PCIC Personal Computing Industry Center
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Digitizing Physical Objects in the Home

Alladi Venkatesh**
And
Debora Dunkle

Personal Computing Industry Center (PCIC)
Paul Merage School of Business
University of California, Irvine
Irvine, California 92697-4650

(**contact author: avenkate@uci.edu)

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Introduction

Recent research has shown that the Internet has become a major transformational force (Joy et al 2010) and is indispensable to consumers and households in the context of their everyday life (Hoffman, et al 2004, Venkatesh et al forthcoming). For many, the home computer is as essential as other appliances commonly found in the home. That the personal computer has become an integral part of households is apparent. And, as computers have become integrated into the household and their use has spread across family members, this technology is expected to make and, in a number of households, has already made fundamental changes in home life and in the performance of household tasks. Current trends on the home front indicate that we are witnessing the emergence of the networked home (Venkatesh et al 2003) and a digital culture associated with various daily activities in families. The focus of this research is to empirically examine digitization in the home particularly as it relates to the impact on family life and activities. Specifically, the main research question posed here is what is the nature of digital transformation in the home and what key activities of family life are digitized and to what extent?

The Emergence of Digital Culture

When the PCs first came into the home in the early 1980s, there was much anticipation and excitement about what the future was going to hold (Rogers 1986). By today's standards, the early home computer was a primitive machine and had limited performance potential. For many, the computer was introduced into the home to do job-related work either for a home-based business or for work outside of the home and to do word processing (Vitalari et al 1985). Families with children also touted the home computer as useful for educational purposes, but this type of use tended to take a back seat to the more business-oriented uses. Since the home computer of the 1980s was in many households a stand-alone unit, the full potential of its use was not realized until after the arrival of the Internet in the mid-1990s. With the introduction of

the Internet, some fifteen years ago, and accompanied later on by various technological advancements such as Google, broad band connectivity, and more recently, the Social Media, the home computing has assumed a more central role in household activities. That is to say, recent technological developments have heralded some rapid changes that point to the emergence of a digital world filled with transformational possibilities.

To put the current trends in a historical perspective, digital technologies are following a technological trajectory that we have witnessed in other areas of our social and cultural life. For example, more than a century ago, we witnessed the emergence of the telephone which was a major technological innovation resulting in changes in communication patterns (Fischer 1994). Similarly, in the world of entertainment, the introduction of the cinema initiated an artistic revolution and heralded a new form of audience engagement (Stanley 1978). This prompted Walter Benjamin (1936 -1972) to write his famous commentary, "The Work of Art in the Age of Mechanical Reproduction." In the same fashion, the social life has undergone radical change with the introduction of the automobile (Flink 1970). In addition, as part of the technological culture, radio (Hilmes and Laviglio 2002) and television (Fiske 1987) similar to the telephone and the movies have brought about fundamental changes in the areas of mass communication and entertainment. All these developments have one fundamental characteristic. They introduced new forms of behaviors that did not exist before and at the same time displaced some older forms. In a similar fashion currently, the areas of communication and entertainment are converging now into a new digital medium made possible by the Internet and various digital technologies. Henry Jenkins (2008) describes the contemporary digital culture as "convergence culture." while Vaidyanathan (2011) refers to it as *Googlization* of our social and personal lives. Thanks to the digital technologies, not only do we find that social and physical distances are shrinking and transactions are becoming instantaneous, but new methods of social interaction are

beginning to emerge. As a result we live in a qualitatively different, digitally constituted world. Terms such as interactivity, connectivity, virtual spaces, digital divide, crowd sourcing, cloud computing, web cultures, social networking and many more are proliferating and are now part of the new digital vocabulary. In the world of communication, face-to-face contacts are being supplanted or reinforced by electronic contacts (RoAne 2008) resulting in the redefining of social distance in the global communication context. In the field of marketing, Hoffman and Novak (1996), Kozinets et al (2010) and others have drawn our attention to new forms of consumer behaviors and practices. Along the same lines, mobile communication technologies (e.g. smart phones) are dramatically altering communication patterns locally and globally (Shankar et al 2010). Newspaper readership is gradually being supplanted by electronic news (Paterson and Doming 2008) altering the information landscape. The rise of social media and on-line networks is a major development that is changing the digital landscape quite dramatically (Koizinets et al 2010).

Digital Players and Lifestyles

In terms of digital demographic segments, children and youth are acknowledged as advanced users of emerging technology in their daily lives (Ito et al 2009, Venkatesh and Behairy, forthcoming). In addition, gender and ethnic differences are disappearing along with other distinctions associated with the digital culture. The general conclusion seems to be that what seems to matter is not so much competence in using the technology but individual life interests and other social needs. Thus children are most interested in games and similar forms of entertainment. Young females more than males use mobile technologies for communication and texting.

In general, it looks as though people's use of these technologies is based on their life style characteristics and needs. The question that is often asked is does technology follow life patterns or do life patterns change according to technology. We believe that there is an element of truth in both statements and, more importantly, it is the interaction between the users and technology that gives rise to new life style patterns. It is with this background, that we examine the nature of digitization in the context of home life. In the next section we present some theoretical perspectives on the role of technology as an agent of change. This will be followed by an empirical analysis focusing on digitization trends in family life based on survey data.

