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Race, Place, and Information Technology

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What role does environment play in influencing information technology access and skills – over and above individual characteristics such as income, education, race, and ethnicity? One of the puzzles that emerged from our recent research on the "digital divide" was that African-Americans, and to a lesser extent, Latinos, had *more* positive attitudes toward information technology than similarly-situated whites. And yet, African-Americans and Latinos are less likely to have information technology access and skills, even when controlling for other factors such as income and education (Mossberger, Tolbert and Stansbury 2003). The research presented in this paper takes a first step toward explaining this paradox by unraveling the impact of place.

One of the enduring debates in social science is what difference environment makes in shaping an individual's opportunities. Scholars have long contended that place does matter, particularly when racial segregation and concentrated poverty are involved (Myrdal 1944; Clark 1965). More recent research shows that serious inequities persist in poor urban communities, despite decades of civil rights and fair housing legislation (Massey and Denton 1993; Kozol 1991; Kasarda 1990; Hill and Wolman 1997; Rosenbaum 1995; Wilson 1987 and 1996; Sampson et al. 2002). The information age may have transformed these existing disparities in very poor communities, particularly inner-city neighborhoods, into new barriers to technological access and skill.

To better understand the impact of environmental factors, we plan to examine survey responses on information technology access and skill using three different levels of data – individual-level demographic characteristics, individual variables merged with county level socioeconomic and demographic data, and individual variables merged with these same environmental factors measured at the census tract level. This will allow us to

untangle the effects of place, differentiating between the effect that environmental factors such as poverty have at the county level and at the neighborhood level. Living in a poor region may have some effect on individual technology access and skill because of limited regional employment opportunities or poor services. Research on racial segregation and concentrated poverty suggests, however, that structural disadvantages in urban neighborhoods with high levels of poverty may have an even more dramatic effect on individual opportunities. Our hypothesis is that lower rates of technology access and skill among African Americans and Latinos may be partly explained by environmental effects, since attitudes about technology cannot account for these differences. No previous studies of technology access and skill have explored the impact of environmental factors such as the racial, economic, and educational composition of the area at either the county or neighborhood level.

We begin with a literature review on information technology disparities that includes our previous research and explores the ways in which environmental factors may matter for access and skill. The methodology section that follows describes the techniques used in this paper as well as the July 2001 national random-sample telephone survey on which this study is based. This survey is unique because it includes a sample drawn from high-poverty census tracts, as well as a more general sample. We present the findings from the survey data merged with county-level demographic data, which shows that contextual factors do indeed matter for technology access and skill. Our analysis of the survey data merged with census tract-level demographic data is currently incomplete, but we conclude by considering the additional questions that can be answered in this final stage, given what we have already learned.

INFORMATION TECHNOLOGY DISPARITIES AT THE INDIVIDUAL LEVEL: REVIEW OF PREVIOUS RESEARCH

The term "digital divide" has been used to describe patterns of unequal access to information technology based on factors such as income, race, ethnicity, gender, age, and residence in urban or rural areas.[1] While the number of computer and Internet users has steadily grown over the past decade, census data and other research have shown systematic differences between those who are connected and those who are not. Inequities based on gender have diminished over the years (NTIA 2002), and some predictions have been made that racial and ethnic gaps are currently insignificant or will soon disappear of their own accord. The "strong version" of this scenario is that all differences between groups, including those based on income and education, are being erased by the rapid diffusion of the Internet and computers throughout society (NTIA 2002; Compaine 2001).

Do race and ethnicity matter for technology access and skill? Major surveys published by the National Telecommunications and Information Administration and the Pew Internet and American Life project present descriptive data that shows that African-Americans and Latinos have lower rates of home access to computers and the Internet (see for example, NTIA 2002 and Pew 2000). Some market research has found the opposite case, that Latinos have higher rates of access than whites (Walsh 2001).[2] Academic studies are contradictory. Nie and Erbring (2000) and Wilhelm (2000) dismiss the influence of race, whereas Hoffman, Novak, and Schlosser (2000) and Neu,

[1] Early government reports on the issues, identified lower rates of access for individuals living in urban and rural areas (NTIA 1995).

[2] This market survey has been quoted by academic sources (see Compaine 2001, Chapter 14), but it was based on a mail survey, for which the response rate was not disclosed.

Anderson, and Bikson (1999) find racial and ethnic disparities in computer access. Most research, including academic studies, suffer from either the lack of multivariate statistical controls, research design limitations, or insufficient sample data to draw inferences to the national population. They are therefore unable to disentangle the effects of overlapping variables such as race and income.[3] Most research also shares a narrow definition of the divide as an issue of access alone. Access, however, is insufficient if individuals lack the skills needed to use technology. With the advent of the Internet, technology use requires reading skills and the ability to search for, use, and evaluate information (information literacy). There is little systematic or generalizable research on skill. What exist is drawn primarily from case studies or non-random samples, such as questionnaires from community technology centers (Lentz et al. 2000).

