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## Seniors and Information Technology: A MIS-Fit?

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### ABSTRACT

*The “digital divide” between the haves and have-nots in society continues to draw attention in traditional media outlets as well as academic research. Those yearning to join the computer revolution comprise several groups defined by wealth, ethnicity, country (even regions of countries), and age. While there has been research into the digital divide in all of these areas, the focus of this paper is Information Technology (IT) use by the elderly, or our senior citizens. Our interest in this group stems from the dynamic interaction of two forces: 1) senior populations are growing in percentage and sheer number both in the United States and internationally; and 2) as a group, the elderly have more disposable income to spend on IT than their younger counterparts. In order to coordinate our research agenda, the current investigation presents a framework that delineates scholarly inquiry into this topic by the elements of the framework. We look at what has been done, and what we feel needs to be done, in order to incorporate an important demographic group into the mainstream of computing society: our seniors.*

### INTRODUCTION

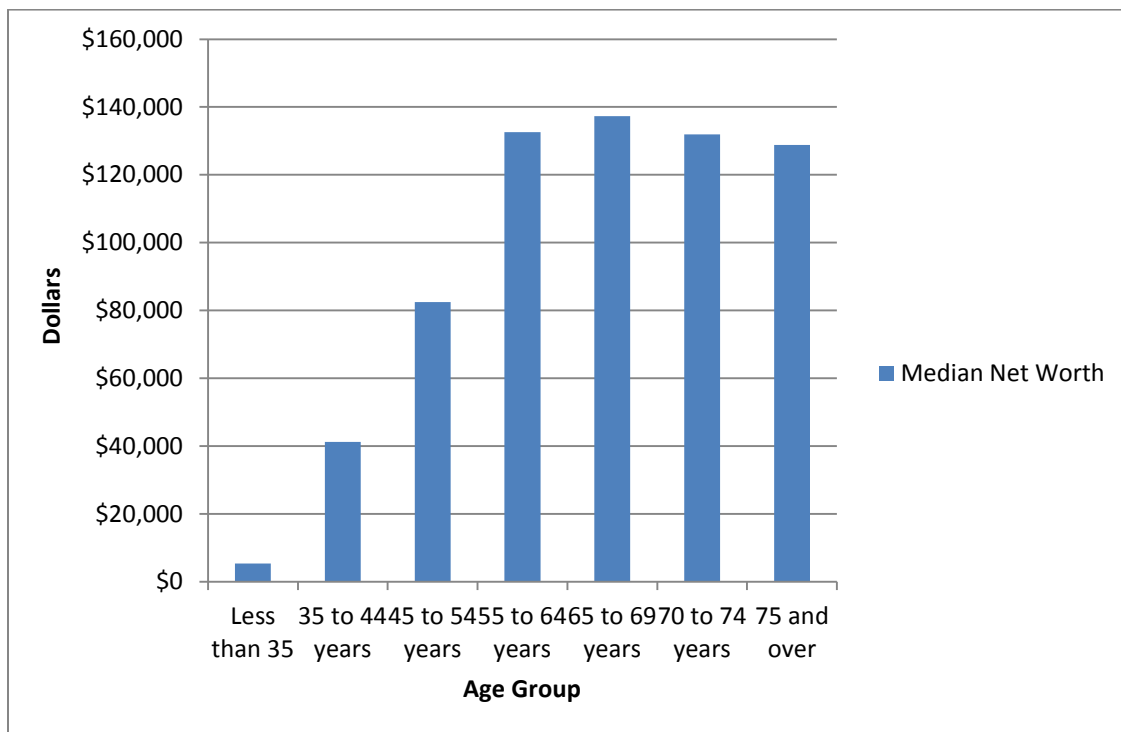
The elderly continue to remain on the edge of the “digital divide”. This separation is well known and is split among many different lines including wealth, education, ethnicity, and age, among others (e.g., gender, country of residence, state of residence, broadband access, etc.). While there has been progress made in shrinking these partitions, many feel there is much more to be done. Our particular interest is in the use of IT by senior citizens, as they comprise one of the fastest-growing segments of society, both in the USA and internationally. Furthermore, this group has significant disposable income (compared to younger generations), available to spend on IT and its related products. Issues such as social interaction, government services, e-commerce activities, healthcare, and education can be enhanced through increased computer usage by our senior citizens. However, the topic in general has been largely ignored in the traditional MIS research realm. A perusal of the top IS journals in the field, over the past five years, shows that scant attention has been paid to this subject. It begs the question of whether we in MIS should care about this group. This paper investigates the current state of IT use by the elderly and reports on what has been done, and remains to be done, to integrate this group of users into the mainstream of modern digital society.