The Role of Technology in the Home: Digital Transformation Issues

The basic dynamic with respect to home-based technologies is that technologies play a key role in relation to home life. This can be identified in terms of three possibilities: the enabling role of technology, its mediating role and its transformative role (Venkatesh 2008). In the simplest of the three, the enabling role suggests that technologies introduce practical efficiencies and show some qualitative and quantitative improvements in existing practices. The focus here is on looking at technology as a tool. For example, if a family buys a more roomy car, or a vehicle which goes faster or saves more gas, one might say that the new car performs existing functions by facilitating time and monetary savings and added comfort and the like. Such functional advances are not considered radical changes but we grant that they add efficiency and convenience to the routine activities in the home. This is an example of a enabling role of technology.

In its mediating role, technology assumes a more complex functionality by intervening between the user and their social space. For example, when the cable TV was introduced into the home, it opened up several channels for family viewing and acted as a go-between the user and the entertainment world. As a mediating technology, the cable (or satellite) TV connects the family

with the outside world of entertainment over which they have no control. The mediating role of technology is a bit more complex than its enabling role because it adds a higher order dimension to the application of technology for users' benefit not present in its simpler version.

A transformative role is one which alters family life and activities in some fundamental ways. Of course, when the automobile was introduced into the market, it was indeed a transformational technology because over the years, it changed many aspects of people's living patterns. When the PC entered the home environment, it made it possible for individuals to bring work into their home thus altering their work life. And, it did not stop here. In the ensuing years, or, as we now call it, in the age of the Internet, families have begun to perform a lot of activities using the computer: for shopping, email and other forms of communication, online banking, information search, home based learning, telemedicine, home-based business and so on. When we consider the impact of the Internet on family life, one can easily recognize its transformative role. If we now add digital or smart appliances, the possibilities increase dramatically.

Of course, the same technology can perform different roles under different conditions. Thus for a user who never owned a TV set, a new TV can fundamentally alter their viewing habits and transform their life. However, in a family that already has a TV set, a new replacement TV will have a minimal impact. In other words, what role a technology plays is partially dependent on the user and their existing use patterns. The important point is that the various technologies that are now ready to be launched seem to have the potential to change the home life in some major ways. As a large part of this transformation involves the actions of the consumer/user and the overall user environment, one must take them into account seriously.

We argue that digitization in the home leads to the transformation of domestic technological activity and the emergence of a digital culture.

Digital Family and the Networked Home

It is in this context of a rapidly evolving digital culture we examine digitization resulting of family use of computers. In our earlier and also ongoing work, we have highlighted various possibilities in this regard. First we presented a conceptual model of household adoption of computers (Venkatesh 1996), and this was followed by some other studies including an analysis of post adoption processes (Shi and Venkatesh 2004), the emergence of networked home and the children and family use of computers (Venkatesh et al forthcoming) and a few others. To put these developments in a time frame, we divide the past 15+ years after the arrival of the Internet into three periods – the early Internet (1995-2000), the Internet growth (2001-2006) and Internet maturity (2006 – present). During these time periods the Internet has contributed to many changes in people's daily activities. These three periods also represent some forms of digital transformation.

Conceptually, we identify the household in terms of 8 major activity centers (see Figure 1). These activity centers are communication, information, shopping, home management, education/learning, job/work/employment, entertainment-hobbies and social.

(Figure 1 about here)

Technology in the home has brought about a number of changes in the way things are being done within the activity centers. Particularly interesting is the question as to how these activity centers are being digitally transformed. For example, if we consider the home activity of shopping, changes in technology have made it so that rather than hopping in the car and driving to the mall for a table lamp, the consumer can now simply 'computer mall shop' without leaving the home. Similarly, the inside of a bank is most likely foreign to many people not just because of ATM machines, but also because of the sophisticated online banking sites where accounts can be

tracked, bills can be paid and loans can be processed. There are several other examples of this type for other activity centers. In the next section we examine empirically some of these changes by considering the extent to which some physical objects in the home are being digitally replaced.

Empirical Analysis

To obtain some idea of how widespread digital replacement is, we conducted a national survey of 1200 U.S. households[1] and looked at five household objects that we considered standard for a number of years – the telephone, the newspaper, the file cabinet with family records, the TV and finally, the photo album. In addition, we also identified households under three categories of telephone ownership – households with both landline and mobile phones, landline only and mobile phones only. The national sample of households was queried regarding the extent to which there has been digital replacement in the home. They were given the following question in relation to each of the five physical objects in question: "For some people the computer has provided a way of replacing a physical device or object with a digitized version. On a scale of 1 to 5 where 1 is 'not at all' and 5 is 'completely' please tell us the extent to which each of the following has happened in your household." In addition to the digital substitution across the entire sample in aggregate, we also analyzed the extent to which the changes observed may be a function of household demographic characteristics including age, education level and household income. We also asked our respondents to indicate the level of transformation in the household

[1] The survey was conducted using a national RDD sample. Any adult 18 years and over who was knowledgeable about the household's use of computers in the home was eligible to be interviewed. A total of 1,030 interviews were completed with respondents with a landline phone; 170 interviews with respondents who have only a mobile phone and no landline in the home. AAPOR response rates for the mobile phone sample: response rate 1 = .217; response rate 2 = .223; response rate 3 = .235; response rate 4 = .241. AAPOR response rates for the landline sample: response rate 1 = .216; response rate = .229; response rate = .290; response rate = .307. The survey was conducted by telephone by Abt SRBI (New York) during the period April 15, 2010 to May 24, 2010. The interview took approximately 18-20 minutes.

resulting from computer use. The results for the study are presented in Figure 2 (2a through 2f) and Tables 1 thru 7.