Low-Income Survey on Access and Skill

The individual-level data from our survey show that race and ethnicity do matter for access. Using a national random surveys that oversampled low-income neighborhoods, and multivariate regression, Mossberger, Tolbert and Stansbury (2003) found that African Americans, Latinos, the poor, older individuals, and the less-educated are all statistically less likely to have access to home computers, the Internet, and e-mail. In addition, we found evidence of a skills divide that mirrors the access divide. Race,

[33] Although Wilhelm (2000) and Neu et al. (1999) used multivariate regression, these studies have some limitation as well. The data used by Neu et al. is from the 1993 Current Population Survey, before widespread use of the Internet. Wilhelm's findings on race and ethnicity are suspect. He included two variables for white (non-Hispanic) in his analysis: (1) a dummy variable for ethnicity coded 1 for non-Hispanic and 0 otherwise and (2) a series of dummy variables for race that included white. This dummy variable coding of race/ethnicity creates a situation of near perfect multicollinearity, which makes it impossible to determine the impact of race or ethnicity on access to a home computer or modem. In addition to the dummy variable for white, Wilhelm also included dummy variables for African American, Asian American, and Native American respondents, leaving "other race" as the reference group for race. Given that very few individuals would have been in the reference group, the race variables also suffer from

ethnicity, education, income, and age are all statistically significant predictors of lower levels of self-reported technology skill as well. This is true for technical computer skills (needing assistance to use a mouse or keyboard, e-mail, or a word processing or spreadsheet program), as well as for information literacy skills (using computers to find books, do homework, or find information on the Internet).

These findings on access and skill lead us to conclude that the optimistic scenario depicting information technology diffusion throughout society may be unrealistic without some policy intervention in low-income and minority communities. About 20 percent of our respondents reported needing assistance using the mouse and keyboard. National studies of literacy also show that nearly one-quarter of the population lacks more than the most elementary level of literacy (Kaestle et al. 2001). Some skill disparities may be a matter of educational inequities, and technology use may require more than affordable or accessible computers and Internet connections (Penuel and Kim 2000).

Persistent disparities in access and skill may be the result of environmental influences such as poor education and a dearth of opportunities to become acquainted with technology in these communities. The case for environmental effects is also strengthened by other results we found in our survey. Race and ethnicity influence *attitudes* toward technology, in a surprising way. African-Americans had *more positive* attitudes toward information technology than similarly-situated white respondents, across a range of questions. While over 2/3 of Americans view the Internet and computers as important for "keeping up with the times," or as important for economic opportunity, African Americans are significantly more likely to agree with these statements. They are

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near perfect multicollinearity, violating the assumptions of linear regression and possibly invalidating the findings.

also more likely than whites to be willing to learn new computer skills in a variety of ways, and are more willing to use public access sites for computers and the Internet. In terms of actual behavior, we found that African-Americans are more likely than whites to have used computers for job search or to have taken an online course. Our findings agree with other survey research on Internet job search (Pew 2000), but our analysis shows that these racial differences are statistically significant even after controlling for differences in income and education.

Ethnic differences are less pronounced, but Latinos are more likely than whites to say that the Internet is necessary to keep up with the times, and are more willing than white respondents to take computer classes to learn new skills. Otherwise, their attitudes differ little from white respondents in the sample.

Taken together, these statements show a fairly consistent pattern of positive attitudes about information technology for African Americans especially, as well as Latinos. Some other studies have also shown that African-Americans, Latinos, and urban residents are among the Internet nonusers who are most likely to say they will use the Internet someday (Lenhart 2003). Because apathy is an insufficient explanation for racial and ethnic differences, and individual income is also insufficient to account for these differences, environmental influences may be at work.

HOW ENVIRONMENT MAY MATTER

Research on racial segregation and concentrated poverty suggests environmental factors in poor urban neighborhoods may account for racial and ethnic differences in access and skill. Drawing on this research and some of our own survey results, we identify three ways in which location could influence access and skill: public and

nonprofit institutions (particularly schools, but also libraries and community centers); social networks for information and informal learning; and job opportunities.

Institutions

The potential effect of public institutions is probably clearest in regard to the quality of education, something that measures such as individual educational attainment fail to capture. There are marked disparities between central city and suburban school districts, which have grown in recent years (Bahl et al. 1992; Bahl 1994). These district-wide inequalities are often exacerbated, however, within the poorest neighborhoods (Kozol 1991). Increased investment in technology hardware through the federal E-rate program has not closed the technology gap in poor urban schools, despite an increase in the number of computers in poor districts. Students in low-income schools may use technology less frequently because of lack of teacher training or the time required to familiarize students with basic technical skills that more affluent students have acquired at home. Computers tend to be used for rote learning exercises rather than for exploration of the Internet and its information resources (Bushweller 2001; Manzo 2001).

Poor communities may lack other important institutional supports for technology use at libraries or community centers. Federal grants and non-profit agencies have provided funding for community technology centers in poor neighborhoods, but such centers are not universally available, and their operations often rely upon volunteers or unstable funding sources. One study of Los Angeles conducted by the Tomas Rivera Institute concluded that in many neighborhoods, the only available resource for public access was the neighborhood library (Trotter 2001). According to the American Library Association, 95 percent of libraries in the United States offer public access to at least one

computer, and almost half of them provide some type of technical assistance or training for patrons (Trotter 2001). Yet we know little about the extent or quality of these computer services, especially in poor communities. Both schools and libraries tend to be heavily dependent on local revenues. The needs/resource dichotomy means that central cities have less fiscal capacity to provide public services, despite the need to serve residents who are often unable to purchase equivalent services in the private sector (Rusk 1995, 47). Moreover, central cities tend to have a higher fiscal burden for police, fire, and courts, limiting their ability to invest in other services, such as libraries (Pack 1998).