### BACKGROUND AND IMPETUS FOR THE STUDY

There have been few previous studies in the MIS literature, especially in the top-tier journals, pertaining to IT and senior citizens. McMurtrey, McGaughey, and Downey (2008, 2009)

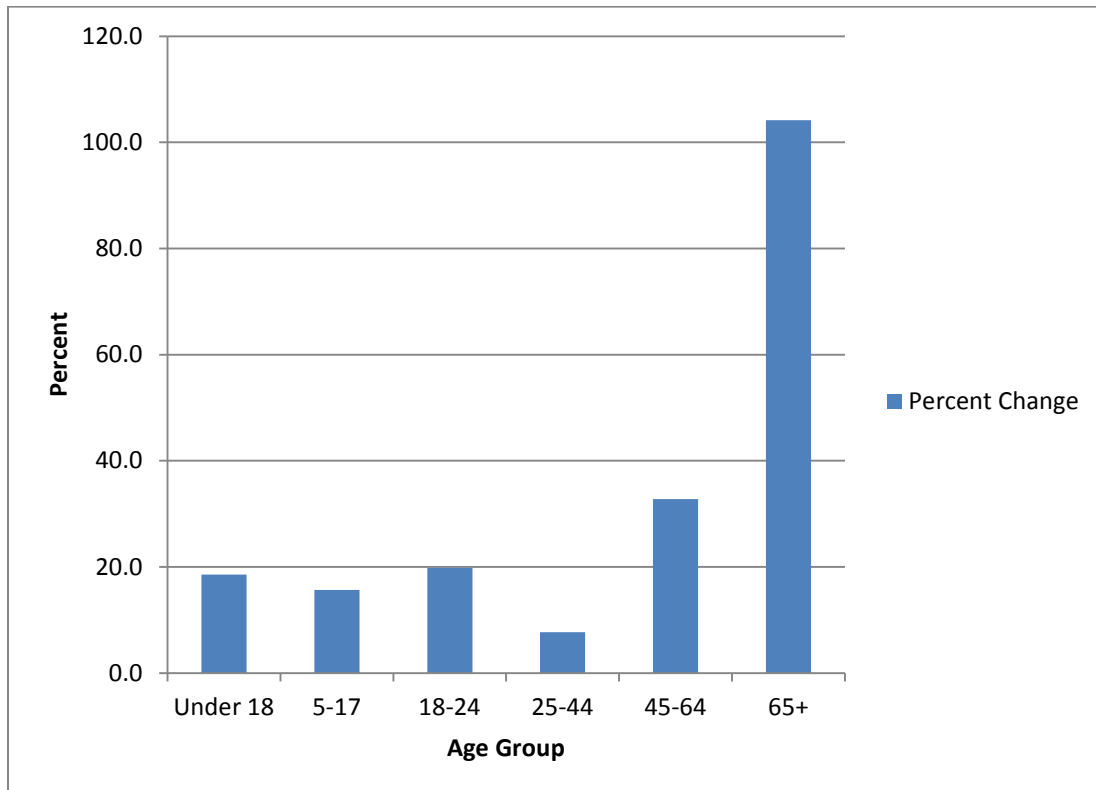
lamented the lack of effort among IT vendors in addressing the particular, specific needs of the elderly when it comes to using computers and related peripheral devices. These authors posit that vendors of IT products are perhaps missing out on a goldmine of opportunity. As shown in Figure 1, the median net worth of individuals aged 65 to 69 is higher than any other age group represented (U.S. Census Bureau, 2008). A closer inspection shows that, starting with the 55 – 64 set, each successive collection of older citizens has much more net worth than their younger counterparts. Therefore, from a financial standpoint, seniors have more to spend on IT and its related wares than other groups. This situation motivated the studies by McMurtrey et al. (2008; 2009).

**Figure 1: Median net worth by age of householders.**



Source: US Census Bureau (2008). 'Net worth and the assets of households', <http://www.census.gov/prod/2008pubs/p70-115.pdf> (Issued April, 2008)

Furthermore, population projections (Figure 2) show that the number of seniors (age 65 and over) will double from the year 2000 to 2030, according to the most recent data available (U.S. Census Bureau, 2005a). It is apparent that, at least in terms of raw numbers, the elderly in the future will be out in large force and have a lot of money to spend.

**Figure 2: Projected population of the US increase from 2000-2030.**

Source: US Census Bureau (2005a). Population Division, Interim State Population Projections <http://www.census.gov/population/projections/52PyrmUS3.pdf> Internet Release Date: April 21, 2005

Thus it does seem contrary to conventional wisdom that research studies involving the elderly and IT are conspicuously absent from the mainstream MIS literature, at least in the top-tier journals. Management Information Systems, as a field of study, has components in a wide variety of areas including end-user computing, systems analysis and design, the use of database and telecommunication technologies, etc. MIS is related to the business uses of information technology and, at least tangentially, to the use of such tools and techniques in order to make a profit. This latter point drives home why the current study finds the issue of seniors and IT so perplexing: seniors are large in number and have significant money to spend. It would seem that IT vendors would take notice – not to mention MIS researchers and the journals in which they publish.

