⩾$35 K (%)	45.9	77.0	71.3	68.9	54.3	77.0
N/Chi-square	363	709/104.4***	463	373/7.5**	127	709/28.5***
Education						
<College (%)	81.5	56.0	51.9	69.0	81.3	56.0
⩾College (%)	18.5	44.4	48.1	31.0	18.7	44.0
N/Chi-square	455	850/84.9***	538	462/30.5***	150	850/34.0***
Race						9.1% overall
African-Amer (%)	14.6	10.2	11.3	10.6	15.2	10.2
White (%)	85.4	89.8	88.7	89.4	84.8	89.8
N/Chi-square	411	753/4.9*	469	416/0.1	132	753/2.8
Marital status						
Other (%)	53.0	51.2	53.0	52.2	60.7	51.2
Married (%)	47.0	48.8	47.0	47.8	39.3	48.8
N/Chi-square	455	850/0.4	538	462/0.07	150	850/4.6*
Children						
None (%)	60.2	54.9	58.4	49.1	49.3	54.9
Any (%)	39.8	45.1	44.6	50.9	50.7	45.1
N/Chi-square	455	850/3.4*	538	462/8.5**	150	850/1.6
Work						
Full time (%)	48.6	62.7	63.6	59.7	56.7	62.7
Other (%)	51.4	37.3	36.4	40.3	43.3	37.3
N/Chi-square	455	850/7.3***	538	462/1.5	150	850/2.0
Letters sent						
None (%)	66.0	66.8	65.6	68.0	66.0	66.8
1 or more (%)	34.0	33.2	34.4	32.0	34.0	33.2
N/Chi-square	150	850/0.04	538	462/0.6	150	850/0.04

Table 3 (*continued*)

Demographic	Nonusers (never, former)	Current users	Veteran: 1997 or before	Recent: 1998 or after	Dropouts	Current users
Phone calls						
None to 9 (%)	37.3	39.6	36.1	43.1	37.3	39.6
10 or more (%)	62.7	60.4	63.9	56.9	62.7	60.4
N/Chi-square	150	850/0.3	538	462/5.1*	150	850/0.3
Emails sent						
None (%)	92.7	26.0	29.0	44.2	92.7	26.0
1 or more (%)	7.3	74.0	71.0	55.8	7.3	74.0
N/Chi-square	150	850/246***	538	462/24.8***	150	850/245.9***
Religious orgs						
None (%)	44.8	46.2	49.4	44.6	52.7	46.2
Any (%)	55.2	53.8	50.6	55.4	47.3	53.8
N/Chi-square	455	850/0.2	538	462/2.4	150	850/2.1
Leisure orgs						
None (%)	94.5	93.4	93.7	94.2	96.7	93.4
Any (%)	5.5	6.6	6.3	5.8	3.3	6.6
N/Chi-square	455	850/0.6	538	462/0.1	150	850/2.4
Community orgs						
None (%)	83.1	72.0	72.7	73.8	80.0	72.0
Any (%)	16.9	28.0	27.3	26.2	20.0	28.0
N/Chi-square	455	850/19.9***	538	462/0.2	150	850/4.2*

Note: Census percentages: Female, 51.0%; 40 years or older, 55.0%; less than $35,000 income, 44.6%; less than college degree, 71.0%; African-American, 12.7%. Census figures are from the online Statistical Abstracts of the US, either 1998 counts or July 1, 2000 estimates: www.census.gov/prod/www/statistical-abstract-us.html (January 1, 2001). The 2000 survey probably slightly under-estimates the percentage of African–Americans in the population. This may mean that the surveys slightly under-represent the percent of Internet users who are African–American; however, if those African–Americans who are under-represented in national probability samples are especially poor or less educated, then they are also less likely to know about or use the Internet, so these percentages may be slight over-estimates.

*$p<0.05$;**$p<0.01$;***$p<0.001$.

emails. Compared to veteran *mobile phone* users, recent mobile phone users are more likely to be younger, have less income, have less education, be African–American, not be married not have a partner, not work full time, not belong to religious organizations, and not belong to community organizations.

