The Prevalence of Smartphone Use Among a Wired Group of Young Adults

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Abstract

Despite cell phones' popularity, little is known about the extent to which people's devices include advanced functionalities and which features people use regularly. Mobile phones have the potential to help people overcome limitations in traditional ways of accessing the Internet. Who is most likely to use cell phones for going online and other advanced functionalities? Drawing on a unique data set representing a diverse group of young adults, this working paper looks at the prevalence and predictors of cell phone usage for a varied set of activities. Results suggest that African Americans adopt most features at higher rates than others. Hargittai and Kim also find that mobile devices seem to supplement traditional access to the Internet rather than replacing it.

Introduction

        Mobile phones have diffused very rapidly with as many as 4.6 billion users worldwide

by 2009 (International Telecommunication Union., 2009). Although the United States was

not at the forefront of this phenomenon, by the first decade of the 21st century the

technology had taken off considerably in the US as well. The number of subscribers grew

from 184.8 million in 2004 to 298.4 million by 2009 (ITU 2010) with more than 80% of

American adults owning a cell phone and using a wide range of mobile phone applications

by 2010 (Lenhart, 2010; Smith, 2010).

        Although quite a bit of scholarship exists documenting the diffusion of various

communication technologies over the years, curiously, the spread of mobile phones has seen

relatively little investigation (notable exceptions are Akiyoshi & Ono, 2008; Cotten,

Anderson, & Tufekci, 2009; Rice & Katz, 2003; Wareham, Levy, & Shi, 2004). Given the

many potential benefits of mobile technologies from ubiquitous contact with others to

information retrieval, it is important to investigate their diffusion patterns and how people

are incorporating them into their lives in order to understand their implications for different

segments of society (Wareham, et al., 2004). The relatively low cost of such devices

compared to computers gives underprivileged groups the opportunity to benefit from them

by potentially leapfrogging such disadvantages as lower rates of computer ownership (Rice &

Katz, 2003). Given the widespread use of mobile phones in the United States and the

increasing spread of smartphones with numerous functionalities, it is important to look more

closely at how common access is to devices with many features and whether differentiated

usage patterns emerge among different groups of mobile phone users. These questions will

help determine whether mobile phones contribute to or perhaps alleviate concerns of digital

inequality, that is, social inequalities stemming from variations in access to and use of

information and communication technologies (Cotten, et al., 2009; DiMaggio, Hargittai,

Celeste, & Shafer, 2004).

Late teens are a particularly interesting group to investigate in this domain given the

especially high rate at which they have adopted mobile devices (Selian & Srivastava, 2004;

Smith, 2010). According to a report from the Pew Internet & American Life Project, most

Americans in their late teens and twenties own a cell phone (90%) and tend to engage with

the various affordances of mobile devices more than those in other age groups (Smith, 2010).

Research has suggested that cell phones constitute more than just a personal communication

device for young adults, rather, mobile phones have become a necessity in young people's

everyday lives (Aoki & Downes, 2003; Campbell & Park, 2008; Stald, 2008). However, little

is known about the details of what functionalities are universal in the devices of young users

(e.g., availability of texting, taking and sharing photos, accessing the Internet), which options

they regularly use and whether there exist differentiated patterns of mobile phone usage that

might result in the unequal distribution of resources depending on user background.

Drawing on a unique data set with information about the mobile phone uses of a diverse

group of young adults, this study examines whether and how user background characteristics

and Internet experiences are related to the availability and use of various mobile phone

features.

We start by reviewing the literature on cell phone uses with a particular focus on the

basic adoption of devices and differences in their usage patterns by various population

groups. Next, we describe our research questions derived from the literature, followed by a

description of our data set. We then present the findings from the statistical analyses and

discuss the results. We conclude the paper with the implications of our findings for digital

inequality scholarship.

Prior Work on Mobile Phone Adoption and Use

Scholarship on mobile phone use has mainly focused on device diffusion (Akiyoshi & Ono, 2008; Singh, 2008; Wareham, et al., 2004) and general use patterns (Ling & Helmersen, 2000; Rice & Katz, 2003). In addition to documenting basic mobile connectivity levels, some work has also looked at how psychological factors such as motivations, attitudes, and perceptions of mobile communication technologies influence cell phone usage (Aoki & Downes, 2003; Campbell, 2007; Leung & Wei, 2000; Madell & Muncer, 2004; O'Doherty, Rao, & Mackay, 2007; Rice & Katz, 2008; Wei, 2008). With widespread adoption and use of mobile phones in most parts of the world (International Telecommunication Union., 2009), more recent studies have considered the social, political, and cultural implications of this phenomenon. These include the relationship between cell phone use and social inclusion (Baym, Zhang, & Lin, 2004; Fortunati, Manganelli, Law, & Yang, 2008; Kim, Kim, Park, & Rice, 2007; Richardson, Third, & MacColl, 2007; Sooryamoorthy, Miller, & Shrum, 2008; Wajcman, Bittman, & Brown, 2008; Wei & Lo, 2006), job mobility (Cartier, Castells, & Qiu, 2005; Ngan & Ma, 2008; Ureta, 2008; Yang, 2008), civic and political engagement (Campbell & Kwak, 2010), and youth culture (Campbell & Park, 2008; Stald, 2008; Thulin & Vilhelmson, 2007; Wei, 2006; Wilska, 2003).

The recognition that advanced mobile technologies offer great potential to underprivileged groups has drawn scholarly interest in whether mobile phone use can help reduce digital inequality across population groups (Wareham, et al., 2004). That is, of interest to scholars of social stratification is whether mobile devices can have a leapfrogging effect by providing cheaper and more accessible resources to those who are not able to benefit from more costly technologies such as personal computers with Internet connections. Smartphones with data plans can provide advantages similar to computer-based Internet

connections such as the ability to search for information, citizen mobilization and social

integration, but may require lower hardware costs and possibly less sophisticated skills to

take advantage of their potential benefits. Moreover, mobile phone technology provides

unique advantages such as real-time coordination of work and home activities, interaction

with friends and family, and personal safety (Rice & Katz, 2003). Despite the pervasiveness

of mobile phones in everyday life and the potential benefits derived from various features of

mobile services, there has been little attention given to cell and smartphone use patterns in

relation to the digital divide or the differences between the "haves" and "have-nots" when it

comes to information and communication technologies (exceptions are Akiyoshi & Ono,

2008; Cotten, et al., 2009; Rice & Katz, 2003; Wareham, et al., 2004). Especially little work

has looked at these questions based on data collected at a time when smartphones had

become increasingly widespread.