To demonstrate the lack of attention by the top-tier journals in MIS to this topic, we examined the back issues of six top journals in our field and counted how many articles were devoted to the subject. While it is debatable as what outlets would constitute the top six, we utilized existing rankings from the literature (c.f., Shim, 2008; Rainer and Miller, 2005; Mylonopoulos and Theoharakis, 2001) as well as our own experience in coming up with the journals to include. While there may be some disagreement as to what journals constitute the top six, few would argue that the ones chosen for this research are *not* top-tier in nature.

Table 1 shows the results from our efforts. As can be seen, there has been almost no published research regarding IT and the elderly in the journals we studied. There were only three studies identified that were directly related to this topic. In the *Communications of the ACM*, Czaja and Hiltz (2005) highlighted the importance of considering the needs and abilities of older adults in system design. Another CACM piece (Becker, 2005) from the same year emphasized the need for government websites to be sensitive to the navigational needs of older users. The *Journal of Management Information Systems* article (Lam and Lee, 2006) was a longitudinal study of internet adoption by older adults in Hong Kong; the time period in which the research was conducted was during 2002-2003. Almost incredibly, these three were the sole articles pertaining to this topic in the six journals we searched. The *Information Systems Research* piece by Agarwal, Animesh, and Prasad (2009) discussed the digital divide, of which the elderly are a part, but seniors were not the main thrust of the research and were only mentioned in passing.

**Table 1: Number of Articles on IT and the Elderly in Six Top MIS Journals.**

Year	Journal					
	CACM	DS	ISR	JMIS	MISQ	MS
2004	0	0	0	0	0	0
2005	2	0	0	0	0	0
2006	0	0	0	1	0	0
2007	0	0	0	0	0	0
2008	0	0	0	0	0	0
2009	0	0	1	0	0	0
2010	0	0	0	0	0	0
*2011	0	0	0	0	0	0
Totals	2	0	1	1	0	0
* not complete at press time.						
Key:	CACM            Communications of the ACM DS                Decision Sciences ISR               Info. Systems Research JMIS              Journal of MIS MISQ             Management Information Systems Quarterly MS                Management Science					

However, there has been attention paid to this group by other researchers in various other outlets. Some of these publications are domain-specific (e.g., *Home Health Care Management & Practice*, *European Journal of Ageing*, etc.) while others would be considered middle-tier MIS research outlets. There has been some activity in the marketing literature; Eastman and Iyer (2004) and Iyer and Eastman (2006) examined elderly use and attitudes toward using the

internet. An update of these studies was provided by Reisenwitz, Iyer, Kuhlmeier, and Eastman (2007). More recently, Hough and Kobylanski (2009) reported on how marketers could tap into this segment of consumers by focusing on the 4 P's of marketing (Price, Product, Promotion, and Place). It is interesting that marketers recognize the importance of seniors with regard to e-commerce yet, for the most part, MIS researchers have not. This seems ironic, in that e-commerce is certainly a major part of the IT domain.

Apparently little progress has been made in terms of understanding the special needs of seniors with regard to computers and information technology in general. Thus, the present investigation purports to summarize the findings of what has been done in this regard, as well as define future areas of research. The following section delineates the framework for this research effort.

### **ORGANIZATION OF STUDY**

For the remainder of this monograph, we wish to address the issue of IT use by the elderly by organizing the literature into a set of common themes. Our intent is to set up a classification scheme, or taxonomy, that will provide a snapshot of what has been done to date as well as guide future research efforts. Thus, based on our review of the literature, we have categorized these research streams as:

- Design and Interface Issues
- TAM (Technology Acceptance Model)
- Government and e-Government
- Social Interaction
- Quality of Life
- Healthcare
- Education
- Use and Non-Use

Understandably, there will be some overlap regarding a number of investigations. For example, Design and Interface Issues would certainly have common characteristics with the Technology Acceptance Model, especially in terms of Perceived Ease of Use. Likewise, the Social Interaction category might overlies Quality of Life. However, there have been enough studies performed to indicate that separate groupings are warranted, as each area approaches the underlying issue of IT use by the elderly in a different fashion.

Table 2 (Appendix) contains a synopsis of the studies and the various authors' findings. While this list captures the essence of the present investigation, it is by no means exhaustive. There has been scholarly inquiry, for the most part, into these areas over past decades. Our interest is specifically what has been done and *what needs to be done* to move the field (and our seniors, specifically) forward.

#### ***Design and Interface Issues***

It would seem intuitively obvious that there are many issues related to the design and layout of the user interface with regards to IT use by the elderly. As we advance in age, our eyesight

diminishes and our manual dexterity deteriorates. Thus, it would seem readily apparent that such concerns would be addressed by vendors of IT products. However, with some exceptions, this has not been the case. For the most part, computers and their associated peripheral devices are not designed with senior citizens in mind. This is true of both hardware and software components. On the hardware side, there are very small buttons and plugs for the associated equipment (e.g., printers, speakers, external drives, etc.) that are difficult to see and manipulate by seniors.