4.2.4. Dropouts compared to current users

Internet dropouts, compared to current users, were more likely to be younger, have lower income, have less education, have never been married or have a partner, (obviously) send fewer emails, and belong to fewer community organizations. Of the approximately 110 respondents who answered questions about reasons for stopping their use of the Internet, the following percent indicated these were "extremely important" or "important" reasons, in decreasing order of

Table 4
Demographics of Mobile phone usage categories

Demographic	Nonusers (never, former)	Current users	Veterans: 1997 or before	Recent: 1998 or after	Dropouts	Current users
Overall percent (%)	44.6	54.4	53.8	46.2	14.1	85.9
N	606	723	390	335	119	723
Gender						
Male (%)	44.7	46.6	48.5	44.5	41.2	46.6
Female (%)	55.3	53.4	51.5	55.5	58.8	53.4
N/Chi-square	606	732/0.5	390	335/1.1	119	723/1.2
Age						
<40 yrs (%)	47.8	52.8	43.6	63.2	48.3	52.8
⩾40 yrs (%)	52.2	47.2	56.4	36.8	51.7	47.2
N/Chi-square	580	708/3.3	381	329/27.4**	116	708/0.8
Income						
<$35 K (%)	47.8	22.4	14.6	31.8	46.2	22.4
⩾$35 K (%)	52.2	77.6	85.4	68.2	53.8	77.6
N/Chi-square	492	608/78.5***	335	274/25.5***	104	608/26.2***
Education						
<College (%)	70.1	60.9	52.3	71.0	68.9	60.9
⩾College (%)	29.9	39.1	47.7	29.0	31.3	39.1
N/Chi-square	606	723/12.5***	390	335/26.6***	119	723/2.8
Race (%)					14.3 overall	11.2 overall
African-Amer (%)	12.9	12.7	10.3	16.1	16.3	12.7
White (%)	87.1	87.3	89.7	83.9	83.7	87.3
N/Chi-square	549	636/0.01	359	279/4.8*	104	636/1.0
Marital status						
Other (%)	59.6	45.8	34.9	58.2	28.6	30.6
Married (%)	40.4	54.2	65.1	41.8	71.4	69.4
N/Chi-square	606	723/25.1***	390	335/39.6***	119	723/1.2
Children						
None (%)	60.6	53.3	56.4	49.9	61.3	53.3
Any (%)	39.4	46.7	43.6	50.1	38.7	46.7
N/Chi-square	606	723/7.2**	390	335/3.1	119	723/2.7
Work						
Full time (%)	48.5	65.3	71.8	57.0	58.8	65.3
Other (%)	51.5	34.7	28.2	43.0	41.2	34.7
N/Chi-square	606	723/37.9***	390	335/17.3***	119	723/1.9
Letters sent						
None (%)	67.2	66.4	67.1	65.4	63.1	66.4
1 or more (%)	32.8	33.6	32.9	34.6	36.9	33.6
N/Chi-square	384	616/0.07	347	269/0.2	84	616/0.4

Table 4 (*continued*)

Demographic	Nonusers (never, former)	Current users	Veterans: 1997 or before	Recent: 1998 or after	Dropouts	Current users
Phone calls						
None to 9 (%)	42.7	37.2	40.1	33.5	48.8	37.2
10 or more (%)	57.3	62.8	59.9	66.5	51.2	62.8
N/Chi-square	384	616/3.0	347	269/2.8	84	616/4.2*
Emails sent						
None (%)	39.3	33.9	33.4	34.6	45.2	33.9
1 or more (%)	60.7	66.1	66.6	65.4	54.8	66.1
N/Chi-square	384	616/2.9	347	269/0.09	84	616/4.1*
Religious orgs						
None (%)	47.5	44.4	39.7	49.6	45.5	44.4
Any (%)	52.5	55.6	60.3	50.4	54.6	55.6
N/Chi-square	606	723/1.3	390	335/7.0**	119	723/0.04
Leisure orgs						
None (%)	95.2	93.8	93.3	94.0	91.6	93.8
Any (%)	4.8	6.2	6.7	6.0	8.4	6.2
N/Chi-square	606	723/1.3	390	335/0.15	119	723/0.8
Community orgs						
None (%)	79.0	73.9	68.5	80.0	79.8	73.9
Any (%)	21.0	26.1	31.5	20.0	20.2	26.1
N/Chi-square	606	723/4.9*	390	335/12.4***	119	723/1.9