(Figure 2 about here)

Results

Information Center: Replaced a physical newspaper with online news.

The physical newspaper appears to be on its way out, being replaced by information and news services available on the Internet. Our results (Figure 2a) show that 60% of our sample families have replaced newspapers with online news in various degrees. That is, 25% report replacement completely and 35% partially. The rest of the sample (40%) reported that they have not replaced the physical newspaper at all. This seems to be a significant trend in the news category.

In Table 1 we present the overall distribution and breakdowns by age, education and household income. While there is still a sizeable percent subscribing or buying a newspaper, it is important to note that age is a significant factor. Younger adults in contrast to older adults are more likely to report having switched to accessing online news sites. About one-third of those 18-29 reported that they have completely replaced the physical newspaper and a substantial 44% of those 30-39 reported replacing the physical newspaper with access to online news. Similarly, education is a factor with college graduates significantly more likely to have made the change than those with a high school education or even only some college education. Income is much less linear with lower incomes (under $30,000) and higher incomes (over $100,000) more likely to have switched in contrast to mid-level incomes.

(Table 1 about here)

Home Management Center: Replaced paper records such as bills, insurance claims, maintenance contracts, warranties with digital versions.

As for paper records in the family, 61% have replaced them in varying degrees and 39% not at all (Figure 2 b). However, only 10% report replacement of paper records completely. Paper

records include check writing, medical records, bill payment, insurance records, tax documents, rental/lease agreements and so on. While the future of physical newspapers seems clear, the paperless home is still a part of the future with over half of households continuing with paper records over digital versions. About one-tenth of the households report being paperless in terms of records of bills, insurance claims, contracts and warranties, etc. In this context we also note that our survey results show that 75% of the families use their computer for virtual shopping which can be considered a an activity under home management.

There is a less clear demarcation of what types of households are more paperless than others (Table 2). Income variations are not very clear cut although higher incomes are slightly more likely to store digital versions of records. Age again shows a decline in digitization of household records with those 60 and over significantly less likely to have given up paper records. Similarly, those households with higher levels of education are more likely to have made the transition to digital versions than those with lower levels of education. Nonetheless, no group is truly committed to paperless. By income level, the percent range for reported paperless record keeping was as low as 7% (households between $30,000 and $50,000) to a high of 16% (households between $75,000 and $100,000). For age groups, the range was from 4% (age 70 and over) to a high of 18% (ages 30-39).

(Table 2 about here)

Entertainment Center: Replaced watching programs and movies on a TV to watching them on a computer or hand-held device.

Utilizing the media substitution theory, Jaye and Johnson (2003), examined the status of traditional media in the online world. We were similarly interested in finding out how families are using computers to watch TV programs (Figure 2c). We found that 38% use the computer or a hand held device (e.g. iPad) at various degrees and within that range only 5% report replacing it completely. It is important to note here that our question is not directed towards what is the percentage of families using computers for hobbies and entertainment. Indeed, about four-fifths of the households report using the home computer for

hobbies and entertainment (table not shown). Rather our interest here is on the extent to which one form of entertainment (watching TV programs and movies on the TV) is being replaced by watching these programs and movies on the computer.

The TV set is not going away too soon. While there have been new websites that have TV programs and movie rental companies such as NETFLIX are now offering downloadable movies for viewing, roughly three-fifths (62%) of households report that they have not replaced the TV with a computer or hand-held device for viewing programs and movies (see Table 3). Only about 5% reported that they have made the change to TV on the computer. A further development is that TV sets are now coming equipped with Internet access. At the time of the survey in 2010, approximately 22% of the respondents reported that they owned TV sets that could connect to the Internet. Similar to other digital replacements, age is clearly a factor in that as age increases the likelihood of using a computer as a TV decreases. There is a higher proportion of experimentation with the use of the computer as TV in the younger age groups. Level of education is not a factor. But to some extent household income does appear to be a factor with a higher likelihood in the lower income categories, which may simply be an artifact of age.

(Table 3 about here)

Communication Center: Replaced the landline telephone with the computer to make calls using for example Skype or Vonage.

In terms of communication, we make a distinction between written communication (e.g. emails displacing hard copies of letter writing, and voice communication. The question of communication replacement (physical vs virtual) is complex because we are already witnessing a dramatic increase in the use of mobile phones which are replacing the landlines as the principle mode of communication activity for a sizeable segment of the population. It is already well established that as far as written communication is concerned, computers have overtaken handwritten letters by a large proportion and this appears to be less of an issue now as compared to, say ten or fifteen years ago. Our own research shows that the highest use of computers is for

email with 98% of the sample reporting this use. So the question remaining is to what extent are the computers being used for voice communication and more specifically, are telephones being replaced with computer-assisted voice communication.