Likewise, software usually entails a learning curve and what is intuitive to the younger generation is not necessarily so for the elderly. While drop-down menus and the like are commonplace and only require secondary thought for all but the novice user that has grown up in the digital age, such navigation procedures can be daunting for others. While some software products are moving away from drop-down menus and more toward a “tabs orientation” (for example, Office 2007 and 2010), such a layout is not necessarily less complex for any user. Thus, much remains to be done if we are to incorporate our senior citizens into the digital age. The following literature does begin to address this gap and is depicted in Table 2.

Gregor and Dickinson (2007) noted that there are 250 possible operations and five panels on the first page of Microsoft Outlook, a popular and commonly used e-mail client program. Such a dizzying array of options can be confusing even for advanced users. In their study, 50% of a group of older beginners failed to complete basic e-mail tasks. Such software complexity can impose cognitive difficulties and prohibit access to IT by all users, senior or not.

Dewsbury, Rouncefield, Sommerville, Onditi, and Bagnall (2007) support the notion of “inclusive design”, which emphasizes the importance of human and social factors in system use. Special demands are placed on the designer in order to produce designs for specific groups, such as older or disabled people. They note that it is not a prerequisite to be older to determine what older people need. Their research “...challenged some current ideas surrounding designing *for* people, advocating the concept of designing *with* people” (p. 217). Such inclusive design principles should result in systems that are more accessible to our elderly users.

To address such issues, a workshop was recently held at the annual ACM Computer-Human Interaction (CHI 2009) conference in Boston, Massachusetts. Participants recognized that internet-based, mobile and pervasive technologies provide the means for older people to establish and maintain intergenerational relationships over long distances. However, the significance of this intergenerational context has been largely ignored when considering potential interactions and the design of new technologies (Harley, Kurniawan, Fitzpatrick, and Vetere, 2009).

It is intuitively obvious, and readily apparent, that design issues are easily among the most crucial elements in creating IT systems that are accessible to all users. Quality of life, access to e-government and e-commerce applications, and other components of our framework are profoundly impacted by accessible design. As such, it is noted that design represents a major undercurrent in all aspects of computer use by the elderly.

**TAM (Technology Acceptance Model)**

The Technology Acceptance Model (TAM) is one of the most widely utilized and studied representations of user behavior in the MIS discipline. Since the original work of Davis (1989) and Davis, Bagozzi, and Warshaw (1989), TAM has been an integral part of the methodology of at least a hundred published research studies, both in the MIS realm and other fields (King and He, 2006; Ma & Liu, 2004). Grounded in the theory of reasoned action (Fishbein & Ajzen, 1975) TAM has provided invaluable insight into user interaction with computer systems for the past two decades. Two of its core constructs, Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), are especially germane to inquiries regarding IT use by the senior population.

While there have been some studies using TAM as part of the research focus with seniors (see Table 2), there is a consistent call from these efforts to investigate it further. Smith (2008) reported that while many studies have used the model to better understand e-commerce, they have ignored one very important external variable – the effects that aging may have on the usability of the internet and of e-commerce web sites. He found that the research model accurately reflects the effects of the aging process and that the perceived usefulness of e-commerce web sites positively and significantly influenced a senior's attitude toward using and intention to use the web sites. Results also showed that that a web site's usability positively and significantly influenced the perceived ease of use of e-commerce web sites.

Chung, Park, Wang, Fulk, and McLaughlin (2010) examined age differences in perceptions of online communities held by people who were not yet participating in these relatively new social spaces (i.e., the elderly). They used an extension of TAM to investigate the factors that affect future intention to participate in online communities. It was found that age was negatively associated with Internet self-efficacy, perceived quality of online community sites, Perceived Usefulness (PU), and Behavioral Intention (BI). In particular, the negative associations between age and PU and BI indicate that there still exist significant generational gaps despite the rapid growth in Internet use among older adults. Further, the negative associations between Internet self-efficacy and perceived quality of online community sites suggest that older adults still experience difficulties in fully enjoying Internet applications because of their lack of confidence or the poor quality of the sites they visit (p. 1680).

Phang, Lee, Sutanto, and Kankanhalli (2005), using TAM as the theoretical foundation, investigated an innovative e-government service specifically tailored for senior citizens called CPF-Withdrawal. They attempted to identify the antecedents of perceived usefulness by drawing from the innovation diffusion literature as well as age-related studies. Their findings agree with TAM and indicate that internet safety perception and perceived ease of use are significant predictors of perceived usefulness. Theirs was an international study (i.e., Singapore) that could of course be cross-listed in our framework under Government and E-government.