*$p<0.05$; **$p<0.01$; ***$p<0.001$.

frequency: Wasted my time (68.3%), too complicated (65.5%), too expensive (54.5%), lost access (48.2%), not interesting (46.4%), and not useful (48.2%).

Mobile phone dropouts, compared to current users, were more likely to have lower income, make fewer phone calls, and send fewer e-mails. Reasons for stopping owning a mobile phone that were rated by the 97 respondents as "important" or "extremely important", in decreasing order, were: too complicated (78.4%), lost access (74.7%), too distracting (58.3%), not useful (52.7%) and too expensive (44.0%). Note that across the two media, the two most important reasons for dropping out involved excessive complexity of the technology, and insufficient relevance to one's time (wasted, distraction). Palen and Salzman (2001) provide an excellent study of the difficulties novices have in using wireless communication technology, in the areas of hardware, software, "netware" and "bizware." Harper (2001) particular notes the complexity of many mobile phone interface. Inability to maintain access, the primary conceptualization of the digital divide, was the next most common important reason. Expense, also traditionally related to the digital divide, was the third most important reason for Internet, but least important reason for mobile phone, dropouts.

4.2.5. Multivariate influences on internet and mobile phone usage categories

Because the various demographic and other variables tend to be intercorrelated, it is useful to combine all those variables that were statistically significant across dropouts and users into a

logistic regression equation, which then controls for shared variance across the predictors. The final logistic equations for Internet and for mobile phone usage categories included only the remaining significant predictors (see Table 5).

Internet users, compared to nonusers (never and former), were older and had greater income (explaining 15% of the variance). Recent (that is, adopted in 1998 or after), compared to veteran, users, were older, had less education and lower income, were more likely to be female, have more children, use the phone less, and had a slight, nonsignificant tendency to belong to more religious organizations (8% of the variance). Finally, users, compared to dropouts, were more likely to have more education (6% of the variance). Note that more factors distinguished veteran from recent users than distinguished users from nonusers, though age and income explained nearly twice as much variance in the distinction between current users and others. Also, dropouts are distinguished from users by different factors than are nonusers (which include dropouts as well as those who have never used). Thus the dropout digital divide is substantively different from the nonusage digital divide.

Mobile phone users, compared to nonusers, were more likely to have full-time jobs, have higher income, and be currently married (explaining 12% of the variance). Recent, compared to veteran mobile phone users, are more likely to not work fulltime, be younger, not be married or have a partner, and have a slight tendency to belong to fewer religious organizations (13% of the variance). Current users, compared to mobile phone dropouts, were more likely to have higher income and make more weekly phone calls on a regular phone (5% of the variance). Again, different factors distinguish among these three usage measures. Current usage is influenced by characteristics of work, income, and marital status. Later adoption (recent vs. veteran usage) is influenced by work, age, and marital status. Mobile phone dropouts are characterized by lower income and less regular phone usage.

