Diffusion of Technology: Frequency of Use for Younger and Older Adults

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Abstract

Objectives—When we think of technology-savvy consumers, older adults are typically not the first persons that come to mind. The common misconception is that older adults do not want to use or cannot use technology. But for an increasing number of older adults, this is not true (Pew Internet and American Life Project, 2003). Older adults do use technologies similar to their younger counterparts, but perhaps at different usage rates. Previous research has identified that there may be subgroups of older adults, "Silver Surfers", whose adoption patterns mimic younger adults (Pew Internet and American Life Project, 2003). Much of the previous research on age-related differences in technology usage has only investigated usage broadly -- from a "used" or "not used" standpoint. The present study investigated age-related differences in overall usage of technologies, as well as frequency of technology usage (i.e., never, occasional, or frequent).

Methods—The data were gathered through a questionnaire from younger adults (N=430) and older adults (N=251) in three geographically separate and ethnically diverse areas of the United States.

Results—We found that younger adults use a greater breadth of technologies than older adults. However, age-related differences in usage and the frequency of use depend on the technology domain.

Conclusion—This paper presents technology usage and frequency data to highlight age-related differences and similarities. The results provide insights into older and younger adults' technology-use patterns, which in turn provide a basis for expectations about knowledge differences. Designers and trainers can benefit from understanding experience and knowledge differences.

Keywords

technology use; age-related differences; computer and Internet use; technology diffusion

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Technology interactions have the potential to ease the performance of tasks and sometimes to enable people to accomplish activities they might not otherwise be able to do on their own

(see Charness, Fox, and Mitchum, in press, for a review). Computer technology is prevalent in many domains beyond personal computers and the Internet, such as communication, financial transactions, home management, and health care.

There is a common misperception that people over a certain age (e.g., 65) tend to be less open or perhaps even averse to adopting new technologies for everyday tasks. However, more and more research makes clear that this is a misperception and an overstatement (O'Hanlon, Bond, Knapp, and Carragher 2010; Pew Internet and American Life Project 2004, 2009). Many older adults use technologies widely, including personal computers and the Internet. However, little is known about the depth and breadth of technology use by older adults or whether it differs from younger adults' usage patterns.

Technology adoption is influenced by various factors, such as relative advantage of the technology (compared to the previous method of accomplishing the activity) and degree to which the innovation is compatible with one's values, experiences, and needs (Rogers 2003). A systematic understanding of the technology experience of younger and older adults can provide insights into the knowledge that might be available to these user groups when faced with novel technologies.

The recent international standard about the design of everyday technologies (ISO 20282-1; International Standards Organization 2006) specified a design requirement for "knowledge of comparable machines". This information about prior knowledge will help designers to select and arrange elements on new technologies with which the user is already familiar. At present, it is difficult to provide designers with the necessary guidance to accurately represent the technology knowledge base of older and younger adults.

General Computer Use

In general, older adults are one of the least likely demographic groups to have a computer in their homes; however, many are using computers, and their numbers are rising. In 2000, 59 percent of Americans aged 50–64 and 21 percent aged 65 and older indicated they used a computer (Pew Internet and American Life Project 2004). Four years later, a study by the Kaiser Family Foundation (2005) found that 76 percent of Americans 50–64 years old and 42 percent of adults 65 years and older used a computer; both groups have become more computer savvy. These studies have provided useful general information on older adults' computer usage; however, their frequency of computer usage and the activities they use it for remain unclear.

Internet Use

A 2008 survey of American adults by the Pew Internet and American Life Project revealed that 89 percent of 18–29 year-olds reported Internet use, compared to only 33 percent of adults 65 and older (Pew Internet and American Life Project 2008). Such data however, can hide the trend that older people are the fastest growing segment of the population using the Internet. For example, that Pew survey also showed that 67 percent of adults aged 50–64 are currently Internet users.

In general, surveys have shown that older adults are aware of some specific activities that the Internet can support. At least 37 percent of older Internet users have looked for information about medication prescriptions online and about 16 percent have compared prices and made purchases (Kaiser Family Foundation 2005). In addition, more than 14 percent of older Internet users have researched information about health care providers. However, few older adults, only 2 percent, indicated that they have emailed their doctor,

though 15 percent of older people point out that they have received emails advertising drugs, supplements, and other medical devices (Kaiser Family Foundation 2005).

Health care in particular may be a domain in which older adults adopt the Internet as a useful tool (see e.g., Taha, Sharit, and Czaja 2009). Of adults who have used the Internet and have chronic conditions, 53 percent reported that information found on the Internet had informed their decision-making about their own health or someone they care for (Pew Internet and American Life Project 2007). Respondents reported that information found had affected treatment decisions and strategies for coping with the condition and associated pain, helped them formulate new questions for their provider, and/or influenced a decision to seek a second opinion. The Internet may prove particularly valuable for older adults who are likely to have at least one chronic condition: 53 percent have hypertension, 31 percent have heart disease, and 18 percent have diabetes (Centers for Disease Control 2009).

Technology Use across Domains

Technology usage does not refer only to using the computer for emailing or for browsing the Internet. Therefore, technology usage surveys have also examined usage in devices such as cellular phones, CD players, DVD players, and digital cameras. One study found that 55 percent of adults aged 65 and older were mobile phone users (Pew Internet and American Life Report 2008). A study in the United Kingdom found that 54 percent of adults aged 61+ were current users of CD players (Selwyn, Gorard, Furlong and Madden 2003). A poll by Gallup and Newport (2007) found 47 percent of adults aged 50–64 and 22 percent of adults aged 65 and older owned digital cameras. Gallup and Newport (2007) also found that 83 percent of adults aged 50–64 and 48 percent of adults aged 65 and older owned DVD players. Although these data suggest that the oldest adults may continue to be slower adopters of new technologies, the adults aging into this population will nevertheless increase as currently working adults have already incorporated many technologies into many daily activities (Pew Internet and American Life Project 2005).