WiFi and access to the Internet on the mobile phone pretty much reduces the need for the computer as a telephone. There is very little acceptance of the replacement of the telephone with the computer; indeed, nearly 78% of the households reported 'not at all' for this replacement (Figure 2d). In addition, age, education and income do not make much of a difference in the replacement value of the computer for the telephone.

(Table 4 about here)

The widespread use of mobile phones, particularly the 'smart phones' has made a considerable dent in the use of landline phones as well as the use of the computer for making cheap to free long distance phone calls. So we are faced with a voice communication triangle involving landlines, computers and mobile phones. As shown in Figure 2e, we found that 14% of the households have mobile phone only, 14% have landline only and 72% have both landline and mobile phone. As a further refinement to our analysis, we are able to examine the extent to which age, education and household income level are associated with mobile phone communication (see Table 5). Age is a contributing factor as the proportion of mobile phone only households are highest for the younger age groups and steadily declines with age. The age distribution for landline only and landline and mobile phone is fairly similar across age groups with a decided upswing in the landline proportion for the 70 and over and a decrease in landline and mobile phone. Mobile phone only decreases by income with a steady increase in the income levels for landline and mobile phone. Proportion of mobile phone only versus landline and mobile phone households is relatively stable across the educational levels.

(Table 5 about here)

Social Center: Replaced printing photos with using a digital picture frame or viewing pictures online.

Digital picture frames and online viewing is becoming more and more popular. Nearly one-quarter of the households reported that they have completely replaced photo printing with viewing pictures online or with a digital picture frame (Figure 2f). On the other hand, about one-quarter have not joined the digital photo revolution. Age is associated although the differences are not very substantial (Table 6): While 25% of those 18-29 report that they have completely made the replacement, a full 20% of those age 60-69 and those over 70 years old have also replaced printing with digital. Household income levels do not differentiate nor does educational level. It appears that the digital camera significantly reduced the need for photo developing services; photo printing is now on the chopping block.

(Table 6 about here)

Enabling-Mediating-Transforming (EMT) – Model of Technology's Role)

To capture the impact of technology resulting from its Enabling-Mediating-Transforming (EMT***)*** role, we asked our respondents to indicate how computers have affected their lives. The computer has been an instrument of change as seen from the information gathered from our samples of respondents over the ten year period (Table 7). Its transformative role is quite evident from the responses from our subjects. While it has played a vital role in terms of its enabling and facilitating functions, a larger number of its impacts are in terms of its transformation role. Our respondents have recorded progressively their agreement over the four periods of data collection on various impact statements.

(Table 7 about here)

A good percentage (66%) of respondents feel that they are better informed about the world because of the Internet. Computers are also seen as contributing significantly to family social life in terms of establishing contacts with friends and relatives (55%) and also the use of social

networking sites (21%) – which though small, is a recent phenomenon and likely to grow. Certainly there is agreement that those that are not knowledgeable about computers are falling behind (70%). Computers are seen as replacing newspapers as an information source (40% in 2008) – a sign of digital living. A large number (61%) agreed that it would be difficult to imagine life without a computer and a larger number (72%) feel that the computer has become part of the daily routine. Time savings (55%) is also reported because of the computer as well as being more productive (48%). However, very few (15% in 2008) feel that the computer has replaced the telephone which is still the most important tool for voice communication. In this context, it would be interesting to see what role smart phones would play especially because smart phones do have computer like capabilities.

In sum, the transformation is occurring in terms of technological dependence and initiatives, and the indispensable nature of computers to conduct family activities and especially in the areas of communication, information, home management and social networking.

Conclusions and Discussion

We began by identifying 8 major activity centers: information, communication, shopping, home management, education/learning, job/work/employment, entertainment-hobbies and social. We selected five major activities for analysis -- reading newspapers (information), paper records (home management), watching programs on TV (entertainment), substituting for landline phones (voice communication), sharing photos (social). We also noted that 98% of the households use computers for emailing (written communication) and 75% for home shopping.

There are clear changes in some household physical devices as a result of the home computer and most importantly the Internet. In some instances it may just be that the next replacement will be that of the home computer as smart phones like the I-Phone and androids become more

affordable to a wider number of people. In any case, at the moment, we are observing the significant reduction in physical newspaper ownership and what might be generally thought of as the physical photo album as more people opt for viewing photos online or in rotating digital frames. On the other hand, what probably 10 years ago might have been considered – the elimination of the landline phone with the replacement of the computer as phone has not evolved as originally thought. In place of that changeover, the landline phone is being replaced by the mobile phone. Instead of a family phone, the phone becomes individual. Thus far, the TV is not in danger of being replaced; rather, it is more likely that the TV will be further integrated into the Internet. Indeed in this survey, 22% of the respondents indicated that their TV is connected to the Internet. As a consequence, it will be interesting to see if the computer replaces TV or the TV becomes more like a computer. Finally, despite corporate efforts and incentives, the paperless home is still very much in the future. The majority of households still rely on the paper versions of bills, claims, insurance documents, etc. In other words, taken as a whole, the developments seem to suggest that "digitizing physical objects" in the home seems to be an on-going project perhaps pointing to an evolving "convergence culture."