Table 5
Logistic regressions predicting Internet and Mobile phone user categories

Predictor	Nonusers (0)/users (1)		Veteran (0)/recent (1)		Dropouts (0)/users (1)	
	Internet	Mobile phone	Internet	Mobile phone	Internet	Mobile phone
Income	1.4***	0.99***	−0.36*			0.99***
Age	−0.66***		0.35*	−0.64***		
Education			−0.68***		1.2***	
Work		−0.58***		0.73***		
Marital		0.27*		−0.69***		
Phone calls			−0.33*			0.47+
Rel. orgs			0.26+	−0.3+		
Children			0.37**			
Gender			0.34*			
Chi-square	124.5***	102.1	53.3***	71.8***	37.1***	16.2***
Nagelkerke R^2	0.15	0.12	0.08	0.13	0.06	0.05
Correctly predicted	71.4%	64.3%	60.9%	64.4%	85.0%	87.5%
N	1061	1100	828	710	1000	590

Values are unstandardized beta coefficients from logistic regressions.
+ $p<0.1$; * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

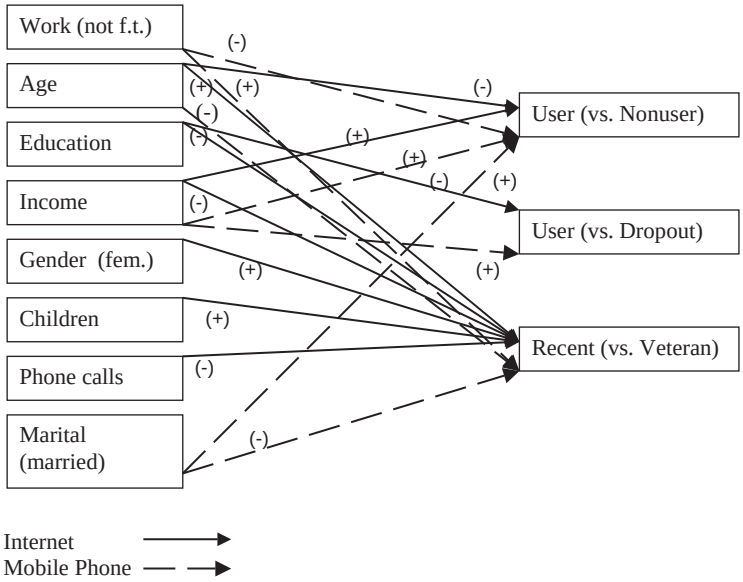

Fig. 1. Summary of bivariate influences on three kinds of digital divide, for internet and mobile phone.

Fig. 1 visually portrays the primary significant predictors for the three types of Internet and mobile phone digital divides. The recent/veteran divide is characterized by the most influences (six for Internet and three for mobile phone), the familiar user/nonuser divide involves two influences the Internet and three for mobile phone, and the user/dropout divide is characterized by only one significant (though different) influence for each medium. Thus, there is a fair diversity in the factors that influence each of the three kinds of Internet and mobile phone divides. On these grounds, the conclusion can be drawn that Internet and mobile phone users (and kinds of digital divides) are related, but not the same.

4.3. Contrasting groups of internet and mobile phone users

4.3.1. Influence of sociodemographic variables on cross-media usage categories

The above analyses showed a variety of influences within each of the three kinds of divides, and across the two media. But those analyses did not assess the extent to which usage categories across the two media overlap, a more stringent test of the basic question as to whether Internet and mobile phone users/nonusers are essentially the same (alternatively, whether the Internet and mobile phones are fulfilling substantially the same needs for the same kinds of users) and thus represent a single digital divide. Here, consideration is given to current Internet and mobile phone users versus Internet and mobile phone nonusers (combining never users with former users), resulting in four categories: currently use neither, currently use Internet only, currently use mobile phone only, and currently use both Internet and mobile phone. The user/nonuser distinction is the most familiar of the digital divides, and here also takes into account the most respondents.