The few studies that have examined the digital divide of mobile technologies have

focused on the differences in mobile phone ownership and daily hours of cell phone use

associated with users' demographic characteristics (e.g., age, gender, race/ethnicity, marital

status, presence of children in the home) and socioeconomic status (i.e., income, education,

occupation) (Akiyoshi & Ono, 2008; Cotten, et al., 2009; Wareham, et al., 2004). Findings

from this work have been more or less consistent with previous investigations of digital

inequality concerning the adoption of other digital devices. For example, in a study of the

diffusion of 2G-based mobile systems (i.e., voice-centric communication), Wareham and his

colleagues (2004) found that income and education were positively related to 2G-based

mobile phone ownership, but did not find any associations with age. They also found that

African Americans' adoption rates were higher than those of the general population. The

authors projected that for 3G-based systems using multimedia transmission, income and

education would still be positively related to mobile phone adoption given costs associated with such services, but hypothesized that age might be negatively correlated with ownership due to technological skills needed for 3G applications. Due to lack of relevant data at the time, however, they were not able to test these propositions.

In another study, Rice and Katz (2003) reported that cell phone users in the United States – compared to nonusers – had higher levels of income and education. In a different national context, studying the diffusion of mobile Internet in Japan, Akiyoshi and Ono (2008) similarly found a positive relationship between income and education, and device ownership as well as mobile Internet access. It is noteworthy that age exhibits a negative relationship with cell phone adoption and Internet access from mobile phones at a statistically significant level, consistent with earlier projections by Wareham and his colleagues (2004) noted above. This might be due to older adults not being able to enjoy the benefits of advanced mobile devices fully due to lack of technological proficiency required for more advanced systems.

Among user background variables, gender has received the most attention from scholars when it comes to mobile phone uses. In particular, several studies have investigated gender differences in ownership, use frequency and usage patterns among pre-adolescents and adolescents (Cotten, et al., 2009; Kelan, 2007; Madell & Muncer, 2004; Rees & Noyes, 2007; Wilska, 2003). Most studies have found no significant gender differences regarding ownership and general use. However, regarding more specific usage patterns, scholars have identified some variations. Boys tend to use mobile phones for recreational or non-communicative purposes such as playing games, listening to music, sending or receiving emails, and accessing the Internet whereas girls are more likely to use the devices for maintaining social contacts by using features such as text messaging or using the phone as a

phonebook (Cotten, et al., 2009; Madell & Muncer, 2004; Wilska, 2003). Given such patterns,

Kelan (2007) has argued that different media use styles exist with some adopting an

"instrumental style" (seemingly more common among males) and others having more of an

"expressive style" (more common among females). Others have also found similar gender

differences among youth mobile device usage (Madell & Muncer, 2004; Wilska, 2003)

mirroring formerly identified variations among men and women regarding other

communication technology uses (e.g., Boneva, Kraut, & Frohlich, 2001; Kennedy, Wellman,

& Klement, 2003).

       Another variable of interest in the literature has been users' race and ethnicity.

Research has found that in contrast to relatively low levels of computer ownership and

Internet connectivity among African Americans (National Telecommunications and

Information Administration 2010), they are the most active mobile phone users adopting

and using this technology at much higher rates than other racial and ethnic groups (Cotten,

et al., 2009; Smith, 2010; Wareham, et al., 2004; Watkins, 2009). From the perspective of

digital divide research, this could mean that for certain information have-not groups, mobile

technologies may help in decreasing access discrepancies by offering an alternative to

personal computers for taking advantage of content and communication opportunities of

the digital age (Wareham, et al., 2004).

       Given the especially widespread use of mobile devices by young people (Lenhart,

2010), many researchers have examined their adoption and use by this age group in

particular to understand better the social implications of these technologies as they become

increasingly integrated into people's everyday lives (Campbell & Park, 2008; Carroll, Howard,

Peck, & Murphy, 2002; Karim, Oyebisi, & Mahmud, 2010). Much of the literature has

looked at the ways in which young adults incorporate mobile phones into their everyday

practices such as coordinating social activities (Aoki & Downes, 2003; Grinter, Palen, & Eldridge, 2006), maintaining peer and family relations (Leung & Wei, 2000; Wei & Lo, 2006), producing and sharing digital photographs (Okabe, 2004; Scifo, 2009), and building identity (Castells, 2007; Stald, 2008; Wei, 2006). However, most studies have approached young people's mobile phone uses narrowly by addressing a specific aspect of the device, for instance, text-messaging (also known as "short message service" or SMS) (Grinter, et al., 2006), digital photographic practices (Scifo, 2009), or coordination of everyday activities (Ling, 2004). As Thulin and Vilhelmson (2007) accurately point out, focused approaches to young people's cell phone use in a certain context can give insight into the detailed explanation of the use of this technology, but they are unable to provide a comprehensive picture of *how* technology is used in many varied ways in people's everyday practices. Our study resonates with Thulin and Vilhelmson's (2007) criticism of existing scholarship in that it takes a broader approach by investigating aspects of how mobile phones are used by a diverse group of young adults. We are particularly interested in whether there is variation in the number and types of activities for which late teens use the medium.

Given rapid changes in mobile phone capabilities and the diffusion of smartphones, it is important to revisit questions of the digital divide with respect to mobile technology uses based on more recent data sets than were previously available. Work cited above relies on data from as far back as 2001 (Akiyoshi & Ono, 2008) and 2006 (Cotten, et al., 2009), leaving room for investigations with data about more recent usage patterns especially in light of the increasing diffusion of smartphone technologies. Here, we draw on a unique data set collected in 2009 about the mobile phone uses of a diverse group of young adults. Because most previous work has looked at use of mobile for phone calls, we focus on what explains variation in the use of other cell functionalities instead.