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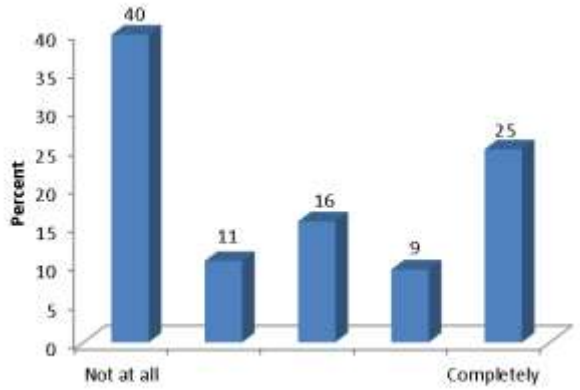
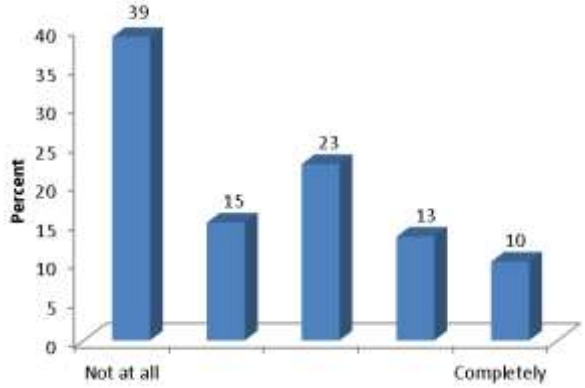
Figure 1. Household Activity Centers

Figure 2. Distributions of Digitized Replacement of Household Objects

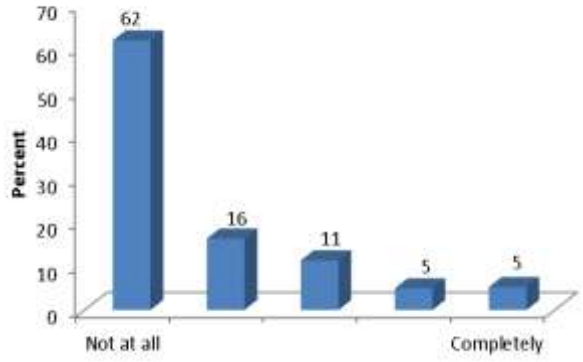
2a. Replaced physical newspaper with online news



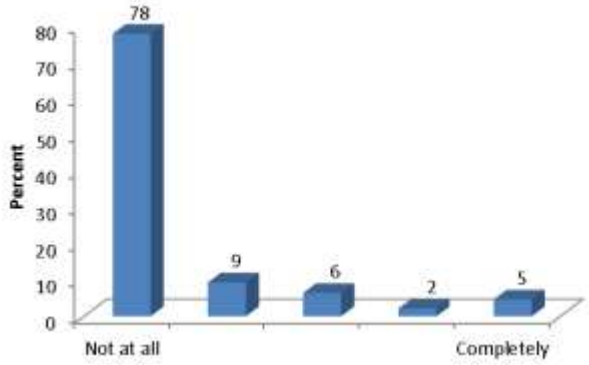
2b.. Replaced paper records with digital versions



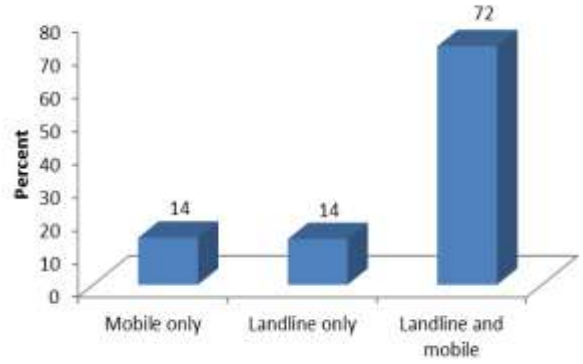
2c. Replaced watching programs on TV to computer/handheld device