One research effort that was of special interest to us was conducted by Renaud and van Biljon (2008). They noted that while technology acceptance had been studied from a variety of perspectives, including IS, Sociology, and Human Computer Interaction, technology acceptance by the elderly mobile phone user has received less attention. Furthermore, no model exists to predict *their* technology adoption. These researchers developed such a model through structured



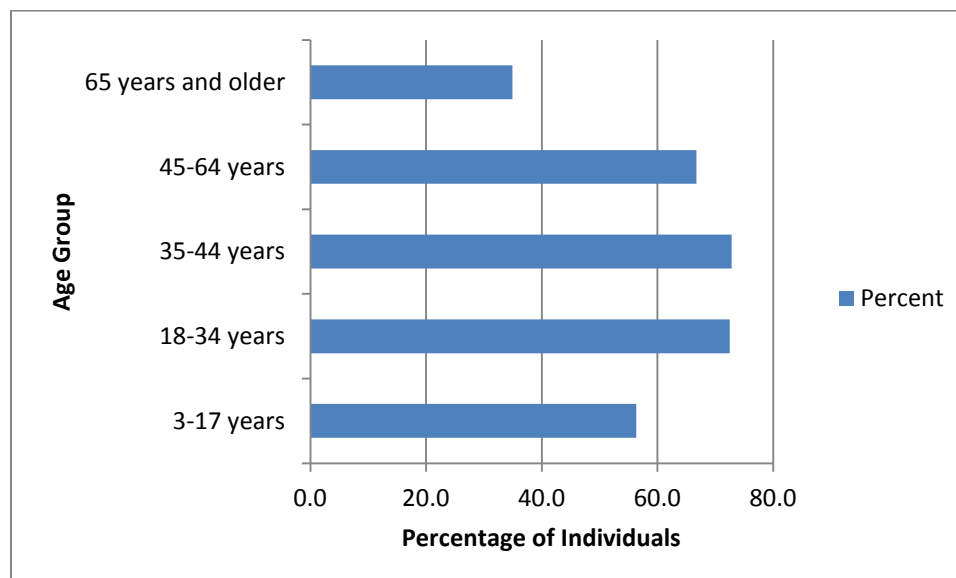
interviews with senior mobile phone users. The Senior Technology Acceptance & Adoption model for Mobile technology (STAM) is a set of interlinked acceptance factors and adoption phases. By relating acceptance factors to adoption stages, STAM provides an explanation as to why many elderly adults never reach the final adoption phase and never fully accept the technology. This monograph is of exceptional interest to the current researchers as we are formularizing a large-scale study on technology use by the elderly, particularly their adoption of mobile phones and PDAs as primary computing platforms.

### ***Government and e-Government***

Governments have the responsibility of ensuring that its citizens are adequately informed about government matters that impact their lives. Societal evolution is dependent upon, among other things, the robust dissemination of pertinent information to affected parties. Examples abound: changes in existing laws, tax codes, or personal property assessment would affect almost all adult citizens. A proposal to re-route a highway, change the form of city government, or build a new school would affect all citizens within that municipality. It would be an understatement to say that the advent of the Internet has changed the way people get news and interact with not only each other, but their government as well.

However, not *all* citizens (e.g., the elderly) have embraced the digital age with equal proportion. Figure 3 show that senior citizens constitute one of the lowest groups of user participation with regard to utilizing computer resources, especially the internet (U.S. Census Bureau, 2007). While there are signs that their use is increasing (Harley et al., 2009) penetration rates are still the lowest among all age groups (U.S. Census Bureau, 2005b).

**Figure 3: Individual accesses internet from some locations.**



Source: U.S. Census Bureau, Current Population Survey, November 2007.

<http://www.census.gov/population/www/socdemo/computer/2007/tab05.xls>

Internet Release date: June 2009

Phang, Sutanto, Kankanhalli, Li, Tan, and Teo (2006) revealed more in depth findings from their earlier study (Phang et al., 2005) on seniors' acceptance of an e-government service (CPF e-Withdrawal). In addition to the results reported in the previous section, they also showed that the usefulness perception of senior citizens can be driven by both tangible benefits such as resource savings and intangible benefits such as self-actualization (p. 571).

In another international study set in the Netherlands (Batenburg, Versendaal, & Erasmus, 2008), the case was made that IS holds the main solution for all the complex problems in the cooperation and communication between government, public bodies, and elder citizens. They used group interview data collected from three elderly panels, and three panels of policy actors and stakeholders, applying the methods of focus group and expert consultation. The opportunities identified matched with several other European initiatives, such as the Service Oriented Programmable Smart Environments for Older Europeans (SOPRANO) project.

Another contribution from this investigation was the manner by which these researchers segmented the elderly. Participants were categorized as "current elderly" (age 70 years and older), the "next elderly" (between age 50 and 70) and the "future elderly" (between age 30 and 50). Future research should keep these classifications in mind, as one problem that plagues these kinds of studies is how the "elderly" are defined for research purposes (c.f., Hough & Kobylanski, 2009; McMurtrey et al., 2008).

A recent study involving the UK, Italy, and Norway revealed that there is much to be done in terms of online form design on government websites. Money, Lines, Fernando, and Elliman (2011) reported on the findings of Delivering Inclusive Access to Disabled and Elderly Members of the community (DIADEM), a three-year project, funded by the European Commission's Sixth Framework Programme, to assist older adults when accessing, completing, and submitting online forms, by developing web-based assistive technologies that adapt the online form according to users' needs. 23 online form design guidelines were identified. Like other research studies in our taxonomy, this particular study could have been cross-listed under Design and Interface Issues.