Research Questions

Based on gaps in the existing literature, this study poses the following research questions.

RQ1. What is the relationship between user background characteristics and access to various mobile phone features?

RQ1A. How do Internet experiences relate to having access to a diverse set of phone features?

RQ2. What is the relationship between user background characteristics and the diversity of regularly-used mobile phone features?

RQ2A. How do Internet experiences relate to the diversity of phone features used regularly?

RQ3. What is the relationship between user background characteristics and specific mobile phone uses?

RQ3A. How do Internet experiences relate to using specific features of one's phone?

Data and Methods

We draw on a unique data set about a diverse group of young American adults' digital media uses at an urban public university. The authors of this piece are not now nor have ever been affiliated with the school beyond the scope of this project, rather, it was chosen thanks to the diversity of students enrolled at the institution allowing for enough variation on race and ethnicity to examine differences in digital media uses across population groups.

We administered a paper-pencil survey in February-April, 2009 to students in the one course on this urban campus that is required for everybody, the First-Year Writing Program. By working with this course, the project avoided biasing against people who may be less

likely to take certain classes since this one is required for all students. The survey was administered in class on paper rather than on the Web so as not to bias against those students who are online less frequently or who are less inclined to fill out Web forms for whatever reason (e.g., lack of enough private time spent online). Of the 92 course sections offered as part of this course, 86 took part in the project for a 93% participation rate on the part of course sections. Overall, counting all students who were enrolled in the course, the final response rate was 80.5%. The analyses presented in this paper draw on 1,115 first-year students in the course. Close to 99% of participants reported owning a cell phone so it is a helpful data set for looking at nuances of differentiated mobile phone uses.

Measures: Independent Variables

User Background

Table 1 presents the demographic and socioeconomic background of study participants. Although both genders are well represented, somewhat more women (58.7%) than men took part in the study. Students were asked their year of birth to calculate their age. Almost everybody in the sample (close to 99%) is either 18 or 19 years of age so that variable is not included in the analyses given that it is nearly constant. For measures of race and ethnicity, following U.S. Census conventions, students were first asked if they were Hispanic or of Latino origin and about a quarter (24.0%) indicated being so. Then students were asked their race including the following categories: (a) White/Anglo/Caucasian/Middle Eastern; (b) Black/African American; (c) Asian; (d) American Indian or Alaskan Native; (e) Other. The final race and ethnicity categories used for the analyses are: Hispanic, non-Hispanic African American, non-Hispanic Asian American, and non-Hispanic White. As the figures in Table 1 indicate, less than half of the sample is White and there are a considerable number of both Hispanic students and Asian Americans (22%) in the group. There are fewer African

Americans although they still make up over ten percent of the sample. There are just a

handful (5 or less than half a percent) of Native Americans in the group who have been

excluded from the analyses due to their small numbers.

We have data about parental education serving as a proxy for socioeconomic status.

Respondents were asked to report the level of education of both their mother and father

using the following categories: (a) less than high school degree; (b) high school degree; (c)

some college; (d) college degree (for example: B.A., B.S., B.S.E); (e) advanced graduate (for

example: master's, professional, Ph.D., M.D., Ed.D.). Based on information from these two

questions, we created a parental education variable that is assigned the value of the highest

education by either parent, e.g., if a student has a mother with a high school degree and a

father with a college degree then the parental education variable for that student is coded as

"college degree". Table 1 shows that there is considerable diversity regarding the educational

background of students' parents. Close to a quarter of students come from families in which

neither parent had more than a high school education and just below a fifth of participants

have at least one parent who has a graduate degree.

As evidenced by these descriptive statistics, while the sample is homogenous when it

comes to age and education level (everybody is in the first year of college at the same

institution), there is considerable diversity regarding race/ethnicity and socioeconomic status.

In fact, this campus consistently ranks among the most ethnically diverse universities in the

United States (U.S. News & World Report, 2010), an important reason why it was chosen as

the site of the research project.

Internet Experiences

We collected detailed data on people's experiences with using the Internet. Although

all respondents use the Internet to some extent, they may not be identical when it comes to

their online experiences. We use four measures to assess experiences with the Internet:

veteran status, frequency of use, autonomy and online skill. Table 2 shows the mean and

standard deviation of these measures.

Veteran status is calculated using information from survey questions that asked

about the stage in one's academic career when the student first became an Internet user (i.e.,

in elementary school or earlier, in middle school, in high school before senior year, senior

year of high school or during college). User years – our measure of veteran status – were

capped at 9 (22.5% of the group has this value). This measure is logged in the analyses given

that there are likely diminishing returns to additional years of having been a user as the

number of years increases. We collected information about frequency of Internet use by

asking respondents how many hours they spend on the Web – excluding time spent using

email, chat or voice applications – on an average weekday and an average Saturday/Sunday.

From these responses, we calculated weekly Internet use hours. This measure ranges from 0-

42 hours with a mean of 17.4. We log it in the analyses for the same reasons as noted above

for the use-years measure.

To establish autonomy of use – freedom to use the Internet when and where one

wants to – we asked respondents to indicate the types of locations (from a list of 10) where

they could access the Internet if they wanted to (e.g., home, a friend's house, a café, etc.). We

add up these locations resulting in an average of 6.6 access locations per respondent. In the

analyses, we log this figure given that each additional location is likely going to have

diminishing returns. The Internet skill measure comes from aggregated information about 27

items asking respondents their level of understanding of Internet-related terms (Hargittai,

2009, 2010). With the exclusion of missing values on these measures, the valid responses to

these 5-point Likert-scale items were averaged to generate a global measure of Web-use skill.

This measure is normally distributed with similar representations of low, medium, and high-level skilled users in the sample.

Considering the above figures, it is clear from the data that this is truly a generation that grew up with digital media (Palfrey & Gasser, 2008). However, there is some amount of variation in Internet access and use. While everybody in the sample has basic access, people's opportunities and experiences to go online differ. We include these factors in the analyses to see whether use of mobile phones for various activities complements or replaces traditional online access.