2d. Replaced landline with computer to make calls



2e. Replaced landline phone with mobile phone



2f. Replaced printing photos with viewing online

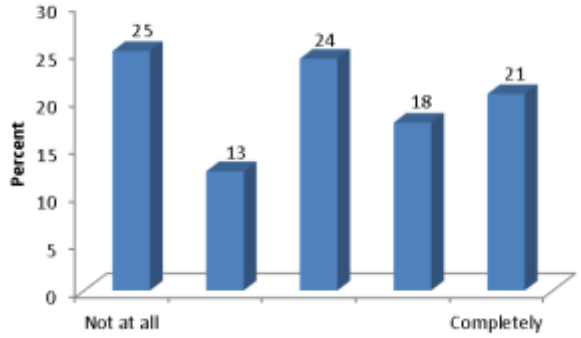


Table 1. Replaced a physical newspaper with online news

	Mean score[a]	Not at all %	(N)	%	(N)	%	(N)	%	(N)	Completely %	(N)	Total %	(N)
Total	2.69	39.7	(474)	10.5	(126)	15.5	(186)	9.3	(112)	24.8	(297)	100.0	(1195)
Age													
18-29	3.30	22.2	(36)	11.1	(18)	16.7	(27)	14.2	(23)	35.8	(58)	100.0	(162)
30-39	3.44	26.2	(45)	4.7	(8)	12.8	(22)	12.2	(21)	44.2	(76)	100.0	(172)
40-49	2.74	41.9	(98)	7.3	(17)	14.1	(33)	8.1	(19)	28.6	(67)	100.0	(234)
50-59	2.55	41.7	(113)	12.9	(35)	14.8	(40)	9.6	(26)	21.0	(57)	100.0	(271)
60-69	2.22	47.0	(85)	12.2	(22)	23.8	(43)	6.1	(11)	11.0	(20)	100.0	(181)
70 and over	1.80	60.6	(72)	16.0	(19)	11.8	(14)	6.7	(8)	5.0	(6)	100.0	(119)
Household income													
$15,000 and under	2.84	36.5	(23)	11.1	(7)	12.7	(8)	11.1	(7)	28.6	(18)	100.0	(63)
$15,000 - $30,000	2.72	43.3	(52)	5.8	(7)	14.2	(17)	9.2	(11)	27.5	(33)	100.0	(120)
$30,000 - $50,000	2.42	49.0	(103)	8.6	(18)	12.4	(26)	11.4	(24)	18.6	(39)	100.0	(210)
$50,000-$75,000	2.74	37.6	(80)	10.8	(23)	16.9	(36)	9.4	(20)	25.4	(54)	100.0	(213)
$75,000-$100,000	2.70	39.4	(61)	11.6	(18)	13.5	(21)	11.0	(17)	24.5	(38)	100.0	(155)
More than $100,000	2.94	31.2	(77)	12.1	(30)	19.0	(47)	7.3	(18)	30.4	(75)	100.0	(247)
Education													
High school or less	2.60	43.3	(197)	10.1	(25)	14.2	(35)	8.5	(21)	23.9	(59)	100.0	(247)
Some college	2.47	42.9	(141)	12.5	(41)	18.2	(60)	7.6	(25)	18.8	(62)	100.0	(329)
College graduate	2.85	36.7	(223)	9.4	(57)	15.0	(91)	10.7	(65)	28.3	(172)	100.0	(293)

[a]Scale item scores range from 1 (not at all) to 5 (completely).

Table 2. Replaced paper records such as bills, insurance claims, maintenance contracts, warranties with digital versions

	Mean score[a]	Not at all %	(N)	%	(N)	%	(N)	%	(N)	Completely %	(N)	Total %	(N)
Total	2.41	38.9	(464)	15.1	(180)	22.6	(270)	13.3	(159)	10.1	(121)	100.0	(1194)
Age													
18-29	2.64	31.7	(51)	16.8	(27)	21.7	(35)	15.5	(25)	14.3	(23)	100.0	(161)
30-39	2.81	26.3	(45)	17.5	(30)	22.2	(38)	16.4	(28)	17.5	(30)	100.0	(171)
40-49	2.47	38.4	(89)	9.9	(23)	26.3	(61)	17.2	(40)	8.2	(19)	100.0	(232)
50-59	2.38	37.0	(101)	16.8	(46)	25.6	(70)	12.1	(33)	8.4	(23)	100.0	(273)
60-69	2.15	48.1	(87)	16.6	(30)	16.6	(30)	9.9	(18)	8.8	(16)	100.0	(181)
70 and over	2.04	52.1	(62)	10.1	(12)	23.5	(28)	10.1	(12)	4.2	(5)	100.0	(119)
Household income													
$15,000 and under	1.98	54.8	(34)	16.1	(10)	12.9	(8)	8.1	(5)	8.1	(5)	100.0	(62)
$15,000 - $30,000	2.35	45.8	(55)	9.2	(11)	19.2	(23)	15.8	(19)	10.0	(12)	100.0	(120)
$30,000 - $50,000	2.29	40.4	(84)	15.9	(33)	25.5	(53)	11.1	(23)	7.2	(15)	100.0	(208)
$50,000-$75,000	2.37	38.0	(82)	18.5	(40)	20.4	(44)	14.4	(31)	8.8	(19)	100.0	(216)
$75,000-$100,000	2.63	33.8	(52)	14.3	(22)	22.7	(35)	13.6	(21)	15.6	(24)	100.0	(154)
More than $100,000	2.62	31.2	(77)	14.2	(35)	27.5	(68)	15.4	(38)	11.7	(29)	100.0	(247)
Education													
High school or less	2.27	49.6	(122)	9.8	(24)	17.5	(43)	10.2	(25)	13.0	(32)	100.0	(246)
Some college	2.19	45.9	(151)	15.2	(50)	20.1	(66)	11.2	(37)	7.6	(25)	100.0	(329)
College graduate	2.59	30.4	(185)	17.1	(104)	26.3	(160)	15.8	(96)	10.4	(63)	100.0	(608)

[a]Scale item scores range from 1 (not at all) to 5 (completely).

Table 3. Replaced watching programs and movies on a TV to watching them on a computer or hand-held device