Social Networks

Social networks facilitate technology use, according to our survey. Computers and the Internet are used far more frequently at the homes of friends or relatives than at public access sites. Twenty percent of all respondents reported using computers and the Internet at the homes of others, and twenty-four percent of respondents without home computers relied on friends and relatives. This is about 10 percentage points higher than rates of usage of public access computers at libraries[4] (Mossberger, Tolbert, and Stansbury 2003). Informal processes of learning about computers and their uses may be as significant as public access and formal training. Much has been written about the lack of resources and information in social networks in areas of racial segregation and concentrated poverty (Coleman 1988; Wilson 1987 and 1996; Holzer 1987; Ihlanfeldt 1997; Ainsworth 2002; Sampson et al. 2002). Individuals living in high-poverty neighborhoods are more likely to have friends who are out of the job market and less-educated (Rankin and Quane 2000), and may therefore have less exposure to technology

[4] Ten percent of all respondents use computers at libraries, whereas 13 percent of respondents without home computers use them at libraries.

through personal networks. A recent survey shows that 31 percent of those who are "truly unconnected" say that very few or none of the people they know go online, whereas only 4 percent of Internet users report such social networks (Lenhart 2003).

Employment

Finally, the workplace provides formal and informal training in computer and Internet use. Many individuals introduced to computers on the job eventually acquire them at home, so jobs can represent an important step in technology adoption (NTIA 2002). Low-skill jobs requiring less education are less likely to demand information technology use, but 45 percent of our respondents who had a high school education or less used computers at work, and 25 percent used the Internet on the job (Mossberger, Tolbert, and Stansbury 2003; see also Holzer 1996, 49; Kruse and Blasi 2000, 72; Moss and Tilly 2001, 83).

Residents in inner-city neighborhoods (or other impoverished areas) may be disadvantaged by lack of employment or low-skill jobs that don't use technology. High levels of unemployment in areas of concentrated poverty may be perpetuated by social networks lacking in information and contacts that could lead to employment or better jobs (Granovetter 1973; Hill and Wolman 1997; Ihlanfeldt 1999). Shifts from manufacturing to the service sector coupled with the movement of many employers to the suburbs may create a "spatial mismatch" between the occupational skills of inner-city residents and the requirements of the knowledge-intensive professional jobs experiencing growth in nearby downtowns (Kasarda 1990; Hill and Wolman 1997).

Poverty at the County Level

Most of the research cited above discusses urban phenomena rather than the geography of poverty more generally. Some scholars caution that their findings on concentrated poverty are most applicable in neighborhoods with poverty rates of 40% or more (Jargowsky 1998; Wilson 1996), primarily in the Northeast and Midwest (Wilson 1996). African-Americans are more likely to experience the effects of concentrated poverty than whites or even Latinos (Massey and Denton 1993).

We are therefore interested in the influence that spatial factors have on technology access and skill at both the regional (county) and neighborhood (census tract) levels. Social networks clearly operate on a smaller scale closer to the neighborhood level. But regional poverty may affect job opportunities in the broader area labor market. Counties are also significant service providers in the South and West, and education providers in the South. High-poverty counties may influence services such as education or libraries because services are administered at that level, or because poor counties are comprised of impoverished municipalities and school districts. We examine the difference that county level environmental factors make for technology access and skill in comparison with individual characteristics. We conclude with predictions on what we will find in the next stage, at the census tract level.

METHODOLOGY

Because we are interested in the environments in which individuals use and access information technology, we turn to available aggregate data to measure social and economic context. Identifying a context's boundaries is essential for understanding its potential effects (Oliver and Mendelberg 2000). Our primary source of data is a national telephone survey conducted in July 2001 by Kent State University's Computer Assisted

Telephone Interviewing (CATI) lab merged with county-level 2000 US census data. We use county-level data to measure wealth, educational opportunities and racial diversity. Future research will merge the survey data with census-tract data to explore neighborhood factors including concentrated poverty. At the time of writing this manuscript, 2000 US Census Bureau tract level data was not available in a usable form.

The survey data was based on a split-sample design, with one national random sample of 1190 respondents drawn from all high poverty census tracts in the 48 states, excluding Alaska and Hawaii. High poverty tracts were defined as those with 50% or more of the households living at or below 150 percent of the official poverty level. The response rate for individuals in the high poverty tracts was 92 percent. Federal data shows that telephone service now reaches 94 percent of the population (U.S. Department of Commerce 1995), so telephone surveys are a reasonable methodology for obtaining sample data even in low-income communities. A second national random sample of 655 respondents served as a control group, with a response rate of 88 percent. There were 1837 valid responses overall. The telephone survey included 50 items and averaged 8.5 minutes to complete.[5]

Because the survey targeted high poverty areas, the sample included a relatively large proportion of racial and ethnic minorities, compared to standard surveys. Of the 1837 respondents, 70 percent were white non-Hispanic, 19 percent were African-American, 9 percent Latino and 1.5% Asian American. Thus, Latinos and African-

[5][5]Telephone numbers were dialed daily through the months of July (37 days in the field) by trained interviewers. Up to 524 callbacks were attempted to contact potential respondents for the general population sample and 371 for the poverty sample. Answering machines were treated as "no answer" and called back on a regular no answer rotation, a minimum of three hours later. After securing cooperation, interviewers used Computer-Assisted Telephone Interviewing systems to administer questions and record responses.

Americans comprised 28 percent of the sample population, compared to 25 percent of the U.S. population in the 2000 census. Thirty-eight percent of our sample had household incomes below $30,000. This allowed us to make accurate inferences to minority and low-income populations as a whole. The survey generated data that was comparable to large-sample studies. Sixty-one percent of our respondents reported having access to a home computer, 54 percent reported having home Internet access, and 58 percent reported having an e-mail address. This closely tracks the figures in the U.S. Department of Commerce study conducted in August of 2001 – 57 percent and 51 percent of households having home computers or home Internet access respectively (NTIA 2002).