Frequency of Daily Phone Calls

In order to take into account how much respondents talk on the phone, we inquired about the frequency with which participants make phone calls daily. A small minority (5%) reported making calls less than daily with an additional ten percent suggesting they make approximately one call per day. Over a quarter (27%) reported making 2-3 calls a day, close to a third (30%) claimed to make 4-6 calls daily while 13% said they make 7-10 calls per day with the remaining 14% making even more calls on a daily basis. We created a binary variable for those who make phone calls often by grouping respondents reporting 4 or more daily calls together; just over half (57%) of the sample falls into this category.

We examined the correlations between our independent variables to address any potential issues of multicollinearity. We found no evidence of multicollinearity in our data set (see the correlation matrix of independent variables in Appendix I).

Measures: Dependent Variables

Mobile Phone Features

To collect information about the types of mobile phone features available to respondents on their devices and which of them they use, we asked the following question:

"Besides making phone calls, how often – if ever – do you use your cell phone for any of the following?". This question was followed by this list of activities:

Sending text messages/SMS

Playing games

Accessing email

Accessing the Web

Taking pictures

Sending pictures to others or uploading them to a Web site

Listening to music

Creating a voice recording

Watching videos

Making videos

Sending videos to others or uploading them to a Web site

Keeping track of appointments

Checking the time

For each of the above options, we asked respondents to choose from the following answers: Never, Few times a year, Monthly, Every few weeks, Weekly, Few times a week, Daily and Several times a day. Additionally, respondents had the option of checking "if the service is not available to you" thereby allowing us to distinguish between people who decide not to use a service even when it is available versus those whose devices or subscription plans do not allow them to use the phone for a certain type of function. Table 3 presents the availability of various functionalities and the frequency with which respondents use them on their cell phones.

For the analyses, we measure the availability of mobile phone functions by creating a summary of all device functionalities that respondents reported having available to them. We then create a dummy variable to distinguish among those respondents who have all 13 functionalities on their phones and those who do not. Half of the sample falls into one group, the other half in the other group.

To measure use of mobile phone activities, we create a summary of types of mobile functionalities that respondents report using on a weekly basis. The majority (70%) of respondents report using 3-8 features regularly with few participants using either very few or very many features weekly. We use this index measure as the indicator of cell phone usage diversity.

For looking at different phone use patterns, we group similar phone activities together by type and create a binary variable for using the device regularly (weekly, except for SMS, which is daily) for each. These activity types are: (1) sending text messages (SMS); (2) playing games; (3) accessing Internet functions (i.e., email or the Web); (4) using photographs and video functionalities; (5) listening to music; and (6) using time management features (i.e., appointments and telling time).

Analyses

First we look at the binary relationship of user background variables and our outcomes of interest, i.e., the availability of phone functionalities, the diversity of phone usage and specific phone use patterns. Next, we turn to regression analyses to see how important various factors are in explaining cell phone usage while holding other variables constant. For a look at diversity of device usage, we use OLS regression. When considering what explains the availability of a diverse list of phone functionalities and whether a user takes advantage of specific phone features regularly, we use logistic regression. When

considering availability of functions and diversity of uses, we first only include user

background variables in the models. Then we add the Internet experience measures (years of

use, weekly Web hours, number of access locations, Internet skills) as well as the frequency

of daily phone calls at a second stage in order to be able to isolate the added explanatory

value of the latter group of factors.

Findings

The Prevalence of Various Phone Functionalities

While almost everybody in the sample has a cell phone (99%), something

characteristic of young adults in the general population as a whole, it is worthwhile to look at

how widespread are various features of mobile devices before assuming that everybody owns

a smartphone with the latest functionalities and that everybody uses these regularly. The first

column in Table 3 shows what proportion of respondents does not have certain services

available at all on their mobile devices. Over a third of students can neither access their email

or the Web on their phones. This may limit the potential for these devices to help

supplement Internet availability for those who do not have easy access otherwise. A quarter

of students cannot watch or send videos on their phones and just below a fifth cannot listen

to music on them. While about half of participants have devices that can do all 13 things we

asked about, it is important to recognize that availability of these features is not universal

even among a highly-wired group of young adults.

Regarding use of various services, figures (see Table 3) suggest that the majority of

students only use a few of them regularly. Most common is using the phone for telling time,

which almost everybody (98%) reports doing daily. Next in prevalence is text messaging,

which 89% claim doing every day with an additional five percent doing so at least weekly.

Those are the two functionalities that most people use with much regularity. Less common,

but still popular is use of the phone for taking pictures, which half of the sample reports

doing at least weekly. All other activities enjoy much less popularity on a regular basis.

Although close to a third of respondents report using their mobile devices for accessing

email or the Web at least weekly, the majority of respondents never use their phones for

such purposes. Again, this questions the potential leveling effects of mobile phones when it

comes to Internet access.

User Background and Phone Usage

We consider the bivariate relationship between user characteristics and several

measures of mobile phone use in order to find which user background factors are related to

differentiated uses of cell phones. Table 4 presents the relationship of user background

characteristics (i.e., gender, race and ethnicity, parental education) and the availability of

mobile phone functions as well as the diversity of their uses. The figures suggest that race

and ethnicity are the only user characteristics that show a statistically significant relationship

with the availability of numerous phone functionalities. African Americans report, on

average, almost 12 mobile phone functions (out of 13) available to them whereas this figure

is less than 11 for every other racial and ethnical category. Similarly, the number of mobile

phone functions that respondents use on a weekly basis differs among racial and ethnic

groups. African American students report that, on average, they use 6.6 mobile phone

functions at least weekly whereas White students use less than 5 functions on average. These

differences are statistically significant. Both Asians/Asian-Americans and Hispanic students

use between 5 and 6 mobile phone functions on a weekly basis. We find no statistically

significant differences between female and male students nor by parental education on these

measures.

Table 5 presents the relationship of user background and regular use of different types of mobile phone functionalities. We find statistically significant gender differences when it comes to text messaging and to a lesser degree use of the phone for telling time with women using the device more for both of these activities. Race and ethnicity are related to all types of mobile phone uses, except for telling time, at a statistically significant level. African Americans are the most active users of mobile phones for various purposes, which is consistent with patterns found by others (e.g., Smith, 2010; Wareham, et al., 2004). In particular, the use of cell phones for Internet functions (accessing email or the Web) and picture or video functions by African American students far exceeds that of other racial and ethnic groups. Asian Americans are less likely to send text messages, but more likely to listen to music using their mobile phones. Whites are the least active users of mobile phones on the whole; they are less likely to play games, use photo and video functions and listen to music.