Overview of Present Study

Technology usage should not be simply defined in terms of a user or non-user, especially in older adults. The breadth of feature and activity usage within a technology is indicative of one's knowledge of that technology. Use differences may reflect growing confidence with the technology, but they may also relate to more fundamental differences that can help predict whether a new technology would be adopted by older adults in general or by a specific person.

Few existing studies provide in-depth information about the breadth and depth of technology experience across domains for older adults, relative to younger adults. In the present report we provide an analysis of technology experience for 430 younger adults (aged 18–28) and 251 older adults (aged 65–90) from three geographically separate and ethnically diverse areas of the United States. (Note that we did conduct analyses separately for sub-groups of older adults, 65–75 and over 76–90, and the pattern of results was similar; therefore the older adult data were combined.) Our goal was to understand the relative levels of diffusion and experience of common technologies across younger and older adults. The results provide a context for technology experience to help designers and educators predict and encourage effective technology use that leverages existing knowledge and behavior.

Method

Participants—The data set used for the following analyses came from the Center for Research and Education on Aging and Technology Enhancement (CREATE;

www.create-center.org), a consortium of three American universities (University of Miami, Florida State University, and the Georgia Institute of Technology) with laboratories that investigate age-related differences that may affect technology usage (see Czaja et al. 2001, for a more detailed description of this center). All adults gave their informed consent prior to their inclusion in the study.

Specifically, we analyzed demographic and technology experience questionnaires collected from 430 younger (aged 18–28; M=20.45, SD=2.16) and 251 community-dwelling older people (aged 65–90; M=72.93, SD=5.73) in these regions. The sample was racially diverse: for younger adults, almost 52 percent indicated that their primary racial group was Caucasian, 23 percent African American, 10 percent Hispanic, and the remaining participants indicate "other". For the older adults, almost 74 percent were Caucasian, 17 percent African American, and the remaining participants indicated "other".

Participants were screened for cognitive impairment using the Short Portable Mental Status Questionnaire (criterion: 2 errors; Pfeiffer 1975) and the Wechsler Memory Scale (Logical Memory subscale; age-adjusted criterion; Wechsler 1997). The majority (approximately 68 percent) of the younger participants were current college students, and no more than 8 percent had completed a college degree. The older participants had a more varied educational background: 20 percent had a high school education or lower, 27 percent had completed some college, and 46 percent had a bachelor's degree or higher. Females comprised 58 percent of the younger group and 63 percent in the older adult group. All participants were generally healthy: 98 percent of younger participants and 84 percent of older participants reported a range from "good" to "excellent" health.

Survey—The technology-experience surveys were administered over the years 2006–2008 in three geographically separate and ethnically diverse areas of the United States as part of the CREATE research program. Data were collected separately by laboratories at the three CREATE universities according to a standard protocol approved by each Institutional Review Board.

The survey comprised four sections: (a) technology domains – participants reported the frequency in which they performed activities within the domain and the frequency of use for specific technologies for these activities; (b) technology importance – participants rated the importance of technology for each domain using a 5-point Likert scale with 1 as "not at all important" and 5 as "very important"; (c) computer experience – participants reported the frequency with which they used specific input devices, computer operations, computer software, and windows operations; and (d) Internet experience – participants reported their frequency of Internet use, length of time they had been using the Internet, changes in frequency of use, method by which they learned to use the Internet, and the frequency of performing specified activities using the Internet. This survey is available from the first author.

Data Coding—Participants chose one of six frequency options when answering usage questions for each of the technologies. The response options were: 1 – "Not sure what it is"; 2 – "Never"; 3 – "Once in a while"; 4 – "Some of the time"; 5 – "Most of the time"; and 6 – "Always". To better identify frequency trends, the data were recoded into three frequency responses: "Not sure what it is" and "Never" were recoded as 0 – "Never Used"; "Once in a while" and "Some of the time" were recoded as 1 – "Occasionally Used"; and "Most of the time" and "Always" were recoded as 2 – "Frequently Used".

Prior to the specific questions within each domain, participants were asked how frequently they engaged in an activity domain (e.g., How often do you go shopping?). If participants

answered "Never," their data were excluded for the subsequent questions specific to that domain. In addition, participants' data were included only if they answered at least 75 percent of the questions within each domain. For example, when there were six domain items, participants had to provide frequency of use information for at least five of the six items. Exclusion of a participant's data from one domain did not influence his or her data being included in another domain.

Results

General Computer Use—We first asked the general question, "Have you had experience with computers?" (yes or no). Not surprisingly, there was a significant difference between younger and older adults; X^2 (1, N=679) = 64.25, p < .05, whereby 99 percent of the younger adults responded "yes" compared to 80 percent of the older adults.

However, knowing how many younger and older people answered this question with a "yes" provides only minimal information about their computer experience. What types of computer experience do they have (i.e., what is the nature of their experience)? To address this question, we queried participants who responded "yes" to the general question about the extent of their experience with different input devices, computer operations, windows operations, and use of systems/software.

<u>Input device use:</u> We asked participants to indicate their experience with nine different input devices: joystick, keyboard, light-pen, mouse, rotary input knob, speech recognition system, touch screen with finger, touch screen with stylus, and trackball (see Table 1). For most of the input devices, younger adults had more intensive experience; the only exception was for a rotary input knob, which is relatively rare and neither age group had much experience. Also notable is that, although both younger and older adults were at least occasional users of keyboards and mice, only the younger adults reported occasional use of touch screens. Therefore, designers should be aware that even for older adults who have computer experience, the range of input devices they are likely to have experience using is minimal.