We use multivariate regression models to predict the impact of individual level and environmental variables on access to information technology and computer skills. To facilitate interpretation of the statistical findings, the regression coefficients from the statistical models are converted to expected probabilities using a Monte Carlo simulation technique (King et al 2000). These simulation estimates allow us to compare the magnitude of differences for access based on environmental (place) characteristics, holding other factors including race, education, income, gender and age constant. We calculate the change in the probability caused by moving from a variable's minimum to maximum value while simultaneously keeping all other variables set to their mean or (0 or 1 category for dichotomous variables).

HOW PLACE MATTERS AT THE COUNTY LEVEL

Table 1 provides an examination of factors associated with access to a home computer, Internet access and an email address using logistic regression analysis. The first three models in the table have binary dependent variables based on responses to the

following questions, “Do you personally have a home computer?” “Do you have an e-mail address with which you can send and receive e-mail?” and “Do you have access to the Internet from home?” In each model the dependent variable is coded 1 for access to technology, and 0 for no access.

Individual level explanatory variables measure race, ethnicity, gender, partisanship, income, age and education. “Dummy” variables for African-American, Latino, Asian American, Democrat, Republican and those with an annual income less than $30,000 are coded 1 and 0 otherwise. For race and ethnicity whites were the reference group, or the left-out group that was not coded. For partisanship, those without strong partisan identification – independents – were the reference group that was not included. Education was measured on a 5-point scale with responses ranging from 1= less than a high school degree to 5= postgraduate work. Age was recorded in years.

Environmental variables based on the 2000 census data measure county level median household income (mean=39,000), high school graduation rates, percent African American, percent Latino, and percent Asian American populations. If poverty is important in the digital divide, we would expect that county level measures of wealth would be associated with access to information technology and computer skills.

Results

1) Access to Information Technology

What factors explain access to information technology when we control for environmental influences? Individual-level variables are still significant. Across the models reported in Table 1 two of the most important variables measure race and economic resources. The poor (respondents with a family income of less than 30,000 per

year) are statistically less likely to have a home computer, home Internet access or an email address, after controlling for other factors. This is consistent with previous research on the digital divide (Mossberger, Tolbert and Stansbury 2003, NTIA 1995 and 2002, but contradict others such as Compaine 2001, Nie and Erbring 2000). Race/ethnicity is equally important. African Americans and Latinos are statistically less likely to have access to information technology (home computer, email address or home Internet access) than whites. Asian Americans, however, have access comparable to whites. Consistent with previous research, the educated are more likely to have access to all three forms of technology, as are the young. Even after controlling for environmental factors, individuals with Republican partisanship are more likely to have access to computers and the Internet than Independents or Democrats. Gender is also important for two of the three measures, as males are more likely to have an email address and home Internet access than females. Many of these individual findings confirm previous research on the digital divide (Mossberger, Tolbert and Stansbury 2003).

Of the environmental factors, only one variable was statistically significant. Respondents living in poor counties (with lower household median income) were statistically less likely to have access to information technology, all else equal. Residing in a poor area had an independent, negative effect on the probability of an individual owning a home computer, having home Internet access, or an email address. This suggests that the digital divide is the result of poverty at both the individual and environmental levels, a new findings for research in this area. Other contextual variables such as the size of county-level racial and ethnic populations and educational attainment were not statistically important predictors of access. Previous research based on survey

data alone found enduring gaps in access to technology in the United States based on race, ethnicity, income, education, and age (Mossberger, Tolbert and Stansbury 2003; NTIA 2002). *The contribution of this research is that there are also gaps based on community resources, and that concentrated (or regional) poverty is an important component in defining the digital divide.*

Because we are interested in the interaction of race and place (poverty) in technology access we replicate the models reported in Table 1, but include two interaction terms: one for African American respondents multiplied by the median income of the county in which they reside, and one for Latino respondents multiplied by the median income of their resident county. None of the interaction terms were statistically significant (analysis not shown), with the exception of the model reported in column four of Table 1. While individuals residing in poorer counties continue to be less likely to have a home computer, the interaction term between African American respondent and county level median income, is negative and statistically significant. This means African Americans living in poor counties are *less* likely to have a computer in their home than whites living in the same poor counties. The data indicates that race and place (county-level poverty) interact with lower access to computers for poor blacks, compared to poor whites. The remaining control variables are in the expected direction, and consistent with the models without interaction terms in Table 1.

In sum then, race and environment appear to interact in shaping African American access to a *home computer*, but race and environment do not appear to interact in shaping access to the Internet for minority groups. While African Americans and Latinos are in general less likely to have home Internet access and an email address than whites,

African Americans and Latinos *living in poor areas (counties)* have the same Internet and e-mail access as similarly situated whites.

2) Technology Skill

In our previous research we broadened the definition of the digital divide to include not only access, but basic technical competence and information literacy as well. In order to assess the prevalence of both technical competence and information literacy, we asked about what computer assistance individuals would need.