	Mean score[a]	Not at all %	(N)	%	(N)	%	(N)	%	(N)	Completely %	(N)	Total %	(N)
Total	1.75	61.9	(742)	16.4	(196	11.4	(137)	5.0	(60)	5.3	(63)	100.0	(1198)
Age													
18-29	2.40	38.3	(62)	19.1	(31)	19.1	(31)	11.1	(18)	12.3	(20)	100.0	(162)
30-39	2.02	50.0	(86)	22.1	(38)	12.2	(21)	7.0	(12)	8.7	(15)	100.0	(172)
40-49	1.73	61.5	(144)	17.5	(41)	12.0	(28)	4.7	(11)	4.3	(10)	100.0	(234)
50-59	1.63	65.9	(180)	15.4	(42)	12.1	(33)	2.9	(8)	3.7	(10)	100.0	(273)
60-69	1.40	76.2	(138)	13.8	(25)	5.0	(9)	3.9	(7)	1.1	(2)	100.0	(181)
70 and over	1.45	74.8	(89)	11.8	(14)	10.1	(12)	.8	(1)	2.5	(3)	100.0	(119)
Household income													
$15,000 and under	1.94	63.5	(40)	7.9	(5)	11.1	(7)	6.3	(4)	11.1	(7)	100.0	(63)
$15,000 - $30,000	1.91	61.7	(74)	9.2	(11)	15.0	(18)	5.0	(6)	9.2	(11)	100.0	(120)
$30,000 - $50,000	1.71	63.6	(133)	16.7	(35)	10.0	(21)	4.3	(9)	5.3	(11)	100.0	(209)
$50,000-$75,000	1.59	65.7	(142)	18.5	(40)	9.3	(20)	3.7	(8)	2.8	(6)	100.0	(216)
$75,000-$100,000	1.75	60.0	(93)	16.1	(25)	15.5	(24)	5.2	(8)	3.2	(5)	100.0	(155)
More than $100,000	1.75	58.3	(144)	22.3	(55)	10.1	(25)	4.9	(12)	4.5	(11)	100.0	(247)
Education													
High school or less	1.85	64.0	(158)	11.3	(28)	9.3	(23)	6.9	(17)	8.5	(21)	100.0	(247)
Some college	1.63	65.8	(217)	15.2	(50)	12.4	(41)	3.3	(11)	3.3	(11)	100.0	(330)
College graduate	1.78	59.0	(360)	19.2	(117)	11.8	(72)	5.1	(31)	4.9	(30)	100.0	(610)

[a]Scale item scores range from 1 (not at all) to 5 (completely).

Table 4. Replaced the landline telephone with the computer to make calls using, for example, Skype or Vonage

	Mean score[a]	Not at all %	(N)						Completely %	(N)	Total %	(N)
Total	1.47	77.7	(928)	9.3	(111)	6.4	(76)	2.1	(25)	4.6	(55)	100.0 (1195)
Age												
18-29	1.57	72.8	(118)	10.5	(17)	8.6	(14)	2.5	(4)	5.6	(9)	100.0 (162)
30-39	1.60	72.7	(125)	8.7	(15)	10.5	(18)	1.7	(3)	6.4	(11)	100.0 (172)
40-49	1.53	78.1	(182)	6.4	(15)	5.6	(13)	3.9	(9)	6.0	(14)	100.0 (233)
50-59	1.43	78.7	(214)	10.7	(29)	3.7	(10)	2.6	(7)	4.4	(12)	100.0 (272)
60-69	1.35	81.2	(147)	9.9	(18)	5.0	(9)	0.0	(0)	3.9	(7)	100.0 (181)
70 and over	1.35	78.0	(92)	11.0	(13)	9.3	(11)	1.7	(2)	0.0	(0)	100.0 (118)
Household income												
$15,000 and under	1.46	77.8	(49)	7.9	(5)	7.9	(5)	3.2	(2)	3.2	(2)	100.0 (63)
$15,000 - $30,000	1.55	78.3	(94)	4.2	(5)	8.3	(10)	2.5	(3)	6.7	(8)	100.0 (120)
$30,000 - $50,000	1.53	74.0	(154)	11.1	(23)	7.7	(16)	1.9	(4)	5.3	(11)	100.0 (208)
$50,000-$75,000	1.35	83.3	(180)	6.0	(13)	6.0	(13)	1.4	(3)	3.2	(7)	100.0 (216)
$75,000-$100,000	1.54	76.0	(117)	9.7	(15)	5.2	(8)	2.6	(4)	6.5	(10)	100.0 (154)
More than $100,000	1.44	77.9	(191)	11.3	(28)	5.7	(14)	1.2	(3)	4.5	(11)	100.0 (247)
Education												
High school or less	1.51	79.6	(195)	5.7	(14)	6.1	(15)	1.6	(4)	6.9	(17)	100.0 (245)
Some college	1.38	81.5	(268)	8.2	(27)	4.6	(15)	2.7	(9)	3.0	(10)	100.0 (329)
College graduate	1.50	74.8	(456)	11.3	(69)	7.4	(45)	2.0	(12)	4.6	(28)	100.0 (610)

[a]Scale item scores range from 1 (not at all) to 5 (completely).