<u>Computer operations:</u> We asked the participants to indicate their experience with 10 different computer operations: delete a file, insert a disk/CD/DVD, install software, open a file, save a file, set printer options, set monitor options, transfer files, use a printer, and use cut-and-paste operations (see Table 2). Again, younger adults had more intensive use for all items. Note that there was also quite a bit more variability (i.e., higher standard deviations) for the older computer users. Older adults were likely to have at least occasional experience with file manipulation (deleting, opening, saving) but not transferring. Older computer-users also inserted disks and used printers. However, experience was lower for installing software, setting monitor options, and using cut-and-paste operations. These patterns reveal that older computer-users may have an understanding, but more limited experience, with more advanced operations.

<u>Windows operations:</u> Participants indicated their experience with 17 different windows operations such as changing settings, scrolling, and moving between windows (the full list is presented in Table 3). The pattern indicates age-related differences overall, but also shows that older computer-users had experience with opening and closing windows and scrolling, as well as use of menus and icons. Notable is the limited experience for older adults with changing settings (audio, screen, network, clock), moving/managing multiple windows, or using help.

Systems/software: The questions about use of systems and software provide insights into advanced computer knowledge. Participants indicated experience with a variety of systems and software such as Linux, computer-graphics packages, spreadsheets, and programming input devices (the full list is presented in Table 4). Age-related differences were observed for every item and older adults only reported occasional use for the most common activities of email, Windows, and word processing. These data also indicate the limitations for younger computer-users who reported minimal use of conference software, database management, Internet phone, statistical packages, other operating systems, and Web-design software.

Summary of age-related differences in general computer use: Although there were age-related differences for nearly all aspects of computer use, older adult computer users did report a range of experience. Figures 1–4 show the distribution of responses for input devices, computer operations, Windows operations, and systems/software. The older adults did not report a wide range of experience with input devices, but at least occasional or frequent use of a number of computer and Windows operations. Where the age-related difference across computer users was most evident was for advanced systems and software use (Table 4 and Figure 4).

Internet Use—For participants who had experience using computers, we asked about their use of the Internet. Figure 5 shows that the vast majority of the younger adults had been using the Internet for more than five years, whereas fewer than 50 percent of the older adults had been using the Internet that long. Many of the older adults were in the 1–3 or 3–5 year categories. Figure 6 shows the pattern of Internet use per week – more than 40 percent of the younger adults reportedly used the Internet more than 15 hours per week, whereas the largest category for the older adults was 1–5 hours per week. These data make clear that knowing "yes" or "no" about an individual's (or a group of individuals) use of the Internet does not capture the range of use experience over time.

In-depth information about specific Internet activities also revealed age-related and individual-experience differences. Participants reported how frequently they used the Internet for 11 different activities within the past year, such as banking, communication, and entertainment (the full list is presented in Table 5). The only categories that did not differ across the groups were searches for government sites (relatively infrequent for both age groups) and health information (for which both age groups reported occasional use). The younger adults reported (more than) occasional Internet use for many of the categories, whereas the four top categories for the older adults were communication, news, travel, and community.

Figure 7 provides a summary of the usage-frequency data for each age group across the 11 categories of activities. Younger adults reported occasional or frequent use for 91 percent of the categories, whereas older adults reported occasional or frequent use for 68 percent. Thus the sheer breadth of activities for which younger adults use the Internet is much greater than for older adults, but for those categories that are important to them, older adults make use of the Internet quite often.

Breadth and Depth of Technology Use Across Domains—For each domain, participants were asked how frequently they engaged in a particular activity and their data were included only if they did not answer "never". They were then asked about various technologies that were commonly used in that domain (the selections were based on the literature as well as focus group data, see Mitzner et al. in press).

Communication: Table 6 provides frequency reports for six communication technologies: answering machine, cell phone, fax machine, Internet (e.g., e-mail, chat room, video conferencing), telephone, and videophone. Here there were age-related differences wherein the older adults used telephones and answering machines more frequently, whereas the younger adults reported using a cell phone more frequently.

Customer service: Participants reported frequency of use for six technologies for customer service (e.g., technical support, product assistance, reservations): automated telephone menu system, CD/DVD, e-mail, fax machine, Internet (e.g., online manuals, online interactive support, Web site), and person on the telephone. Table 7 shows that younger adults were more likely to use email, the Internet, or an automated telephone menu system. Older adults were numerically (but not statistically) more likely to use a person on the telephone. Although the overall usage rate was low, older adults were more likely to report using a fax machine than younger adults.

Financial transactions: Participants reported frequency of use for six financial-related technologies: automated telephone menu system (e.g., banking, credit card information), automatic teller machine (ATM), drive-through banking, Internet (e.g., online banking, online bill paying, online investing), person on the telephone, and software (e.g., Quicken, spreadsheet, MS Money, TurboTax). Table 8 shows that as observed for general customer service, older adults were more frequent users of a person on the telephone. Younger adults used the Internet and ATMs more.

Health care activities: Participants reported use of technologies for a range of health care activities: automated telephone menu system, health information searching on the Internet, Internet communication (e.g., email, computer support groups), medical-related Internet purchasing (e.g., medication or medical supplies), person on the telephone, and telemedicine (e.g., videoconferencing with doctors or nurses). The importance of health care issues for older adults is revealed in Table 9 – three of the four differences were older adults using the technology more frequently: telephones (in person and automated) and medical purchases. The younger adults had a higher rate of Internet searching for health information.

Health care devices: Older adults also used more health care devices. Table 10 shows usage frequency for nine health care devices: blood pressure measurement device, digital thermometer, electronic dental hygiene system (e.g., electric toothbrush, Waterpik), emergency call system (e.g., Lifeline), heating pads, infusion pump, monitoring device (e.g., glucose, apnea, cardiac), nebulizers, and oxygen equipment. Older adults' use was significantly higher for blood pressure and monitoring devices. Younger adults more frequently used a digital thermometer.