A substantial portion of our survey respondents reported needing assistance to carry out basic tasks using the computer. Nearly 22 percent said that they needed assistance using the mouse and keyboard – the most simple and yet fundamental skills involved in operating a computer. As tasks required more sophistication, the percentage of respondents needing help rose, with well over a third needing computer help to find information on the Web, find books, or do homework. More than half the survey respondents require assistance to use common software applications such as word processing and spreadsheets. Looking at the simple percentages, we get a picture of a substantial minority who need help taking the very first steps toward technical competence, and larger segments of the population (about 37 percent) who need help with more sophisticated applications, including those involving information literacy.

The dependent variable in the model presented in Table 2 is an index of responses to six questions measuring the need for computer "skills", including 1) assistance using the mouse and typing, 2) assistance using e-mail, 3) assistance using spread sheet programs, 4) assistance locating a book in the library [with a computer], 5) assistance doing homework [with a computer], 6) assistance locating information on the web or

Internet. If the respondent reported needing help in an area they were coded 1 and 0 if otherwise. Thus a score of six on the index would represent a respondent who needed help in all areas of technical competence (basic computer skills) and information literacy, while a score of 1 would indicate needing limited computer assistance for just one task. We use the same explanatory variables as in the previous analysis of access to information technology.

Since the dependent variable is ordinal, ordered logistic regression coefficients are reported in Table 2. Consistent with previous research, which did not control for environmental factors, we find that race, education, income, age, and gender are all important in shaping computer skills (Mossberger, Tolbert and Stansbury 2003). African Americans are statistically more likely to lack computer skills (both technical competency and information literacy) than whites, after controlling for other factors. But Asian Americans and Latinos have comparable computer skills as whites, when environmental factors are considered (the non-finding for Latinos may reflect multicollinearity problems between the variable measuring Latino respondent and the percent Latino population in the county, as Latinos are fairly segregated by region). Income again matters, as the poor were more likely to need computer skills than the affluent. Additionally, the uneducated were more likely to need computer skills, and older respondents were more likely to need assistance than the young. Females were more likely to need computer assistance than males.

Mirroring the previous analysis of technology access, the only environmental variable that was statistically significant was median income. Respondents residing in poor counties with low median income were more likely to need computer skills than

those living in more affluent counties, holding other factors constant. This suggests that not only access to technology, but access to quality education, learning opportunities on the job, social networks, or other environmental factors depend upon the wealth of the community.

Again, we hypothesized that the true relationship between race and environment could only be captured via interaction effects. We replicated the model reported in column one of Table 2, but with an interaction term for African American respondents multiplied by the median income of their residing county. The data is reported in column two of Table 2. While the main effects remain unchanged (African Americans are more likely to need computer skills than whites and individuals residing in poor counties are more in need of skills), the interaction term is not statistically significant, suggesting that race and place (context) do not interact in shaping skills to use technology. African Americans living in poor areas (counties) are no more likely to need computer skills than whites living in the same poor areas. Similarly, Latinos living in areas with low median income are statistically no different in terms of computer skills than whites living in the same counties (analysis not shown).

A lower level analysis using merged census-tract data should allow us to sort out with more confidence the effects of concentrated poverty and educational opportunities on both technology access and skills. For now, however, there is strong evidence that county-level wealth and resources affect access to computers and the Internet, as well as computer skills. Individuals residing in poor counties are less likely to have to have a home computer, home Internet access or an email address, as well as adequate computer skills—basic computer literacy (technical competence) and the ability to use computers

to find information (information literacy). In one important case, race and county environments interact. African Americans residing in poor counties are less likely to have a home computer than whites residing in the same poor counties. But race and place don't appear to interact in shaping other forms of technology access or skill.

Probability of Access to Information Technology under Varying Economic Contexts

Probability simulations using Clarify Software (King et al. 2000) give us a more precise understanding of the impact of context on individual access to information technology using the logistic regression models (reported in columns 1-3 of Table 1) and computer skill using the ordered logistic regression models (reported in column 1 of Table 2). We vary county-level median household income from the average (mean of $39,000) to poor counties (one standard deviation below the mean). We also vary median income to wealthy areas (one standard deviation above the mean) and very wealthy (two standard deviations above the mean) holding the other variables in the model constant. In this simulation, the individual is assumed to be white and female, with average income, education, age and independent partisanship. The individual resided in a county with average African American, Latino, and Asian American populations, and average high school graduation rate. What then is the independent effect of living in high poverty counties on access to information technology?

Table 3. Access to Information Technology Varying County-Level Median Income

Median Income	Has Home Computer	Has Email Address	Has Internet Access at Home	Needs Computer Skills
Poor	60%(.05)	49%(.06)	47%(.05)	62%(.04)
Average	65%(.04)	62%(.04)	55%(.04)	64%(.03)
Wealthy	70%(.04)	73%(.05)	64%(.05)	66%(.03)
Very Wealthy	74%(.06)	82%(.05)	71%(.06)	68%(.04)

Note: Standard deviations are in parentheses. To simulate different levels of wealth, the variable county-level median income was set at its mean and one and two standard deviations above and below the mean. Values for percent African American, percent Latino, percent Asian American, percent high school graduates, income, age and education were set at their mean. Gender was set at female, race was set at white, and partisanship was set at independent. Estimations were produced using Clarify: Software for the Interpreting and Presenting Statistical Results, by Michael Tomz, Jason Wittenberg, and Gary King.

Holding other factors constant, the simulations show that geographic region has a significant impact on access to information technology. Individuals residing in counties with average median household income have a 65% probability of having a home computer in 2001, all else equal. This probability drops 5% for the same individual residing in a poor county (one standard deviation below the mean). The same white, female with average income, education and age residing in a wealthy county (one standard deviation above the mean) has a 70% probability of owning a personal computer. Each one standard deviation change in the median income of the residing county results in a five percent change (increase or decrease) in the probably of an individual owning a computer, all else equal.