### ***Social Interaction***

The elderly suffer from a lack of social interaction due to a variety of factors. Friends and family members pass away, relocate to retirement centers or assisted-living facilities, or move in with children during their golden years. Feelings of isolation and loneliness are a natural byproduct of such life-changing events. Fortunately, through regular e-mail, as well as the explosion of social networks online (e.g., MySpace, Facebook, etc.), seniors can remain in contact with loved ones and interact in the mainstream. In addition, computers can be used in a standalone basis to play video games (such as Solitaire, to begin with) or online with other players. Such interaction promotes engagement and feelings of self-worth.

Yet, if senior citizens are apprehensive about computers in general or have reservations about their ability to use them, they will not be able to participate in the social interaction arena. They will be missing out on bountiful opportunities to share memories (and create new ones) with

others. Our contention is that vendors of IT products need to do much more to ensure that our elderly are not left behind.

Fortunately, there has been some research conducted in this area. Pfeil, Arjan, and Zaphiris (2009) found that senior users of the social networking portal MySpace tend to have a more diverse age distribution in their network of “friends” on the site. Results showed the existence of a “social capital divide”: teenagers have larger networks of friends compared to older users, and these acquaintances are in their own age range (+/- 2 years). Godfrey and Johnson (2009) suggested a model for using emerging technologies to introduce new ways in which information for older adults can be improved by digital “circles of support” – a form of social network where mediators collaborate to create and share self-authored content. The UK government strategy for aging in the 21<sup>st</sup> century challenges conceptions of older people as passive recipients of care and promotes their engagement as active citizens. They explored the complex circumstances around which older people access and use social and community information and reported on the design of one particular project, Leeds Link-Age Plus.

### *Quality of Life*

The quality of life domain is probably the most broad and inclusive province in Table 2. This area permeates all the others and serves as an undercurrent to any investigation of elderly use of IT. Nevertheless, several studies focused on this particular aspect. Agarwal, Animesh, and Prasad (2009) noted that despite the widespread diffusion of the web and related technologies, pockets remain where the internet is used sparingly, if at all. They argue that individual choice is subject to social influence (“peer effects”) that emanates from geographical proximity. This assertion was tested by an empirical analysis of a data set compiled from a number of sources, including residential segregation and housing density. Among the results, it was found that 1) widespread internet use among people who live in proximity has a direct effect on an individual’s propensity to go online; and 2) internet usage patterns of people who live in more ethnically isolated regions will more closely resemble usage patterns of their ethnic group.

McMurtrey, McGaughey, and Downey (2008) reported on the shrinking of the digital divide with regard to the elderly. By utilizing census data and marketing research, they painted a portrait of a vastly underrepresented target market pertaining to IT and IT-related products: our seniors. Another study by these same authors (2009) presented evidence that vendors of IT products (both hardware and software) were missing out on what could be described as a “goldmine” of opportunity. The elderly have more assets and disposable income than their younger counterparts, yet by and large the IT industry is aimed squarely away from this ever-increasing group of consumers. It was noted that addressing this gap should result in a “win-win” situation: increased sales for vendors (which leads to jobs and increased tax revenues to fuel growth in communities), and incorporating seniors into the “wired” world. It would seem that such a scenario would improve the quality of life for all citizens.

As previously mentioned, quality of life is a sphere that surrounds almost every research inquiry into elderly IT use. It is obvious that healthcare, social interaction, participation in government, lifelong learning (i.e., education) programs, and other areas reported in this monograph would all contribute to improving people’s lives, especially (but not limited to) their advancing years.

Appropriate interface design, ways to reduce computer anxiety, increase self-efficacy, and other focal areas of research contribute to the successful integration of our senior citizens into the digital mainstream. We believe it would almost be impossible to completely separate any of the studies we found from underneath the umbrella of quality of life. As such, we will consider all of the research efforts that we uncovered to be at least tangentially related to this general topic.

### ***Healthcare***

The use of IT in healthcare is another very broad category that is directly related to quality of life. Healthcare issues range from the use of information technology in hospitals, such as X-ray machines and MRI scanners, to home health situations where the patients monitor themselves. Our focus is less on the former scenario and more on the latter, as many elderly are responsible for their own adherence to physician directives and certainly cannot afford to have a nurse or physician's assistant living with them or being on call 24 hours a day.

Campbell (2008) discussed the design and development of a program to integrate computer technology into two Nurse Wellness centers located in low-income minority high-rise facilities. The goal of the program was to teach residents how to use the computers and the internet to locate health information and to take a more active role in their own health care. He described the training format, barriers to implementation, and initial qualitative findings. Based on firsthand observations, he noted that for many seniors the personal computer and the internet became useful tools for locating health information.