Home-based systems: Home-based technologies included garage door opener, microwave oven, home security system (e.g., visitor entry directory system, home alarm, gate access), personal computer, programmable device (e.g., lights, thermostat, sprinkler, programmable food processor, programmable coffee maker), and robot (e.g., vacuum cleaner, lawn mower). Table 11 shows that there were no age-related differences in the frequently used microwave, occasionally used programmable devices, or less frequently used garage door opener or home security system. Younger adults did reportedly use PCs more, but both groups used them more than just occasionally. Robot use revealed a difference, but it is unclear if the younger adults were referring to toys.

Learning/educational/self-help systems: Participants were asked about their frequency of use for technologies for learning/educational/self-help systems: computer-based instruction

(e.g., CD, DVD, VCR), computer support group (e.g., chat room, discussion forum), digital or tape recorder, Internet searching (e.g., Google, directories, URLs, newspapers), language learning and translation systems, and online library database/catalog. Table 12 shows that, of all the categories, the Internet was most frequent for both age groups, although younger adults reported using this category more frequently. Although there were other age-related differences, the usage rates were quite low, suggesting that neither age group used much technology in the context of learning/education/self-help (excepting online library databases by the younger adults).

Leisure/hobby/entertainment systems: Participants reported frequency of use for nine leisure/hobby/entertainment technologies: books on tape (audio book), computer/video game (e.g., Gameboy, Playstation, Nintendo, GameCube, X-Box), digital photography (e.g., camera, camcorder), fitness device (e.g., pedometer, pulse meter, golf-swing enhancer, treadmill), hobby-specific computer usage (e.g., Internet, Photoshop, genealogy software, patterns), MP3/IPOD, personal digital assistant (PDA), recording and playback device (e.g., CD, DVD, VCR), and TV set-top box (e.g., program TV, pay-per view movies, music stations, TiVo). The results are presented in Table 13. The younger adults used most of the different technologies at least occasionally, with the exception of books on tape and a PDA. Older adults were more likely than younger adults to use books on tape, but their most frequently reported category was use of recording and playback devices for entertainment.

Shopping: With respect to shopping activities, participants reported use frequency of: credit card, debit card, in-store automated kiosk (e.g., self-checkout, price scanner, item locator), Internet (e.g., online purchasing, online product evaluation), telephone, and television shopping. The results are presented in Table 14. Younger adults most frequently reported use of a debit card, whereas older adults most frequently reported use of a credit card. Younger adults were more likely to do shopping via the Internet, whereas older adults reported relatively higher (but rather infrequent) use of the telephone and the television for shopping.

Transportation: Participants reported use frequency for eleven technologies related to transportation: automated telephone menu system, automatic check-in station, automatic parking payment station, automatic ticket purchase station, cruise control in car, in-car navigation system (e.g., GPS, Onstar, Neverlost), online travel schedule, personal digital assistant (PDA), person on the phone, remote control to start the car, and travel direction/ map software (e.g., MapQuest, Streets and Trips, Keyhole). Table 15 shows that for both age groups, most of the various technologies were used infrequently (i.e., less than occasionally). Most frequent for younger adults was travel/map software whereas for older adults it was a person on the phone.

Summary of age-related differences in technology use across domains: Across domains, older adults were more likely to use those technologies that have been around longer, such as telephones, answering machines, microwave ovens, recording devices, and credit cards. Whenever it was listed as an option, older adults reported more frequent use of a person on the phone (significantly more than younger adults in three of four cases). Overall, there was limited evidence that older adults were averse to using technology in a particular domain – but their choice and frequency of using a technology option did often differ from those of younger adults.

Conclusions

Technology-diffusion information provides valuable insights into the relevant knowledge that potential user groups might have. Product designers can capitalize on prior knowledge

to enhance usability of new designs. Instructional designers can better pinpoint what needs to be emphasized in training programs and instructional materials.

The present approach to assessing technology experience across younger and older adults was unique in its focus on the frequency of use. Our data offer insights beyond "yes" or "no'" information regarding experience with a particular technology or component of technology. As such, the results provide a fine-grained assessment of the breadth and depth of technology experience for computers, the Internet, and a range of domain-specific technologies.

Perhaps not surprisingly, the younger adults reportedly used most of the technologies we queried about more frequently than the older adults. Notable exceptions were within the health care domain, where older adults were more frequent users of automated-telephone menu systems, blood pressure devices, and monitoring devices. Older adults were also more frequent users of tape recorders and books on tape.

The data also point to some clear boundaries of knowledge for older adults. For example, even older adults who used computers had limited experience with various input devices, computer operations, windows operations, and software. Their more frequent experience was for the most common devices (e.g., keyboards, mice), functions (e.g., file operations), and windows operations (e.g., clicking, scrolling, opening/closing windows). Moreover, with the exception of email, older computer users had minimal experience with systems and software.

With respect to breadth of Internet use, younger adults used the Internet fairly frequently in a wide variety of domains. Older adults' usage frequency was limited to communication or searching for information about community, health, news, and travel. Interestingly, frequency of searching for health information did not differ across age groups. Thus, although the breadth of experience may differ across age groups, there are certain aspects of Internet use within which older Internet users will be quite familiar. This knowledge base may provide valuable experience to enable them to use the Internet for a broader range of activities. The areas for which they do not currently use the Internet as frequently (e.g., banking, education, shopping) may provide opportunities for improved designs to meet the needs of older users.

The pattern of technology use across domains did not suggest any aversion to technology in general. It is consistent with the idea that older adults are selective in the technologies they use and likely to be slower to adopt (evidenced by their continued frequent use of long-standing technologies and less frequent use of more recent technologies within each domain). However, in health care areas where older adults have a higher need, they do report frequent use of technologies.