Socioeconomic status measured by parental education does not seem related to mobile device functions. There is only one occasion where parental education produces a statistically significant difference in usage; students with parents who have a college degree are more likely to send text messages than others.

Internet Experiences and Phone Usage

To determine whether use of various phone functionalities replaces or supplements other digital media uses and experiences, we look at the bivariate relationship of online experiences and use of people's mobile devices. The figures in Table 6 suggest that people's Internet experiences are positively associated with various types of mobile phone activities. That is, people with more online experiences tend to engage in various types of mobile activities on a regular basis more than those who spend less time online, have fewer Internet

access locations and are less skilled with the Web. For instance, those who have been

Internet users for a longer period are more likely to use SMS, games, the Internet, photos

and video functionalities regularly. The number of hours people spend on the Web weekly is

also positively related to accessing the Internet on mobile devices, using picture and video

functionalities, and listening to music on a weekly basis. Autonomy of Internet use (i.e.,

number of access locations) matters for almost all types of cell phone activities except time

management. People's level of online skill also exhibits a positive relationship with playing

games, going online, taking and sharing picture and videos, and listening to music on one's

cell phone.

In aggregate, of the six types of mobile phone activities we examine, weekly use of

the Internet and picture/video functionalities are both positively related to all four measures

of Internet experiences (veteran status, frequency of use, autonomy and skill). The only

mobile phone activity that is not related to online experiences at all is time management (i.e.,

keeping track of appointments and checking time). This is not surprising given the near-

universal use of these functions by everybody on a weekly basis (see Table 3). Overall, these

figures suggest that rather than offering services to those who may not have them through

more traditional means, advanced mobile functionalities supplement people's use of various

services on their desktop and laptop computers.

Explaining Differences in the Availability of Mobile Phone Functions

The bivariate statistics help us understand general patterns of how each user

background variable is related to various measures of mobile phone usage, but it is important

to consider the relationship of different factors to cell phone use while holding other

variables constant.

The baseline model in Table 7 suggests that being female decreases the odds of having all 13 cell functionalities. Regarding parental education, students whose parents have no more than a high school degree (compared to at least one parent with a graduate degree) have lower odds of having all 13 functionalities available to them. In the full model, however, the relationship of gender and parental education goes away when taking Internet experiences into consideration. Among these added variables, we find that the number of access locations, the level of online skills, and the frequency of phone calls on a daily basis increases the odds of the availability of all 13 cell phone functionalities. These findings suggest that one's experiences with and skills in Internet use are related to how many mobile phone functionalities people have available to them and some of the relationship of user background is mediated by technology-related contextual factors.

Explaining Phone Usage Diversity

As shown in Table 8, the results from the baseline model suggest that there is no gender difference among male and female students when it comes to the diversity of mobile phone functionalities used. Regarding race and ethnicity, African Americans and Asian Americans are more likely to use a diverse set of functionalities than Whites (the omitted category). Parental education does not exhibit any relationship to this outcome. In the full model, the coefficient for African American background remains significant, but we no longer observe a statistically significant relationship between Asian Americans and the number of cell phone functions used. Instead, we find that Hispanic origin (although to a considerably less extent than being Black) and having parents with less than high school education (compared to having a graduate degree) are positively related to the number of mobile phone functions used.

Noteworthy is that most measures of Internet experiences – all but time spent online weekly – are positively related to the number of cell phone functions used by participants. That is, having used the Internet for a longer period, having a larger number of access points to the Internet and possessing a higher level of online skill are all important correlates of using one's cell phone for diverse purposes. These findings suggest that experiences and skills associated with other digital technologies (Internet in this data set) are related to the number of cell phone functionalities with which young adults engage on a regular basis. We also find a positive relationship to frequency of phone calls made daily with those who make more than four calls a day more likely to use a diverse set of cell phone functions than those who make less than four calls on a daily basis.

Explaining Differences in Types of Mobile Phone Uses

Next we consider what explains regular engagement with specific phone functions (Table 9). Regarding gender, we find that being female increases the odds of using one's phone to send text messages and to manage time (telling time and using it as a calendar) at least weekly. Regarding race and ethnicity, being African American, compared to White, increases the odds of playing games, accessing the Internet, using picture and video functionalities, and listening to music on one's mobile device. Being of Hispanic origin increases the odds of using picture and video functionalities, and listening to music whereas being Asian American decreases the odds of sending text messages, but increases the odds of listening to music as compared to Whites.

Parental education only seems to matter when it comes to sending text messages, using photo and video functionalities, and listening to music. Having a parent with a college degree increases the odds of using SMS services compared to having a parent with a graduate degree. Students with parents who have a high school degree have higher odds of

using picture and video functionalities while students who have parents with some college

education have higher odds of listening to music using their cell phones.

Similar to what we reported for the other models, Internet experiences are crucial

correlates of using various cell phone functionalities. Veteran status (i.e., the number of years

since a student first became an Internet user) increases the odds of sending text messages

and playing games. Autonomy (the number of access locations) increases the odds of all

types of cell phone uses except time management. Students with higher levels of Internet

skill have higher odds of using cell phones for various purposes except text-messaging. The

frequency of daily phone calls also increases the odds of using the device for sending text

messages, accessing the Internet, using picture and video services, and listening to music.

Overall, we find that experiences and skills in Internet use and regularly talking on

the phone matter most for explaining regular use of various cell phone functions. However,

we also observe that some of the user background characteristics such as gender and race

(being African-American in particular) still matter for the level of availability and use of

various mobile phone functionalities and different types of mobile phone usage. Next, we

turn to considering the limitations of the project with an eye toward directions for future

research followed by a summary discussion of our overall findings.