Similarly, holding other factors constant the probability of having home Internet access for an individual residing in a county with median household income was 55%. This probability increases by almost 10 percentage points (64%) for the same individual residing in a wealthy county (one standard deviation above the mean), and drops to only 47% for an individual residing in a poor county (one standard deviation below the mean),

all else equal. The impact of county level resources/wealth on the probability of an individual having an email address resulted in more than a 10 percentage point increase or decrease when moving one standard deviation above or below the mean, all else constant. The simulations highlight that not only is place statistically significant in shaping access to technology, but that the magnitude of the effect is large, comparable to individual level factors (income, education, race, ethnicity, gender) reported in previous research (Mossberger, Tolbert and Stansbury 2003; NTIA 2002). The effect on skill, while statistically significant, is not as pronounced as in the case of access.

CONCLUSION AND QUESTIONS FOR FURTHER RESEARCH

In sum, place or environmental factors matter in shaping access and use of information technology, and so does race. This is true even at the county level, where poverty is less concentrated, and where racial segregation is less prevalent. While poverty at the county level may differ from the deprivation experienced by some central city neighborhoods, county income affects computer access and skill. Causes for this outcome may be more limited technology opportunities offered in schools, other public institutions, or in employment.

That area resources or wealth shape access (measured by median household income) is an important factor in understanding the digital divide, and this is the first study to explore the effects of environmental influences on technology access and skill. We began this study asking whether lower levels of access and skill among African Americans and Latinos might be explained by more limited opportunities available within their communities, particularly because these outcomes could not be explained by apathetic attitudes. Our initial answer is that environment does play a role, even at the

county level, particularly for African-Americans. The policy implications of this finding are that expanding technology is less a matter of persuasion or demonstrating relevance than providing more opportunities to use computers and to develop necessary skills, targeting these to low-income communities, and making the residents of these communities aware of available resources.

Individuals of all racial and ethnic backgrounds are better off in wealthier environments. However, African American and Latinos are significantly less likely than whites to have a home computer, email address or Internet access, or the skills to use this technology. Environmental factors and race interact to shape African American access to a home computer. African Americans are less likely to have a home computer than whites residing in the same poor communities. This suggests that racial segregation and concentrated poverty at the neighborhood level may be significant in later studies. Surprisingly, the quality of education (measured by county-level graduation rates) is not statistically significant in predicting technology skill or access, contrary to numerous studies highlighting the importance of education in the digital divide (Nie and Erbring 2000; Compaine 2001). This result, of course, may be due to the shortcomings of using graduation rates as an indicator of educational quality. However, income or wealth remains the critical factor in shaping inequality in this policy area, and this may in turn be related to spending on education and other regional factors such as labor market opportunities.

These preliminary findings imply that environmental factors will also be important for access at the census-tract level, and that the effect may indeed be magnified. Social networks, spatial mismatch, and other features identified in the

literature on inner-city poverty may exacerbate the influence of place. Although the interaction between race and median income was significant only for computer ownership at the county level, we would expect to see other interactions at the neighborhood level, because of the relationship between concentrated poverty and racial segregation. An interesting question is whether skill levels might be more differentiated at the neighborhood level, with greater skill deficiencies reported by individuals living in very poor census tracts. While our initial results show for the first time that both race and place matter in information technology disparities, there is much more to be learned in the next phase, where we can target areas of highly concentrated poverty.

Table 1. Access to Technology Interacting Race and Place

Variables	Do you have a home computer?		Do you have an email address?		Do you have access to the Internet at home?		Do you have a home computer? (with interaction terms)	
Environmental	β (se)	p>|z|	β (se)	p>|z|	β (se)	p>|z|	β (se)	p>|z|
Percent Black	.00(.00)	.843	.00(.00)	.847	.00(.00)	.848	.00(.00)	.825
Percent Latino	.01(.00)	.213	.01(.00)	.292	.01(.00)	.106	.01(.00)	.271
Percent Asian	-.00(.01)	.778	-.01(.01)	.374	-.00(.01)	.518	-.00(.01)	.815
Percent H.S. Graduates	.08(.37)	.823	.07(.37)	.848	.03(.36)	.925	.13(.38)	.738
Median Income	**.12(.00)[4]**	**.087**	**.28(.00)[4]**	**.001**	**.18(.00)[4]**	**.015**	**.20(.00)[4]**	**.034**
Individual								
African American	**-.44(.19)**	**.022**	**-.65(.20)**	**.001**	**-.68(.19)**	**.000**	.84(.69)	.225
Latino	**-.93(.29)**	**.001**	**-.81(.30)**	**.007**	**-.61(.29)**	**.034**	-.28(.92)	.762
Asian American	.52(1.10)	.636	-.73(.88)	.404			.49(1.10)	.660
African American * Median Income							**-.00(.00)**	**.055**
Republican	**.42(.20)**	**.042**	.26(21)	.210	**.34(.20)**	**.082**	**.43(.20)**	**.039**
Democrat	-.11(.19)	.536	-.08(.19)	.663	-.04(.19)	.829	-.10(.19)	.595
Age	**-.03(.00)**	**.000**	**-.04(.00)**	**.000**	**-.03(.00)**	**.000**	**-.03(.00)**	**.000**
Education	**.36(.07)**	**.000**	**.49(.07)**	**.000**	**.32(.06)**	**.000**	**.35(.07)**	**.000**
Poor	**-1.00(.15)**	**.000**	**-.75(.16)**	**.000**	**-.83(.15)**	**.000**	**-1.02(.16)**	**.000**
Male	.11(.15)	.479	**.39(.15)**	**.010**	**.30(.14)**	**.038**	-12(.15)	.410
N	1057		1050		1050		1057	
LR Chi2	236.46	.000	292.74	.000	235.37		240.42	.000
Pseudo R2	.1686		.2061		.1629		.1715	