Table 5. Landline vs. cell phone households

	Cell phone only	Landline Only	Landline And Cell phone	Total
Total	14.2 (170)	13.8 (165)	72.1 (865)	100.0(1200)
Age				
18-29	45.7 (74)	6.2 (10)	48.1 (78)	100.0(162)
30-39	22.5 (39)	13.3 (23)	64.2 (111)	100.0(173)
40-49	9.0 (21)	14.5 (34)	76.5 (179)	100.0(234)
50-59	8.4 (23)	13.2 (36)	78.4 (214)	100.0(273)
60-69	4.4 (8)	13.8 (25)	81.8 (148)	100.0(181)
70 and over	3.4 (4)	23.5 (28)	73.1 (87)	100.0(119)
Household income				
$15,000 and under	22.2 (14)	20.6 (13)	57.1 (36)	100.0 (63)
$15,000 - $30,000	21.5 (26)	19.0 (23)	59.5 (72)	100.0(121)
$30,000 - $50,000	17.1 (36)	10.5 (22)	72.3 (152)	100.0 210)
$50,000-$75,000	16.2 (35)	9.7 (21)	74.1 (160)	100.0(216)
$75,000-$100,000	13.5 (21)	10.3 (16)	76.1 (118)	100.0(155)
More than $100,000	7.7 (19)	8.1 (20)	84.2 (208)	100.0(247)
Education				
High school or less	19.8 (49)	13.8 (34)	66.4 (164)	100.0(247)
Some college	16.1 (53)	12.7 (42)	71.2 (235)	100.0(330)
College graduate	11.1 (68)	14.1 (86)	74.8 (457)	100.0(611)

Table 6. Replaced printing photos with using a digital picture frame or viewing pictures online

	Mean score[a]	Not at all %	(N)	%	(N)	%	(N)	%	(N)	Completely %	(N)	Total %	(N)
Total	2.96	25.1	(300)	12.5	(149)	24.3	(290)	17.6	(210)	20.6	(246)	100.0	(1195)
Age													
18-29	3.22	18.5	(30)	11.7	(19)	23.5	(38)	21.6	(35)	24.7	(40)	100.0	(162)
30-39	3.09	22.1	(38)	8.7	(15)	25.6	(44)	25.0	(43)	18.6	(32)	100.0	(172)
40-49	3.00	23.7	(55)	10.8	(25)	27.6	(64)	17.2	(40)	20.7	(48)	100.0	(232)
50-59	3.03	24.9	(68)	13.2	(36)	19.0	(52)	20.1	(55)	22.7	(62)	100.0	(273)
60-69	2.85	26.5	(48)	14.4	(26)	26.5	(48)	12.7	(23)	19.9	(36)	100.0	(181)
70 and over	2.67	33.1	(39)	14.4	(17)	24.6	(29)	8.5	(10)	19.5	(23)	100.0	(118)
Household income													
$15,000 and under	2.63	40.3	(25)	12.9	(8)	11.3	(7)	14.5	(9)	21.0	(13)	100.0	(62)
$15,000 - $30,000	3.02	30.8	(37)	6.7	(8)	23.3	(28)	7.5	(9)	31.7	(38)	100.0	(120)
$30,000 - $50,000	2.95	25.8	(54)	12.9	(27)	22.5	(47)	17.7	(37)	21.1	(44)	100.0	(209)
$50,000-$75,000	2.97	24.5	(53)	12.0	(26)	25.0	(54)	18.5	(40)	19.9	(43)	100.0	(216)
$75,000-$100,000	3.03	22.7	(35)	9.7	(15)	26.6	(41)	23.4	(36)	17.5	(27)	100.0	(154)
More than $100,000	3.16	16.3	(40)	15.9	(39)	25.2	(62)	21.1	(52)	21.5	(53)	100.0	(246)
Education													
High school or less	2.87	30.4	(75)	10.9	(27)	22.3	(55)	14.2	(35)	22.3	(55)	100.0	(247)
Some college	2.92	27.4	(90)	11.0	(36)	25.3	(83)	14.9	(49)	21.3	(70)	100.0	(328)
College graduate	3.03	21.5	(131)	13.8	(84)	24.5	(149)	20.5	(125)	19.7	(120)	100.0	(609)

[a]Scale item scores range from 1 (not at all) to 5 (completely).

Table 7. EMT Model (Enabling-Mediating-Transforming) of Computer Use

	Percent agreeing 1999	Percent agreeing 2003	Percent agreeing 2008	Percent agreeing 2010	Role of technology
The computer has saved us time at home	48	51	51	55	Enabling
Computers are difficult to use	16	11	13	--	Enabling
Computers have made it easier to organize family/social events	--	34	33	43	Enabling
Households with a computer are run more efficiently than those without a computer	15	22	--	---	Enabling
Computers in the home take away from family interactions	23	27	30	--	Enabling/Disabling
The computer has increased the amount of job related work I do at home	43	37	33	--	Mediating
Computers are more useful than in the home	40	39	37	--	Mediating
I have more contact with friends and relatives now that I have email	50	54	48	55	Mediating
It would be difficult to imagine life without a computer at home	44	50	58	61	Transforming
The computer has changed the way we do things at home	40	45	--	52	Transforming
The computer is as essential as any other household appliance	38	51	59	63	Transforming
Having the Internet makes me much better informed about the world	47	56	61	66	Transforming
Computer give status to their owners	13	11	--	--	Transforming
Those that are not knowledgeable about computers are falling behind	68	68	68	70	Transforming
Watch less TV as a result of the Internet	29	25	23	--	Transforming
The computer has become part of daily routine at home	52	62	63	72	Transforming
The Internet helps me look for product information that was not possible before	58	72	72	71	Transforming
The computer has replaced telephone as major communication device	10	16	15	--	Transforming
Reduced our need of daily newspapers	--	--	40	--	Transforming
I do most of my communication with friends using social networking sites	--	--	--	21	Transforming
More productive because we have a computer	--	--	49	48	Transforming
Computer has enabled me to meet new people	--	--	--	22	Transforming