Directions for Future Research

Our data are, in many ways, unique in allowing us to examine the prevalence of

smartphone usage among a highly-wired group of young adults. Nonetheless, our data set

has limitations leaving room for contributions of future work. For example, while our data

allow us to examine the relationship between user background characteristics, Internet

experiences, and use of mobile phones for various purposes, we do not have more detailed

information about how people are using the various features of their mobile devices. That is,

we are unable to say what type of information people are accessing when they go online using their phones or what types of topics they are discussing and with whom when text-messaging. Future work should collect data on these nuances of mobile phone usage in order to help understand better the specific purposes of the functionalities we cover.

While our analyses suggest a significant relationship between people's online skills and their mobile phone uses, we do not know whether there are specific sets of skills that are especially relevant and related to certain types of cell-phone-based activities. Future work should incorporate mobile-phone-specific skill measures to be able to comment on what exact skills matter most in this domain. Also, because our data set is restricted to young adults with a specific educational level, our findings may be conservative when it comes to certain variations across population groups and may show even larger differences across groups were one to consider them for a more nationally representative sample.

Additionally, while our study looks at various factors related to mobile phone use patterns, we do not examine the social, cultural, and political implications of the differentiated patterns we find. That is, a next step in this line of work should include an examination of what differentiated cell phone use implies for people's life chances and outcomes. Such work could examine the potential benefits and harms of these activities, for instance, how differentiated patterns of mobile phone use are related to information acquisition, social inclusion, self and group identity, or civic engagement among different population groups.

Discussion and Conclusion

The widespread adoption and use of mobile phones among young adults has been broadly covered in scholarly work and market reports alike, but there is relatively little known about various aspects of smartphone use patterns and their implications for digital

inequality. Using a unique data set from a diverse group of young adults, this study examined

the availability and use patterns of a varied set of cell phone functionalities and what

demographic characteristics as well as Internet experiences are related to use of mobile

devices for various purposes.

Despite the almost universal adoption of mobile phones among young American

adults, we find large variation in the availability of phone functionalities and the number of

features that people in our sample use regularly. More than a third of the students are not

able to get access to email or the Web on their cell phones. Given that access to information

and communication technologies is a basic dimension of digital inequality (DiMaggio, et al.,

2004), this finding indicates that those who are excluded from Internet access on their

mobile devices might not be able to get the potential benefits of this medium the same way

as some of their counterparts whose phones and plans support such features.

A particularly interesting finding is that race and ethnicity are important factors in

explaining most aspects of cell phone usage. In stark contrast to documented trends in

Internet use on computers where African Americans are behind Whites and Asian

Americans (e.g., National Telecommunications and Information Administration, 2010), here

we find that they engage in the most diverse types of mobile phone functionalities and have

higher odds of using their phones for such purposes as accessing email or the Web, playing

games, listening to music, and using picture and video features than any other group. The

relationship holds even after we take other demographic factors into consideration as well as

Internet use through more traditional means. These results are consistent with findings from

previous research regarding the prevalent adoption of mobile phones among African

Americans (e.g., Wareham et al. 2004, Watkins 2009), but our investigation goes further by

considering several functions not covered in previous work and highlighting a robust

relationship even after controlling for Internet use experiences. More research is needed to understand what is driving these trends.

Other user background characteristics seem to matter only for certain types of mobile phone uses. Regarding gender, young women in our sample have higher odds of sending text messages compared to young men. This is consistent with findings by others regarding different uses of technology by gender (Cotten, et al., 2009; Madell & Muncer, 2004; Wilska, 2003). However, we did not find any differences between males and females regarding more recreational uses of cell phones (e.g., playing games, music listening) or Internet access (i.e., email or Web use). Parental education is only related to sending text messages, using photo and video functionalities, and listening to music.

Another noteworthy finding is that various measures of mobile phone use are strongly associated with Internet experiences. Except for weekly Internet use hours, our other measures of Internet experiences are important factors when it comes to the availability of phone functionalities, the diversity of phone usage, and use of specific phone functions. In particular, the number of access locations and the level of Internet skills show a positive relationship with the use of most types of cell phone features. This might be explained by the increasing convergence of digital technologies and the skills needed to use multimedia devices effectively and efficiently. To appropriate mobile devices for their needs, people must know how to access certain services online offered by service providers, for instance, downloading various applications on their devices and sharing content they create. Such tasks require skills that are also a part of expertise associated with Internet uses. Also, people who have more Internet access points are more likely to possess higher levels of online skill and have more opportunities to explore a wide range of mobile phone features. Research has demonstrated (Hargittai, 2010; Hassani, 2006) that number of Internet access

locations is positively related to both diverse types of Web uses and online skills. Our findings imply that the same relationship holds in the context of mobile devices.

Overall, the results of this study show that while common among young adults, smartphones with numerous functionalities are by no means universal across population segments. Mere access to a mobile device is not equivalent to the availability of limitless features nor is the availability of a feature equivalent to its regular usage. Although almost everyone in the sample owns a cell phone, we find systematic differences in the extent to which phone functionalities are available, the diversity of phone functionalities people use on a regular basis, and the types of specific phone features young adults incorporate into their daily lives.

Mobile devices are often heralded with the potential to help underprivileged groups leapfrog limitations they may have in accessing the Internet through other means. Our findings suggest caution in this realm given that it is precisely those people who have more Internet experiences who are also more likely to use mobile devices for more functionalities including online access. Consequently, it remains to be seen whether the spread of cell phones can bridge the digital divide or whether the adoption of devices with different functionalities and affordances will exacerbate the existing gaps between information haves and have-nots.