Source: C. Tolbert, M. Stansbury, and K. Mossberger. July 2001. "Defining the Digital Divide Survey." National random digital-dialed telephone survey from high poverty U.S. census tracts and a representative control group, n=1837, conducted Kent State University merged with county-level census data from the 2000 US Census. Unstandardized logistic regression coefficients, standard errors in parentheses; probabilities based on 2-tailed test. Statistically significant coefficients at more then a 90% confidence interval in bold.

Table 2: Need Computer Skills Interacting Race and Place

Variables	Need Computer Skills[1]		Need Computer Skills (with interaction terms)	
Environmental	β (se)	p>|z|	β (se)	p>|z|
Percent African American	-.00(.00)	.846	-.00(.00)	.881
Percent Latino	.00(.00)	.752	.00(.00)	.716
Percent Asian	.00(.01)	.742	.00(.01)	.726
Percent H.S. Graduates	.20(.37)	.598	.23(.37)	.544
Median Income	**-.17(.00)[4]**	**.014**	**-.14(.00)[4]**	**.049**
Individual				
African American	**.62(17)**	**.000**	**1.17(.59)**	**.046**
Latino	.21(.26)	.425	.21(.26)	.417
Asian	.17(.86)	.844	.16(.87)	.850
African American * Median Income			-.17(17)[4]	.324
Republican	.04(.18)	.827	**.04(.18)**	**.004**
Democrat	.22(.17)	.203	.23(.17)	.192
Age	**.06(.00)**	**.004**	**.06(.00)**	**.000**
Education	**-.55(.06)**	**.000**	**-.56(.06)**	**.000**
Poor	**.48(.14)**	**.001**	**.47(.14)**	**.001**
Male	**-.39(.13)**	**.003**	**-.38(.13)**	**.004**
N	914		914	
LR Chi2	436.98	.000	437.95	.000
Pseudo R2	.1390		.1393	

Source: C. Tolbert, M. Stansbury, and K. Mossberger. July 2001. "Defining the Digital Divide Survey." National random digital-dialed telephone survey from high poverty U.S. census tracts and a representative control group, n=1837, conducted Kent State University merged with county-level census data from the 2000 US Census. Unstandardized ordered logistic regression coefficients, standard errors in parentheses; probabilities based on 2-tailed test. Statistically significant coefficients at more then a 90% confidence interval in bold.

[1]Index of responses to the following six questions: Do you need computer assistance 1) using a mouse and typing, 2) using email, 3) locating information on the web or internet, 4) using word processing/ spread sheet programs, 5) doing homework, 6) finding books in a library? Variable range is 0-6.

REFERENCES

Ainsworth, James W. 2002. Why does it take a village? The mediation of neighborhood effects on educational achievement. *Social Forces* 81(1): 117-52.

Bahl, Roy. 1994. Metropolitan fiscal disparities. *Cityscape: A Journal of Policy Development and Research* 1(1): 293-306.

Bahl,Roy, Jorge Martinez-Vazquez, and David L. Sjoquist. 1992. Central-city suburban fiscal disparities. *Public Finance Quarterly* 20(4):420-32.

Bushweller, Kevin. 2001. Beyond machines. *Education Week on the Web.* Available [online]: www.edweek.org/sreports/tc01/tco/article.cfm?slug=35pittsburgh.h20.

Clark, Kenneth B. 1965. *Dark Ghetto: Dilemmas of social power.* New York: Harper and Row.

Coleman, James S. 1988. Social capital in the creation of human capital. *American Journal of Sociology* 94: 95-120.

Compaine, Benjamin M. 2001. *The digital divide: Facing a crisis or myth?* Cambridge, Mass.: MIT Press.

Granovetter, M.S. 1973. The strength of weak ties. *American Journal of Sociology* 78(6): 1360-80.

Hill, Edward W. and Harold L. Wolman. 1997. City-suburban income disparities and metropolitan areas employment: Can tightening labormarkets reduce the gaps? *Urban Affairs Review* 32(4): 558-82.

Hoffman, D.L., T.P. Novak, and A.E. Schlosser. 2000. The evolution of the digital divide: How gaps in Internet access may impact electronic commerce. *Journal of*

Computer Mediated Communication 5(3). Available [online]: www.ascusc.org/jcmc/vol5/issue3/hoffman.html.

Holzer, Harry J. 1987. Informal job search and black youth unemployment. *American Economic Review.* 77:446-52.

Holzer, Harry J. 1996. *What employers want: Job prospects for less-educated workers.* New York: Russell Sage Foundation.

Ihlanfeldt, Keith R. 1997. Information on the spatial distribution of job opportunities in metropolitan areas. *Journal of Urban Economics* 41: 218-42.

Ihlanfeldt, Keith R. 1999. The geography of economic and social opportunity in metropolitan areas. In *Governance and opportunity in metropolitan America*, Alan Altshuler et al., eds., 213-52. Washington, D.C., National Academy Press.