The goal of the present study was to assess technology experience for younger and older adults. The data illustrate that even for individuals who answer "yes" regarding experience with a particular technology, there is a lot of variability in the specific nature of that experience. In-depth understanding of the type and amount of experience across age groups provides guidance for the design of future technologies. For example, our results indicate that older adults frequently use the telephone for interactions about customer service. This suggests that if vendors are interested in the older population using their products, it would be beneficial for them to offer technology support that is easily accessible, perhaps a toll-free telephone number, rather than only having support available through their Website. Our results also indicate that older adults show greater frequency of technology use in health care categories. Vendors might be able to leverage usage of those products to cross-promote other health care technologies, provided that they offer good training and support. For an

example, our results also show that older adults do not frequently change their computer monitor settings. This suggests that it is important that there are good default values for health care equipment settings (Fisk, Rogers, Charness, Czaja, and Sharit 2009).

The present results can also provide guidance for the development of training programs. We found that older adults reported lower computer frequency usage for many different Windows operations, such as changing audio, screen, and network settings, and for using the help system. We also found low-frequency usage for a variety of operating systems and software. These results suggest that computer-training courses taught at senior centers should provide specific training for these types of activities that might be beneficial for older users.

Acknowledgments

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Younger Adults

Older Adults

□Never ▩Occasional ■Frequent
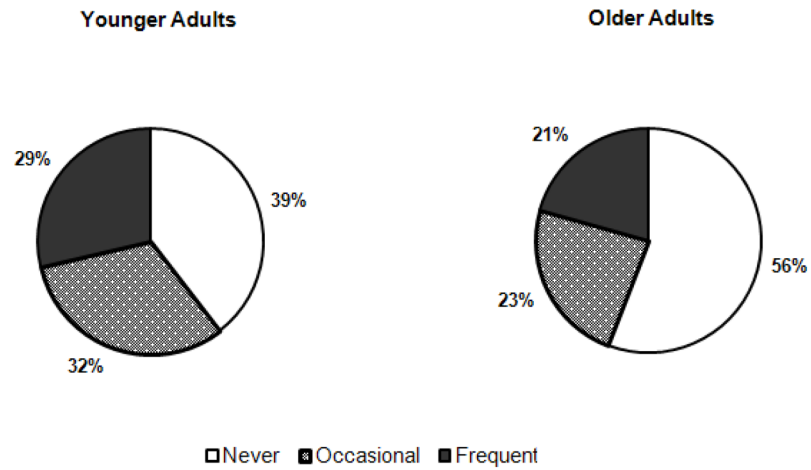
Figure 1.
Younger (*N*=420) and older (*N*=195) adults' mean usage frequencies across 9 different input devices (listed in Table 1). Data are for participants in each age group who reported experience with computers in general.

Figure 2.
Younger (*N*=420) and older (*N*=194) adults' mean usage frequencies across 10 computer operations (listed in Table 2). Data are for participants in each age group who reported experience with computers in general.

Younger Adults

Older Adults

3%

21%

76%

33%

31%

36%

☐ Never ⊠ Occasional ■ Frequent

Figure 3.
Younger (*N*=419) and older (*N*=191) adults' mean usage frequencies across 17 Windows operations (listed in Table 3). Data are for participants in each age group who reported experience with computers in general.

Younger Adults   **Older Adults**

□ Never ▨ Occasional ■ Frequent
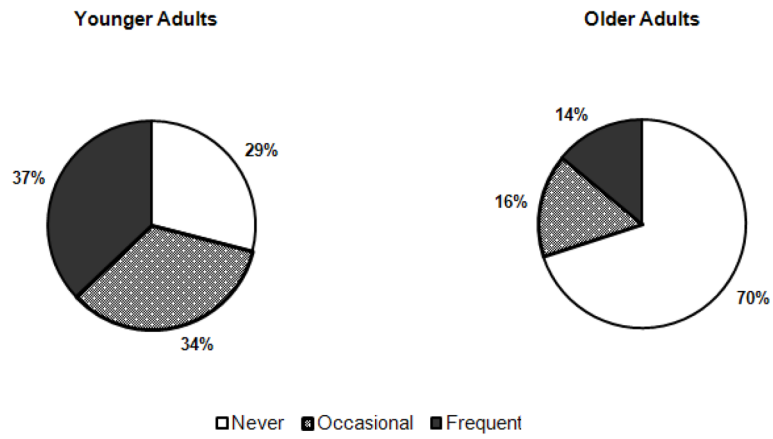
Figure 4.
Younger (*N*=420) and older (*N*=193) adults' mean usage frequencies across 17 systems and software (listed in Table 4). Data are for participants in each age group who reported experience with computers in general.
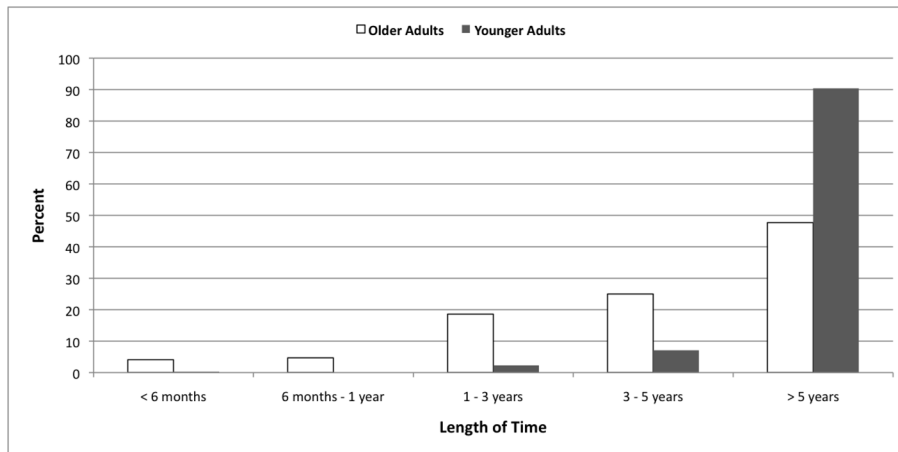
Figure 5.
Younger (*N*=430) and older (*N*=251) adults' mean in months and years of Internet usage. Data are for participants in each age group who reported experience with computers in general and who reported using the Internet.
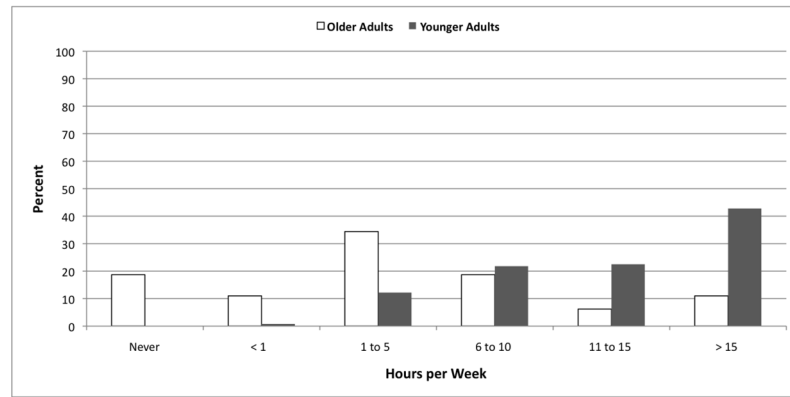
Figure 6.
Younger (*N*=430) and older (*N*=251) adults' mean differences in hours per week of Internet use. Data are for participants in each age group who reported experience with computers in general and who reported using the Internet.