One-way analyses of variance was applied across the four user/nonuser categories as the factor, and the demographic variables that were significant influences across the media categories in Table 5) work, age, education, income, gender, weekly phone calls, and marital status). Table 6 shows that all of these varied significantly across the four interdependent categories of Internet and mobile phone users. Income showed the greatest difference, with users of both media having the highest income, Internet only users and mobile phone users constituting a homogenous group but still in the high-income category, and users of neither media in the low-income category. Education was the next most significant influence, with nonusers and mobile phone users constituting one group (more education), and internet users and users of both media constituting another group (less education). Work status followed in significance, with nonusers least likely to be working fulltime, Internet only users and mobile phone users constituting one group more likely to be working fulltime, and mobile phone users and users of both media as a homogenous

Table 6
Demographic differences of combined Internet/Mobile phone usage categories

Variable	No use	Internet use	Mobile phone use	Both use	*F*-ratio
Work					
0 full time	0.58	0.45 a	0.39 ab	0.33 b	15.7***
1 other	236	321	155	529	
Age					
0 < 40	0.64	0.41 a	0.48 a	0.47 a	
1 > 40	226	309	153	518	9.9***
Education					27.2***
0 < college	0.17 a	0.41 b	0.21 a	0.46 b	
1 ⩾ college	236	321	155	529	
Income					
0 < $35 K	0.40	0.65 a	0.59 a	0.84	48.2***
1 ⩾ $35 K	188	263	131	446	
Gender					
0 male	61 b	0.49 a	0.58 ab	0.51 a	3.5**
1 female	236	321	155	529	
Phone calls					
0 < 10	0.49 a	0.59 a	0.72 b	0.61 ab	
1 ⩾ 10	63	321	87	529	3.0*
Marital					
0 other	0.45 ab	0.37 a	0.47 b	0.56	
1 married	236	321	155	529	9.5***

Values in cells are mean percent of cases with the "1" value of each demographic variables, and the cell sample size. Letters indicate which means are not significantly different across the user categories, by Duncan's pairwise comparisons.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

group with the greatest likelihood of working full time. Nonusers were likely to be over 40, while all the other three kinds of users were equally likely to be under 40. Concerning marital status, nonusers and Internet users were similarly most likely to not be married, nonusers and mobile phone users more likely to be married, and users of both media most likely to be married. Nonusers and mobile phone users were likely to be female, while Internet users, mobile phone users and users of both media were similarly about equally likely to be male or female. Making more phone calls characterized mobile phone users and users of both media, while nonusers, Internet users and users of both media were not distinguishable with respect to a lower level of phone usage.

4.3.2. Joint influence of socio-demographic variables on cross-media usage categories

These separate analyses of variance do not statistically take into account shared variance across the demographic influences. To determine just which media categories are best characterized by these influences, we turn to multiple discriminant analysis,[4] which does control for shared variance among the explanatory variables in attempting to predict membership in nominal groupings. We tested for discriminability across several combinations of the user categories: (A) keeping the four categories separate; (B) combining the two middle categories—Internet only and mobile phone only; (C) combining the nonusers and Internet only users; (D) combining the nonusers with the Internet only and the mobile phone only users; and (E) combining nonusers with Internet only users, and mobile phone only users with users of both media.

In all five models, only income and education were able to significantly discriminate among these categories. In Model A, the four categories were discriminated by one primary function characterized by income that represented nearly all the variance among the predictors, and had a canonical correlation of 0.38 with the variance among the user categories. The second function, characterized by higher education and lower income, represented only 7% of the variance among the predictors. About half (48.6%) of the cases were correctly classified based on these two functions, mostly either as nonusers or users of both media. In general, mobile phone only users could not be correctly predicted.

The first set of three categories combined Internet only with mobile phone only users (Model B). Only the first function was significant, with a canonical correlation of 0.37, the highest of the five analyses. As expected based on the prior analysis, the single function, predominately characterized by income, ordered the groups with nonusers the lowest in income, Internet only and mobile phone only users in the middle, and users of both media with the highest income. This model correctly classified 50.7% of the cases, but could not predict nonusers. As it uses one fewer category, and only assigned about 2% more cases, this model is not a satisfactory improvement.