The main goal of the research by Ahn, Beamish, and Goss (2008) was to understand older adults' attitudes and interests in residential technology products and services that had been adopted at a rate of less than 50%. Early adopters of computer technologies are perceived as persons with early knowledge of newly introduced residential technologies. They explored the potential of these technologies to assist with aging in place, or older people's ability to function and live independently. Although studies of early adopters may not have significant external validity, their research did provide insight useful in understanding and estimating future trends for this population.

Hwang (2011) noted that designing healthcare services for senior citizens is different than traditional healthcare applications. The study's healthcare service utilizes multimedia streaming technology and video clips to present stroke-precaution knowledge for senior citizens. Evaluation benchmarks were provided from medical specialists in the hospital. Results showed that the personalized healthcare service could provide accurate stroke-precaution information for aged senior citizens, thus improving quality of life for both the elderly and their families.

### ***Education***

An educated citizenry is beneficial to nations and society as a whole. Knowledge of current events, government programs, and exciting new opportunities for self-improvement are a tip of the iceberg of advantages to continual education. While many elderly, defined as 65 years or older, are retired, the "middle elderly" (ages 50-64) are still functioning members of the workforce. This group of middle elderly also lags behind their younger counterparts with regard

to computer and internet use. Furthermore, whether retired or not, continuing education has many positive benefits including keeping the mind sharp, social interaction, and learning new things in general.

Moreover, the concept of retirement has changed in the past two decades. Besides the financial benefit of working longer, there are social and psychological advantages as well (Githens, 2007). In addition, there are declining numbers of available workers for organizations that have a need for seasoned, experienced talent (Ennis-Cole & Allen, 1998; McNaught & Barth, 1992). Thus, due to economic and social shifts, people are both living better and working longer.

Lifelong Learning programs encourage seniors to quench their thirst for knowledge. Seals, Moses, Nyagwencha, and Martin (2008) used virtual classrooms in SecondLife as a viable tool for senior adult education. Githens (2007) notes several types of E-Learning programs for older adults, including community education programs, Universities of the Third Age (U3As), Lifelong Learning Institutes, and community college/university outreach programs. SeniorNet, founded in 1986 in San Francisco, has long been recognized as an innovator and continual promoter of computer use by the elderly ([www.seniornet.com](http://www.seniornet.com)). Mensch and Ali (2009) reported on a service learning project undertaken by faculty members to donate a digital video game to a senior citizen center. All of these studies had the express purpose of improving the skills of older adults with regards to computers. Once that fear and resistance to such technology is overcome and familiarity is enhanced, a door opens for the elderly to new worlds of discovery, interaction, and overall quality of life.

### *Use and Non-Use*

A perplexing problem faced by designers of IT is getting seniors to use their products, even after doing all they can to make their experience as pleasant and unobtrusive as possible. No matter how much research is conducted, nor surveys administered and statistically analyzed using the most elegant algorithms and routines, the final hurdle to overcome is whether or not the end user actually *uses* the product or feature under discussion. While certainly not shortchanging the contributions made by research on the Technology Acceptance Model, for example, it is frustrating to society as a whole if one of the largest segments of it (i.e., the elderly) remains offline. Such a dilemma is true for the computer itself (e.g., hardware and software) as well as ubiquitous applications like the internet and world wide web.

Peacock and Kunemund (2007) studied the reasons for non-use and the frequency, intensity, and the socio-demographic correlates of internet use of older citizens in Europe. If seniors remain offline they will become increasingly disadvantaged from a socio-ecological point of view, as the internet's societal pervasiveness progresses. The Eurobarometer of 2003 was used to identify the correlates of internet access. They found that decisions to remain offline were mainly based on private access (i.e., lack of a device), motivational indifference, and deficient knowledge. Another interesting contribution from this study was that they segmented the elderly into three groups for analysis: 1) the Young (ages 55 – 64 years old); 2) Middle-aged (65 – 74 years); and 3) Old (75 years and older). As mentioned in a previous section of this monograph, defining what is “elderly” is a problem acute to this kind of research.

Morris, Goodman, and Brading (2007) reported the results of two connected surveys of computer and internet use among the older population in the UK. Derbyshire residents aged over 55 completed 120 questionnaires and interviews, while 353 over-50 participants from Scotland did the same. Many of the reasons given for non-use were gathered from open-ended questions. Summarizing, their rationale included lack of interest, lack of access, and feeling too old. The study suggested some practical ways forward, highlighting the importance of changing older people's misconceptions about computers, better informing them about what they are, what they can do and how they can be of real practical use.

Gatto and Tak (2008) examined the perceived benefits and barriers to computer, internet, and e-mail use among 58 older adults. Benefits included a sense of connectedness, satisfaction, utility, and positive learning experiences. Barriers included frustration, physical and mental limitations, mistrust, and time issues. As technology advances, professionals who teach and care for older adults need to be aware of the characteristics of older computer users. They need to know the perceived barriers and benefits of computer, Internet, and e-mail use in order to tailor education and interventions to this population. The authors of the present study are developing a research instrument to study these very issues.