Table 1. Background of study participants

	Percent
Men	41.3
Women	58.7
Age	
18	66.2
19	32.6
20-29	1.2
Race and Ethnicity	
African American, non-Hispanic	10.6
Asian American, non-Hispanic	22.2
Hispanic	24.0
Native American, non-Hispanic	0.5
White, non-Hispanic	40.8
Parents' Highest Level of Education	
Less than high school	7.2
High school	15.9
Some college	23.7
College	34.6
Graduate degree	18.7

Table 2. Internet use context and experiences

	Mean	St. Dev.
Number of locations to access the Internet (0-10 scale)	6.6	(2.2)
Number of use years (0-9 scale)	5.7	(2.3)
Hours spent on the Web weekly	17.4	(10.0)
Skill index (1-5 scale)	3.2	(0.8)

Table 3. Frequency of types of mobile phone functions

How often?	Service **not** available	Never	Few times a year	Monthly or few times a month	Weekly or few times a week	Daily
Sending text messages/SMS	3.1	1.4	1.0	1.4	4.5	88.7
Playing games	10.3	23.7	13.7	16.9	20.6	14.9
Accessing email	37.1	28.8	2.9	3.9	6.8	20.6
Accessing the Web	35.9	26.9	3.3	4.4	6.6	22.9
Taking pictures	3.2	3.2	9.5	35.0	35.8	13.4
Sending pictures to others or uploading them to a Web site	13.9	18.4	10.5	27.2	21.2	8.7
Listening to music	17.6	25.3	6.7	11.1	15.3	24.1
Creating a voice recording	7.5	46.1	22.6	14.7	6.6	2.4
Watching videos	25.1	35.8	7.9	13.2	9.5	8.6
Making videos	19.4	35.0	17.4	18.0	7.9	2.4
Sending videos to others or uploading them to a Web site	26.9	47.9	9.6	9.8	3.7	2.2
Keeping track of appointments	4.7	30.4	8.5	15.7	18.3	22.5
Checking the time	0.3	0.6	0.3	0	0.8	97.7

Table 4. Relationship of user background and availability as well as use of mobile phone functions

Use patterns clusters	Availability of phone functions	Use of phone functions
Gender		
Men	10.86	5.37
Women	10.79	5.32
Race/Ethnicity		
African American, non-Hispanic	11.76***	6.62***
Asian American, non-Hispanic	10.69	5.45
Hispanic	10.73	5.35
White, non-Hispanic	10.72	4.96***
Parental education		
Less than high school	10.54	5.63
High school	10.60	5.41
Some college	10.91	5.24
College	10.86	5.36
Graduate degree	10.91	5.35

*p<.05, **p<.01, ***p<.001

Table 5. Relationship of user background and mobile phone use patterns

Use patterns clusters	SMS†	Games	Internet	Pictures/ Videos	Music	Time Management
Gender						
Men	82***	90	32	55	42	97**
Women	93***	89	30	55	37	99**
Race/Ethnicity						
African American, non-Hispanic	95*	95	48***	73***	54***	99
Asian American, non-Hispanic	82***	89	30	53	47**	98
Hispanic	90	91	28	58	39	97
White, non-Hispanic	89	88*	29	50**	32***	98
Parental education						
Less than high school	88	92	30	57	47	97
High school	88	91	29	61	39	98
Some college	87	90	29	52	40	98
College	92**	88	32	55	40	98
Graduate degree	86	92	33	53	36	98

*p<.05, **p<.01, ***p<.001
†On a daily basis; other categories are on a weekly basis

Table 6: Relationship of Internet experiences and mobile phone uses

	SMS use daily		Game use weekly		Internet use weekly		Creating/ sharing pictures/video weekly		Music use weekly		Time manage-ment weekly	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Number of Internet use years	5.32*	5.76*	5.21*	5.77*	5.60*	5.96*	5.49**	5.89**	5.61	5.87	5.48	5.72
Hours spent on the Web weekly	18.46	17.26	16.92	17.42	16.91*	18.45*	16.12***	18.42***	16.80*	18.33*	15.43	17.42
Number of access locations	5.87***	6.68***	6.11*	6.65*	6.31***	7.23***	6.22***	6.90***	6.38***	6.91***	6.61	6.59
Internet skills	3.32	3.19	3.02*	3.23*	3.12***	3.39***	3.06***	3.32***	3.09***	3.39***	2.99	3.21

*p<.05, **p<.01, ***p<.001

Table 7: Logistic regression on availability of all cell functionalities

	Background variables only	Full Model
Female	-0.258*	-0.181
	(0.126)	(0.140)
Race/Ethnicity (as compared to Whites, Non-Hispanic)		
Hispanic	0.047	0.079
	(0.173)	(0.179)
African American, Non-Hispanic	0.378	0.417
	(0.215)	(0.227)
Asian American, Non-Hispanic	-0.023	-0.056
	(0.159)	(0.168)
Parents' education (as compared to graduate degree)		
Less than high school	-0.492	-0.326
	(0.296)	(0.306)
High school	-0.443*	-0.344
	(0.214)	(0.222)
Some college	-0.070	-.007
	(0.192)	(0.200)
College degree	-0.160	-0.162
	(0.174)	(0.180)
Years online (logged)		0.568
		(0.444)
Hours on Web/week (logged)		-.061
		(0.179)
Number of access locations (logged)		1.648***
		(0.493)
Internet skills		0.120*
		(0.088)
Makes phone calls often		0.274***
		(0.132)
Intercept		
Pseudo R2	0.010	0.029
N	1,078	1,042

*p<.05, **p<.01, ***p<.001

Table 8: OLS regression on number of cell functionalities used

	Background variables only	Full Model
Female	-0.225	0.158
	(0.167)	(0.168)
Race/Ethnicity (as compared to Whites, Non-Hispanic)		
Hispanic	0.334	0.436*
	(0.230)	(0.215)
African American, Non-Hispanic	1.640***	1.486***
	(0.282)	(0.268)
Asian American, Non-Hispanic	0.476*	0.214
	(0.211)	(0.201)
Parents' education (as compared to graduate degree)		
Less than high school	0.424	0.942**
	(0.001)	(0.366)
High school	-0.001	0.495
	(0.282)	(0.267)
Some college	-0.117	0.175)
	(0.253)	(0.239)
College degree	0.055	0.179
	(0.230)	(0.216)
Years online (logged)		1.477**
		(0.531)
Hours on Web/week (logged)		0.148
		(0.214)
Number of access locations (logged)		2.619***
		(0.586)
Internet skills		0.686***
		(0.106)
Makes phone calls often		1.002***
		(0.158)
Intercept		
Adj R2	0.033	0.167
N	1,078	1,042

*p<.05, **p<.01, ***p<.001

Table 9: Logistic regression on types of mobile phone use weekly (except for SMS, which is measured daily)