Younger Adults **Older Adults**

☐Never ▧Occasional ■Frequent
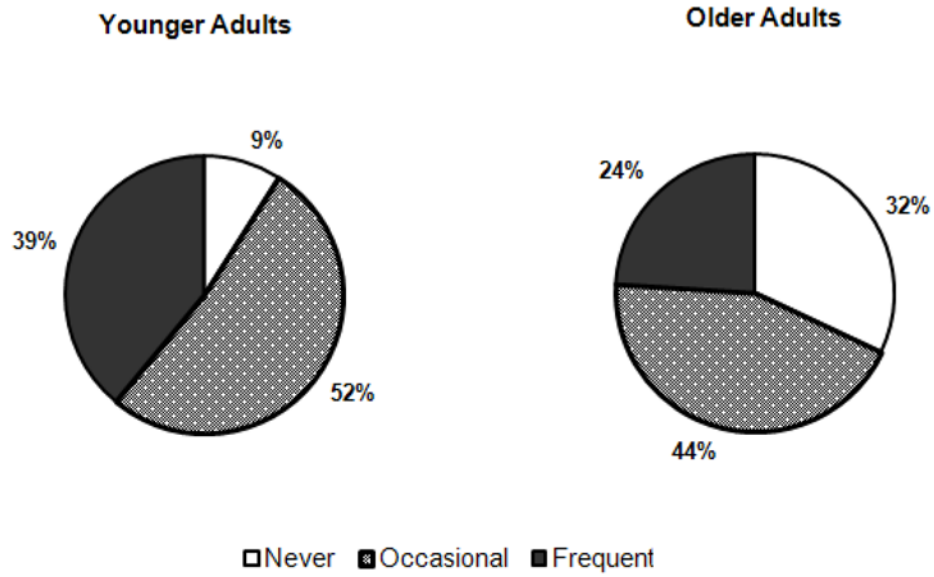
Figure 7.
Younger (*N*=419) and older (*N*=169) adults' usage frequencies for Internet usage in the past year across 11 categories (listed in Table 5). Data are for participants in each age group who reported experience with computers in general and who reported using the Internet.
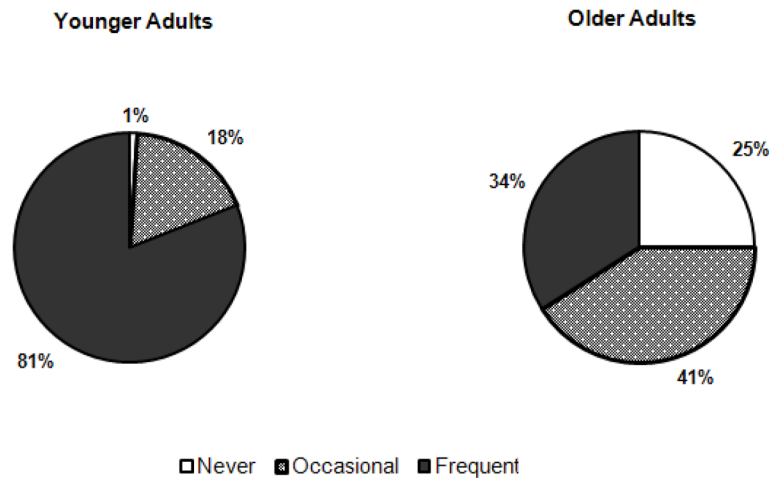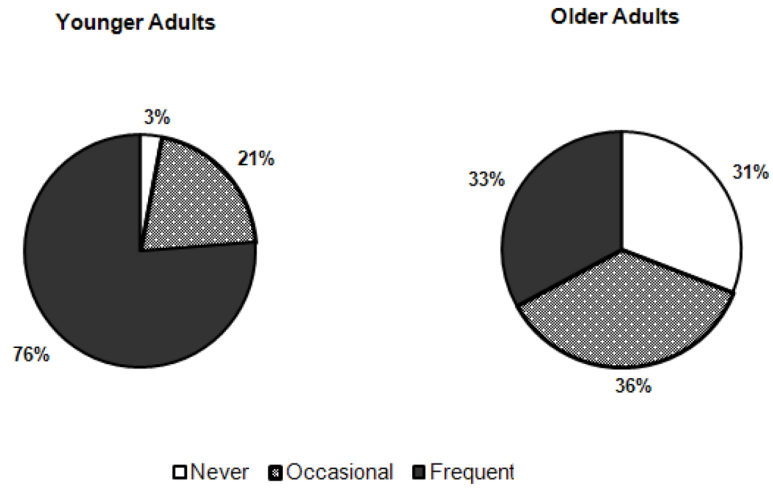
Table 1