[4] While some may object to the use of discriminant analysis, the authors think the approach has value in understanding the questions being analyzed. They think that this is partly because there are extant in the literature studies that have used this approach for conceptually related problems (Awh & Waters, 1974; Lida, 2002). Further, there is support in the statistical sciences literature for approaches similar to those we have pursued, and this support extends even to those who have critical views of discriminant analysis (Mason & Perreault, 1991; National Academy of Sciences, 1988; Press & Wilson, 1978; Schumacker, Mount, & Monahan, 2002). Finally, this method is again a parsimonious way to detect differential influences of a common set of variables on the four intersecting categories of Internet/mobile nonusage/usage.

The second set of three categories (Model C) combined nonusers with Internet only users, and compared them against mobile phone only users, and then users of both media. The same two functions were significant, with canonical correlations of 0.32 and 0.1, again with the first function characterized mostly by income and representing most of the variance among the predictors, and the second function characterized by high education and low income. Here, the first function (income) located the users of both media as distinct from the other two categories (nonusers, and both types of "only" users), while the second function (education) placed the mobile phone users away from the other two groups. This model correctly assigned 56.4%, but was unable, like the first model, to predict mobile phone only users.

The final two models analyzed just two combined categories. The fourth model (D) combined nonusers with Internet only and mobile phone only users, compared to users of both media. The single resulting significant function produced a canonical correlation of 0.32, and separated these two categories with users of both media located with higher income and education, and was able to correctly classify 61.7% of the cases. The fifth model (E) combined nonusers with Internet only users, and mobile phone only users with users of both media, producing a canonical correlation of 0.25. Income dominated the function here; that is, when separating users essentially on the basis of mobile phone use or not, income was even a stronger discriminator. This model correctly classified 63.9% of the cases, the highest of all the models.

None of these five models clearly represents the single best model, though at least three are relatively less satisfactory. Model A has the highest combined canonical correlations, but, like models B and C, cannot predict one of the categories. With 16 cells, the expected random classification is 6% (1/16), so the correctly classified 48.6% is quite an improvement (a difference of 42.6%). Of the three-category models, Model C is better than model B. The expected random classification for nine cells is 11.1%, so 56.4% is again quite an improvement (a difference of 45.3%). Of the two-category models, model D has a higher canonical correlation, but model E correctly classifies 2.2% more of the cases; in both models the expected random classification is 25%, so 63.9% is an improvement of 38.9%. Model C is model A's equal in being unable to predict mobile phone only users, and in the difference from expected correct assignment, but is more parsimonious.

So the best model appears to be either model C and model E. Table 7 presents the results of these two models. In both cases, *currently using only the mobile phone* is the primary distinction. If overall canonical correlation values, and improvement from change classification are the criteria, then model C seems preferable. If avoiding a category of user that simply cannot be predicted is a crucial criterion, then model E seems preferable. In both models, however, people who use only the Internet or only mobile phone are clearly distinct kinds of users, and they are distinguished primarily on the basis of income (higher for mobile phone, lower for Internet) and education (lower for mobile phone, higher for Internet). Thus, while overall usage rates in the US were equal in 2000, the patterns of adoption were not, and two standard dimensions of the traditional divide, income and education, underlie the differences.

5. Discussion

These analyses of a nationally representative telephone survey conducted in 2000 ($n = 1305$) indicate that there are at least two additional kinds of digital divides instead of just the single

Table 7
Discriminant analyses predicting combinations of Internet and Mobile phone usage: the two best models (C and E)