	SMS	Games	Internet	Pictures/ Videos	Music	Time Manage- ment
Female	1.112***	0.031	0.046	0.083	0.105	1.607**
	(0.240)	(0.234)	(0.155)	(0.146)	(0.145)	(0.615)
Race/Ethnicity						
Hispanic	0.334	0.551	0.105	0.378*	0.403*	-1.186
	(0.321)	(0.310)	(0.201)	(0.187)	(0.184)	(0.667)
African American†	0.693	1.424**	0.910***	0.980***	0.720**	0.062
	(0.509)	(0.542)	(0.236)	(0.252)	(0.238)	(1.154)
Asian American†	-0.884**	0.205	-0.060	-0.021	0.681***	0.938
	(0.261)	(0.275)	(0.187)	(0.174)	(0.177)	(1.106)
Parents' education						
Less than HS	0.287	0.152	0.381	0.521	0.605	1.335
	(0.525)	(0.554)	(0.337)	(0.320)	(0.318)	(1.276)
High school	0.202	-0.073	0.073	0.615**	0.317	1.044
	(0.349)	(0.388)	(0.247)	(0.235)	(0.230)	(0.972)
Some college	0.201	-0.039	0.041	0.085	0.472*	1.765
	(0.312)	(0.362)	(0.219)	(0.207)	(0.208)	(1.191)
College degree	0.847**	-0.409	0.080	0.234	0.268	-0.266
	(0.308)	(0.314)	(0.197)	(0.188)	(0.187)	(0.729)
Years online‡	1.997**	1.715*	0.508	0.708	0.058	3.382
	(0.749)	(0.738)	(0.493)	(0.464)	(0.459)	(2.011)
Weekly Web hrs‡	-0.262	-0.336	0.111	0.359	0.211	0.762
	(0.310)	(0.302)	(0.198)	(0.187)	(0.186)	(0.806)
# Access locations‡	2.04*	1.759*	2.658***	1.658**	1.186*	-0.740
	(0.789)	(0.783)	(0.576)	(0.515)	(0.507)	(2.292)
Internet skills	-0.085	0.371*	0.333**	0.400***	0.425***	0.868*
	(0.147)	(0.151)	(0.098)	(0.093)	(0.093)	(0.383)
Makes phone calls often	1.101***	0.314	0.466**	0.735***	0.501***	0.740
	(0.230)	(0.218)	(0.148)	(0.136)	(0.136)	(0.594)
Intercept	-9.132**	-7.699**	-11.595***	-9.674***	-6.179**	-8.940
	(2.828)	(2.841)	(2.037)	(1.862)	(1.814)	(7.542)
Pseudo R2	0.121	0.059	0.067	0.083	0.064	0.185
N	1038	1033	1042	1042	1038	1042

*p<.05, **p<.01, ***p<.001
† Non-Hispanic
‡ Logged

Appendix I. Correlation matrix of independent variables

	Female	African American, NH	Asian American, NH	Hispanic	White	Parents' edu, LTHS	Parents edu, HS	Parents' edu, SC	Parents' edu, College	Parents' edu, Graduate	Number of Net use years	Hours spent on the Web weekly	Number of Net access locations	Internet skills
African American, NH	0.107 (0.000)													
Asian American, NH	-0.012 (0.680)	-0.184 (0.000)												
Hispanic	0.040 (0.202)	-0.196 (0.000)	-0.304 (0.000)											
White	-0.080 (0.008)	-0.286 (0.000)	-0.444 (0.000)	-0.474 (0.000)										
Parents' edu, LTHS	0.069 (0.023)	-0.084 (0.005)	-0.072 (0.016)	0.374 (0.000)	-0.201 (0.000)									
Parents' edu, HS	-0.026 (0.393)	0.003 (0.909)	-0.077 (0.011)	0.119 (0.000)	-0.032 (0.280)	-0.120 (0.000)								
Parents' edu, SC	-0.018 (0.561)	0.023 (0.448)	-0.061 (0.042)	0.090 (0.003)	-0.037 (0.218)	-0.153 (0.000)	-0.239 (0.000)							
Parents' edu, College	0.028 (0.349)	-0.016 (0.604)	0.133 (0.000)	-0.225 (0.000)	0.085 (0.005)	-0.200 (0.000)	-0.313 (0.000)	-0.401 (0.000)						
Parents' edu, Graduate	-0.031 (0.340)	0.046 (0.124)	0.024 (0.431)	-0.186 (0.000)	0.113 (0.000)	-0.132 (0.000)	-0.206 (0.000)	-0.264 (0.000)	-0.345 (0.000)					
Number of Net use years	-0.093 (0.002)	-0.071 (0.018)	0.080 (0.008)	-0.067 (0.028)	0.031 (0.304)	-0.063 (0.036)	-0.109 (0.000)	0.068 (0.024)	0.037 (0.213)	0.016 (0.607)				
Hours spent on the Web weekly	-0.088 (0.004)	0.082 (0.006)	0.131 (0.000)	-0.052 (0.086)	-0.129 (0.000)	-0.010 (0.740)	-0.025 (0.410)	-0.015 (0.611)	0.033 (0.271)	-0.007 (0.827)	0.170 (0.000)			
Number of Net access locations	-0.065 (0.031)	-0.047 (0.116)	-0.001 (0.962)	-0.117 (0.000)	0.119 (0.000)	-0.112 (0.000)	-0.066 (0.029)	-0.022 (0.460)	0.069 (0.021)	0.074 (0.014)	0.158 (0.000)	0.058 (0.054)		
Internet skills	-0.357 (0.000)	-0.030 (0.321)	0.109 (0.000)	-0.111 (0.000)	0.018 (0.555)	-0.100 (0.001)	-0.077 (0.010)	-0.009 (0.778)	0.030 (0.318)	0.101 (0.001)	0.259 (0.000)	0.247 (0.000)	0.247 (0.000)	
Makes phone calls often	0.098 (0.001)	0.114 (0.000)	0.071 (0.020)	-0.061 (0.047)	-0.093 (0.002)	0.010 (0.748)	-0.058 (0.057)	-0.039 (0.196)	0.057 (0.060)	0.011 (0.707)	0.071 (0.026)	0.034 (0.242)	0.155 (0.000)	0.019 (0.524)

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