Usage Frequency for Input Devices

Device	Younger Adults (N=420)		Older Adults (N=195)		t-value
	M	SD	M	SD	
Joystick	.70	.60	.27	.47	9.43 *
Keyboard	1.98	.18	1.71	.55	6.57 *
Light-pen	.42	.60	.18	.46	5.40 *
Mouse	1.94	.26	1.45	.45	4.39 *
Rotary Input Knob	.26	.53	.20	.48	1.25
Speech Recognition System	.39	.57	.22	.46	3.95 *
Touch Screen with Finger	1.15	.58	.73	.63	7.87 *
Touch Screen with Stylus	.74	.67	.52	.61	3.97 *
Trackball	.47	.62	.21	.51	5.56 *

Note. 0=never used, 1=occasionally used, 2=frequently used. Data are for participants in each age group who reported experience with computers in general.

*
p<.006 with Bonferroni corrections for multiple comparisons.

Table 2

Usage Frequency for Computer Operations

Operation	Younger Adults (*N*=420)		Older Adults (*N*=194)		*t*-value
	M	*SD*	*M*	*SD*	
Delete a File	1.84	.39	1.15	.68	13.05[*]
Insert a Disk/CD/DVD	1.88	.33	1.21	.71	12.46[*]
Install Software	1.65	.51	.71	.69	16.89[*]
Open a File	1.95	.24	1.36	.68	11.68[*]
Save a File	1.94	.23	1.34	.71	11.44[*]
Set Printer Options	1.70	.48	1.10	.75	10.40[*]
Set Monitor Options	1.49	.60	.70	.72	13.32[*]
Transfer Files	1.72	.51	.80	.75	15.50[*]
Use a Printer	1.90	.32	1.48	.68	8.01[*]
Use Cut-and-Paste Operations	1.92	.29	.96	.81	15.88[*]

Note. 0=never used, 1=occasionally used, 2=frequently used. Data are for participants in each age group who reported experience with computers in general.

[*]
p<.005 with Bonferroni corrections for multiple comparisons.

Table 3

Usage Frequency for Windows Operations

Operation	Younger Adults (*N*=419)		Older Adults (*N*=191)		*t*-value
	M	*SD*	*M*	*SD*	
Change Audio Settings	1.56	.58	.62	.65	17.24[*]
Change Screen Settings	1.45	.56	.68	.63	14.61[*]
Change Network Settings	1.32	.65	.36	.58	18.01[*]
Click Icon	1.90	.32	1.44	.77	8.01[*]
Close a Window	1.95	.23	1.49	.75	8.25[*]
Empty Trash	1.79	.43	1.15	.82	10.07[*]
Manage Multiple Windows	1.93	.28	.80	.78	19.50[*]
Move between Windows	1.92	.29	.82	.81	18.40[*]
Open a New Window	1.94	.24	1.34	.76	10.62[*]
Perform Operations Using Right Click on Mouse	1.91	.30	1.18	.73	13.37[*]
Resize a Window	1.89	.33	1.07	.79	13.75[*]
Scroll Horizontally	1.85	.38	1.28	.75	9.91[*]
Scroll Vertically	1.91	.31	1.29	.76	10.91[*]
Search for Files	1.81	.39	1.27	.72	9.79[*]
Update Clock	1.37	.66	.66	.72	11.65[*]
Use Drop-down Menu	1.83	.43	1.03	.82	12.68[*]
Use Windows Help System	1.27	.63	.90	.70	6.39[*]

Note. 0=never used, 1=occasionally used, 2=frequently used. Data are for participants in each age group who reported experience with computers in general.

[*] *p*<.003 with Bonferroni corrections for multiple comparisons.

Table 4

Usage Frequency for Systems/Software

System/Software	Younger Adults (*N*=420)		Older Adults (*N*=193)		
	M	*SD*	*M*	*SD*	*t*-value
Apple Operating System	.93	.59	.23	.51	14.92 *
CD/DVD Creation Software	1.33	.62	.39	.60	17.62 *
Computer Graphics	1.07	.65	.36	.58	13.58 *
Conference Software	.30	.52	.05	.27	7.73 *
Database Management	.60	.65	.24	.52	7.14 *
Email	1.93	.25	1.54	.71	7.30 *
Home Computer Network	1.72	.56	.63	.88	15.67 *
Instant Messaging	1.68	.57	.47	.65	22.03
Internet Phone	.51	.70	.22	.54	5.68 *
Presentation Software	1.37	.56	.24	.50	25.01 *
Programming Package	.67	.70	.07	.28	14.94 *
Spreadsheet	1.23	.59	.41	.62	15.53 *
Statistical Package	.40	.62	.02	.12	12.23
UNIX/LINUX System	.28	.53	.04	.24	7.88 *
Web Design Software	.75	.69	.10	.36	15.39 *
Windows Operating System	1.69	.58	1.29	.82	6.11 *
Word Processing	1.93	.27	1.25	.78	11.75 *

Note. 0=never used, 1=occasionally used, 2=frequently used. Data are for participants in each age group who reported experience with computers in general.

*
p<.003 with Bonferroni corrections for multiple comparisons.