(C) Neither and Internet only vs. Mobile phone only, vs. both	Function 1	Function 2	
Eigenvalue, Pct. variance	0.11/92.9	0.01/7.1	
Canonical correlation	0.32	0.10	
Wilks' Lambda	0.89***	0.99**	
Standardized function coefficients			
Income	0.89	−0.53	
Education	0.29	0.99	
Structure matrix			
Income	0.96	−0.28	
Education	0.51	0.86	
Group Centroids			
Neither and Internet only	−0.29	0.06	
Mobile only	−0.28	−0.28	
Both	0.38	0.00	
Classification results (predicted Data correctly classified = 56.4%)	Neither or Internet only	Mobile only	Both
Neither and Internet only	45.5%	0%	54.5%
Mobile only	41.2%	0%	58.8%
Both	15.9%	0%	84.1%
(E) Neither or Internet only, Vs. Mobile phone only or both	Function 1		
Eigenvalue/Pct. variance	0.07/100		
Canonical correlation	0.25		
Wilks' Lambda	0.94***		
Standardized function coefficients			
Income	1.00		
Structure matrix			
Income	1.00		
Education	0.27		
Group centroids			
Neither or Internet	−0.30		
Mobile phone or Both	0.23		
Classification results (predicted Data correctly classified = 63.9%)	Neither or Internet	Mobile or both	
Neither or Internet	45.5%	54.5%	
Mobile or both	21.7%	78.3%	

** $p < 0.01$; *** $p < 0.001$.

familiar one of usage versus nonusage: veteran compared to recent users, and dropouts compared to continuing users. Further, multiple and different factors influence each of these three kinds of Internet and mobile phone divides. On these grounds, the conclusion is drawn that Internet and mobile phone digital divides are not the same, either conceptually or empirically in terms of distinctive categories or significant influences. The paper now return to our original research questions with some summary answers.

1. To what extent are there digital divides in Internet use and in mobile phone use in 2000?
2. What are the influences on and reasons for these divides?
3. To what extent are the primary digital divides of Internet usage and mobile phone usage similar, that is explained by similar influences?

Users vs. nonusers: Concerning the *Internet* in 2000, when all the influences are analyzed together, nonusers were found to be older and had less household income. Concerning the *mobile phone*, nonusers were less likely to work fulltime, had less income, and were less likely to be married.

Veteran vs. recent users: These two categories of adopters are quite different, both within and across the two media. For both media, age is a significant multivariate predictor, but in opposite ways: veteran Internet users were younger, but veteran mobile phone users were older. Amazingly, there is no other common influence. Early adopters of the Internet fit the traditional digital divide model (younger, more education, higher education, male) as well as having some other characteristics (more children, more regular phone use). But early adopters of the mobile phone were more likely to work fulltime, and be married.

Dropouts vs. current users: The divide between users and former users, or dropouts, for the Internet is primarily associated with being less educated, but for the mobile phone it is lower income and less frequent telephone calling. The two common most important reasons for dropping out are complexity, and diversion of attention from more important activities. The two primary reasons for Internet dropout are complexity and cost (with access the third), while for mobile phone dropout they are complexity and access, with cost the least important reason. Thus understanding and being able to use the technical features is the single most important named reason for dropping out (though only as rated by around 100 out of 1305 respondents in the survey).

Dropping out of, or disadopting, a new medium, unlike adopting it in the first place, has hardly been studied. The topic would seem to be of considerable relevance to both the policy community and service providers, including educators. At the same time, the issue of dropouts may be only transient; that is, nearly all dropouts may once again become—and remain—users. Indeed, logic and experience would (as it did) lead us to expect almost no disadoption. The authors' suspicions in 1995 that this large a percentage of dropouts was a measurement error largely evaporated when they continued to find similar dropout rates in 1996, 1997 and 2000 (Katz et al., 2001; Katz & Rice, 2002), and when the independently conducted Pew studies of 2000 found a nearly identical pattern to that described in this paper.

While the ultimate future of the Internet and mobile phone communication cannot be known, there seems at present to be millions of former users of both media. Given the substantial

economic and social equity stakes, the causes and consequences of this phenomenon require further investigation.

Distinguishing among combinations of Internet and mobile phone users and nonusers: While the distinction among the categories of Internet and mobile phone users and nonusers is not primarily predictable, there clearly is a difference between Internet users and mobile phone users. The distinction comes primarily between those who use only the Internet and those who use only mobile phones. People who use both are somewhat more like those who use only mobile phones, and people who use neither are somewhat more like those who use only the Internet. The primary influences on this distinction are income, followed by education. Intriguingly, this particular digital divide occurs in opposite directions: higher income and lower education are associated with the mobile phone only usage, while lower income and higher education are associated with the Internet only usage. In this sense, there are two opposing digital divides involving the Internet and the mobile phone. Those who use both tend to be those with the highest income but only moderately higher education.