Jargowsky, Paul A. 1998. Urban poverty, race, and the inner city: The bitter fruit of thirty years of neglect. In *Locked in the Poorhouse: Cities, Race, and Poverty in the United States,* Fred R. Harris and Lynn A. Curtis, eds., 79-94. New York, Rowman and Littlefield Publishers.

Kaestle, D.F., A. Campbell, J.D. Finn, S.T. Johnson, and L.J. Mickulecky. 2001. *Adult literacy and education in America: Four studies based on the National Adult Literacy Survey.* NCES publication number 2001534. Washington, D.C.: U.S. Department of Education, National Center for Education Statistics. Available [online]: http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2001534.

Kasarda, John D. 1990. City jobs and residents on a collision course: The urban underclass dilemma. *Economic Development Quarterly* 4(4): 286-307.

King, Gary, Michael Tomz, and Jason Wittenberg. 2000. Making the most of statistical analysis: Improving interpretation and presentation. *American Journal of Political Science* 44: 347-61.

Kozol, Johnathan. 1991. *Savage Inequalities: Children in America's Schools.* New York, NY: Crown Publishers.

Kruse, D. and J. Blasi. 2000. The new employer-employee relationship. In *A working nation: Workers, work, and government in the new economy*, D.T. Ellwood, R.M. Blank, J. Blasi, D. Kruse, W.A. Niskanen, and K. Lynn-Dyson. New York: Russell Sage Foundation.

Lenhart, Amanda. 2003. The ever-shifting Internet population: A new look at Internet access and the digital divide. Pew Internet and American Life Project. Available [online]: http://www.pewinternet.org. [15 July 2003]

Lentz, B., J. Staubhanik, A. LaPastina, S. Main, and J. Taylor. 2000. Structuring access: The role of public access centers in the "digital divide." Available [online]: www.ctcnet.org/publics.htm.

Massey, Douglas S. and Nancy A. Denton. 1993. *American Apartheid: Segregation and the Making of the Underclass.* Cambridge, MA: Harvard University Press.

Manzo, K. 2001. Academic record. *Education Week on the Web.* Available [online]: www.edweek.org/sreports/tc01/tc01article.cfm?slug=35academic.h20.

Moss, P. and C. Tilly. 2001. *Stories employers tell: Race, skill, and hiring in America.* New York: Russell Sage Foundation.

Mossberger, Karen, Caroline Tolbert, and Mary Stansbury. 2003 (forthcoming). *Virtual Inequality: Beyond the Digital Divide.* Washington, D.C. Georgetown University Press.

Myrdal, Gunnar. 1944. *An American Dilemma.* New York: Harper and Brothers.

National Telecommunications and Information Administration (NTIA), U.S. Department of Commerce. 1995. *Falling through the net: A survey of the "have Nots" in rural and urban America.* Available [online]: www.ntia.doc.gov/ntiahome/fallingthru.html.

National Telecommunications and Information Administration (NTIA), U.S. Department of Commerce. 2002. *A nation online: How Americans are expanding their use of the Internet.* Available [online]: www.ntia.doc.gov/ntiahome/dn/anationonline2.pdf/.

Neu, C.R., R.H. Anderson, and T.K. Bikson. 1999. *Sending your government a message: E-mail communication between citizens and government.* Santa Monica, Calif.: RAND.

Nie, N. and L. Erbring. 2000. *Internet and society: A preliminary report.* Stanford, Calif.: Stanford Institute for the Qualitative Study of Society. Stanford University.

Oliver, J. and Tali Mendelberg. 2000. "Reconsidering the Environmental Determinants of White Racial Attitudes." *American Journal of Political Science*. 44: 574-589.

Pack, Janet Rothenberg. 1998. Poverty and urban public expenditures. *Urban Studies* 35(11): 1995-2019.

Penuel, W. and D. Kim. 2000. Promising practices and organizational challenges in community technology centers. Available [online]: www.sri.com/policy/ctl/assets/images/vStreets_Promising_Practices.pdf.

Pew Research Center. 2000. African-Americans and the Internet. Available [online]: www.pewinternet.org/reports/.

Rankin, Bruce H. and James M. Quane. 2000. Neighborhood poverty and the social isolation of inner-city African American families. *Social Forces* 79(1): 139-64.

Rosenbaum, James E. 1995. Changing the geography of opportunity by expanding residential choice: Lessons from the Gautreaux program. *Housing Policy Debate* 6(1): 231-69.

Rusk, David. 1995. *Cities Without Suburbs*, 2nd ed. Baltimore, MD: The Johns Hopkins University Press.

Sampson, Robert J., Jeffrey D. Morenoff, and Thomas Gannon-Rowley. 2002. Assessing "neighborhood effects": Social processes and new directions in research. *Annual Review of Sociology* 28: 443-78.

Trotter, A. 2001. Closing the digital divide. *Education Week on the Web.* Available [online]: www.edweek.org/sreports/tc01article.cfm?slug=35solutions.h20.

Walsh, Ekaterina O. 2001. The truth about the digital divide. In *The digital divide: Facing a crisis or a myth?* Benjamin M. Compaine, ed., 279-84. Cambridge, Mass.: MIT Press.

Wilhelm, A. 2000. *Democracy in the digital age: Challenges to political life in cyberspace.* New York: Routledge.

Wilson, William Julius. 1987. *The Truly Disadvantaged: The Inner City, the Underclass and Public Policy*. Chicago: University of Chicago Press.

Wilson, William Julius. 1996. *When Work Disappears.* New York: Alfred A. Knopf.