## **CONCLUSIONS AND FUTURE RESEARCH**

Even though little research in IT use by the elderly has been published in top-tier MIS journals, other journals of various disciplines, including MIS, have published this research. In this paper, we have organized existing published research into different streams in order to get a sense of the entire subject, and to guide our own investigation in the area. Hopefully, this organization will help other scholars delineate their intent and better assemble their agendas.

Some areas of possible research apparent to us include:

- Investigate the growing use of PDAs and cell phones by seniors as their primary computing platform
- Look at how Social Networking websites (e.g. Facebook, MySpace, etc.) have changed the communication fabric woven among seniors and their families, friends, and acquaintances
- Continue building our research framework to include substantive areas such as computer anxiety, self-efficacy, and attitudes toward IT by the elderly
- Use focus groups of seniors to help identify what issues are most important to them in terms of IT use and access
- Put together a research instrument to survey seniors, though regular mail, internet, or personally administer to groups of elderly citizens residing at local senior centers, retirement communities, and assisted living facilities
- Perform longitudinal studies with "younger" seniors (i.e., less than 70 years of age) to track how their usage and attitudes change regarding IT as they grow older.

It is unclear to us why more research in this area has not been published in top-tier MIS journals. We believe the topic is germane to our discipline, and we hope to continue to provide insight into IT use by the elderly.

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## APPENDIX

**Table 2: A Framework for Organizing Major Research Streams on IT Use by the Elderly.**

Area of Study/ Theme	Year	Authors	n =	Participants/Methodology	Sample
Design and Interface Issues	2009	Harley, Kurniawan, Fitzpatrick, & Vetere	N/A	Panel of experts	Workshop on design
	2007	Gregor & Dickinson	N/R	three interlinked examples: word processing, e-mail, & world wide web IS's	elderly users
	2007	Dewsbury, Rouncefield, Sommerville, Onditi, & Bagnall	6	Cultural probes: low key sympathetic data gathering techniques	Prototypes tested by participants in their own homes
TAM (Technology Acceptance Model)	2010	Chung, Park, Wang, Fulk, & McLaughlin	989	Online survey; panel provided  by the Media Research Lab at the U. of Texas - Austin	E-mail sent to  8935 panelists
	2008	Smith	72	Lifelong Learning Institute Daniel Castor Senior Center	Convenience sample
	2005	Phang, Sutanto, Li, & Kankanhalli	99	Seniors randomly selected from coffee shops, community centers, & public housing estates.	Convenience sample
	2008	Renaud & van Biljon	34	Scenarios described to seniors Structured Interviews conducted	Convenience sample
Government & e-Government	2011	Money, Lines, Fernando, &	80	3-year project funded by the European Commission's Sixth	Convenience sample

		Elliman		Framework Programme	
	2008	Batenburg, Versendaal, & Breedveld	28	panel study/focus groups	Convenience sample
	2006	Phang, Sutanto, Kankanhalli, Li, Tan, & Teo	139	Residents of six large senior centers	Convenience sample
Social Interaction	2009	Pfeil, Arjan, & Zaphiris	6,000	MySpace user profiles	Convenience sample
	2009	Godfrey & Johnson	N/A	Literature Review	Literature Review
Quality of Life	2009	Agarwal, Animesh & Prasad	156,941 individuals from 56,000 households	U.S. Bureau of Labor Statistics Current Population Studies and Computer Use Supplement	Probability sample
	2008	McMurtrey, McGaughey, & Downey	N/A	U.S. Bureau of Labor Statistics Current Population Studies and Computer Use Supplement	U.S. residents Census data
	2009	McMurtrey, McGaughey, & Downey	N/A	U.S. Bureau of Labor Statistics Current Population Studies and Computer Use Supplement	U.S. residents Census data
Healthcare	2011	Hwang	25	Simulate 25 records of personal health data, cross-examined by specialists	Hospital records
	2008	Campbell	N/R	Residents of two Nurse Managed Wellness Centers	Convenience sample

	2008	Ahn, Beamish, & Goss	1,546	Alumni of a southern land-grant university	Convenience sample
	2003	Weiner, Callahan, Tierney, Overhage, Mamlin, Dexter, & McDonald	N/R	30 years experience with one of the oldest, largest, & most comprehensive computerized medical record systems in the world	Convenience sample
Education	2008	Seals, Moses, Nyagwencha, Martin, Clanton, Thomas & Doswell	35	Created Second Life Virtual Classroom; mixed method approach to data collection and analysis	Convenience sample
	2007	Githens	N/A	Literature Review	N/A
	2009	Mensch & Ali	N/A	Pedagogical exercise; using digital video games in a service learning project	Donated a digital video game to a local senior center
Use & Non-Use	2008	Gatto & Tak	58	Members of SeniorNet (survey)	Convenience sample
	2007	Morris Goodman, & Brading	120 353	Derbyshire participants over 55; Scotland over 50	Convenience sample
	2007	Peacock & Kunemund	5,091	Eurobarometer: a large representative survey of the European population	

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