6. Conclusion

While the national survey data from 2000 suggest that Internet and mobile phone usage rates were quite similar, in fact there is considerable divergence in usage patterns and demographic and media influences on those usage patterns. Significantly from a policy and conceptual viewpoint, rather than there being "just" an Internet digital divide, there is also a mobile phone digital divide. Moreover, instead of the Internet or mobile phone digital divides being limited to the first and most common distinction (that is between users and nonusers) there also seems to be a noticeable digital divide between ongoing users and dropouts, and possibly more distinctively between earlier and later adopters.

Further, Internet and mobile phone users (or nonusers) are not necessarily the same set of people (or, conversely, the two media do not fulfill similar needs or utilities for the same demographic groups). The simplest distinction seems to be between a group of people who are not currently using either medium or are currently using only the Internet, and a group of people who are using only the mobile phone or are currently using both media. These two groups are distinguished primarily on the basis of income, and secondarily by education, and in opposite directions.

As research and the federal studies of Internet use have argued, people on the short end of the various digital divides (nonusers, dropouts, and in some sense the most recent adopters) could benefit from the social, economic and personal resources that new communication technologies can provide. This need has been clearly recognized in the case of the Internet. Indeed, up until mid-February of 2002, the US government planned to pump billions of dollars annually into social programs to subsidize the Internet's deployment and support social programs to advance training and access to the technology. The FY2003 federal budget, however, abandoned this reasoning, arguing that there is no longer a consequential Internet digital divide, at least not one worth spending federal resources on. By contrast, the mobile phone appears to be the stepchild of social programs, and no "universal service," "lifeline" or training and subsidy programs exist. It is

difficult to explain this disproportionate attention, and why so much socially beneficial potential of the mobile phone seems to be ignored by the federal government. Clearly, the ''voice'' side, namely mobile phone technology, has not received the attention it deserves, both in absolute terms and in terms relative to the ''text'' side, namely the Internet. Our analysis, then, seeks to increase scholarly and policy concern about, study of, and development of social action programs involving mobile phone technology. By being more aware of the variety of usage digital divides within and across the Internet and mobile phones, policymakers and researchers might have improved justifications, choices and strategies available for narrowing the several digital divides.

Acknowledgements

The authors appreciate the helpful comments of Ulla K. Bunz, and two anonymous reviewers. This study is part of a larger project called the *Syntopia Project* (see, for example, Katz & Rice, 2002). The joint aim has been to create through a series of national random telephone surveys, as well as case studies, in-depth observations, and website analysis, a multi-year program charting social aspects of Americans' mediated communication behavior. The name ''Syntopia'' was chosen for several reasons. First, an important aspect of the Syntopia concept is that the Internet is part of a much larger synthesis of communication and social interaction. People's physical and social situation and history influence their actions online, and what they learn and do online spills over to their real world experiences. The term Syntopia underscores this synergy across media and between mediated and unmediated activities. Second, the term Syntopia draws together the words ''syn'' and ''utopia.'' Derived from ancient Greek, the word means literally ''together place,'' which is how we see the Internet and associated mobile communication and its interaction with unmediated interpersonal and community relations. Third, the term Syntopia invokes both utopian and dystopian visions of what new media such as the Internet and mobile telephony does and could mean. At the same time, the term also alludes to the dark side of new media in the homophone ''sin.'' Finally, while mediated communication may be critiqued as ''impersonal'' or ''synthetic,'' the argument can be put forward that the research to date shows that mediated communication can provide wider, more diverse, and possibly more real—even hyperpersonal—communication than traditional face-to-face communication. A syntopic perspective provides a foundation for considering the differences as well as similarities between Internet and mobile phone users and nonusers.

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