Table 5

Usage Frequency for Internet in the Past Year

Domain	Younger Adults (*N*=419)		Older Adults (*N*=169)		
	M	*SD*	*M*	*SD*	*t*-value
Banking/Money Management	1.33	.70	.82	.87	6.80*
Communication	1.88	.36	1.69	.61	3.66*
Community Information	1.25	.61	1.04	.68	3.53*
Education	1.40	.66	.58	.69	13.25*
Employment	1.11	.63	.28	.52	16.40*
Entertainment	1.51	.53	.80	.60	13.23*
Government	.90	.58	.76	.62	2.66
Health Information	1.04	.48	.96	.66	1.27
News Information	1.48	.53	1.28	.67	3.49*
Shopping	1.17	.55	.80	.64	6.59*
Travel	1.24	.54	1.08	.60	3.06*

Note. 0=never used, 1=occasionally used, 2=frequently used. Data are for participants in each age group who reported experience with computers in general and who reported using the Internet.

*
p<.005 with Bonferroni corrections for multiple comparisons.

Table 6

Usage Frequency for Communication Technologies

Technology	Younger Adults (N=424)		Older Adults (N=235)		t-value
	M	SD	M	SD	
Answering Machine	1.29	.64	1.40	.70	−2.11 *
Cell Phone	1.96	.23	1.27	.73	13.97 *
Fax Machine	.65	.54	.75	.67	−1.86
Internet	1.88	.36	1.09	.85	13.67 *
Telephone	1.56	.60	1.90	.37	−8.92 *
Videophone	.21	.47	.06	.26	5.14 *

Note. 0=never used, 1=occasionally used, 2=frequently used. Data are for participants in each age group who reportedly engaged in communication activities and responded to 75% of the items in this domain.

*
p<.008 with Bonferroni corrections for multiple comparisons.

Table 7

Usage Frequency for Customer Service

Technology	Younger Adults (*N*=383)		Older Adults (*N*=195)		*t*-value
	M	*SD*	*M*	*SD*	
Automated Telephone Menu	1.25	.67	1.00	.63	4.36[*]
CD/DVD that comes with a purchase	.49	.64	.39	.60	1.86
Email	1.13	.66	.82	.71	5.02[*]
Fax Machine	.26	.49	.60	.58	−6.94[*]
Internet	1.39	.61	.72	.67	11.71[*]
Person on the Telephone	1.42	.58	1.58	.53	−3.51

Note. 0=never used, 1=occasionally used, 2=frequently used. Data are for participants in each age group who reportedly engaged in computer service activities and responded to 75% of the items in this domain.

[*]
p<.008 with Bonferroni corrections for multiple comparisons.

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Table 8

Usage Frequency for Financial Transactions

Technology	Younger Adults (*N*=401)		Older Adults (*N*=232)		
	M	*SD*	*M*	*SD*	*t*-value
Automated Telephone Menu	.74	.69	.85	.70	−1.98
Automatic Teller Machine	1.38	.63	.82	.77	9.38 *
Drive-thru Banking	.84	.66	.97	.68	−2.29
Internet	1.45	.71	.51	.77	15.22 *
Person on the Telephone	.55	.64	.97	.67	−7.70 *
Software	.31	.56	.28	.61	.47

Note. 0=never used, 1=occasionally used, 2=frequently used. Data are for participants in each age group who reportedly engaged in financial activities and responded to 75% of the items in this domain.

*
p<.008 with Bonferroni corrections for multiple comparisons.

Table 9

Usage Frequency for Health Care Activities

Technology	Younger Adults (N=409)		Older Adults (N=238)		t-value
	M	SD	M	SD	
Automated Telephone Menu	.37	.58	.63	.69	−4.80 [*]
Internet Communication	.51	.67	.44	.60	1.42
Internet Health Information Search	1.07	.66	.65	.67	7.77 [*]
Medical Internet Purchasing	.15	.42	.29	.58	−3.18 [*]
Person on the Telephone	.79	.72	1.27	.65	−8.84 [*]
Telemedicine	.05	.25	.07	.30	−.80

Note. 0=never used, 1=occasionally used, 2=frequently used. Data are for participants in each age group who reportedly engaged in health care activities and responded to 75% of the items in this domain.

[*]
p<.008 with Bonferroni corrections for multiple comparisons.

Table 10

Usage Frequency for Health Care Devices

Technology	Younger Adults (N=109)		Older Adults (N=139)		t-value
	M	SD	M	SD	
Blood Pressure Device	.41	.63	1.09	.75	−7.67[*]
Digital Thermometer	1.05	.52	.69	.67	4.71[*]
Electronic Dental Hygiene	.71	.83	.88	.91	−1.54
Emergency Call System	.08	.34	.10	.37	−.42
Heating Pads	.61	.59	.67	.56	−.78
Infusion Pump	.02	.14	0	0	1.42
Monitoring Device	.13	.41	.54	.86	−4.93[*]
Nebulizers	.12	.38	.21	.52	−1.55
Oxygen Equipment	.04	.23	.08	.38	−1.08

Note. 0=never used, 1=occasionally used, 2=frequently used. Data are for participants in each age group who reportedly used health care devices and responded to 75% of the items in this domain.

[*] $p < .006$ with Bonferroni corrections for multiple comparisons.

Table 11

Usage Frequency for Home-based Systems

Technology	Younger Adults (*N*=426)		Older Adults (*N*=247)		*t*-value
	M	*SD*	*M*	*SD*	
Garage Door Opener	.73	.79	.74	.93	−.21
Microwave Oven	1.74	.47	1.78	.50	−.98
Home Security System	.70	.83	.67	.87	.47
Personal Computer	1.92	.33	1.26	.86	11.52 *
Programmable Device	1.13	.80	1.16	.86	−.45
Robot	.87	.81	.53	.81	5.28 *

Note. 0=never used, 1=occasionally used, 2=frequently used. Data are for participants in each age group who reportedly engaged in home-based activities and responded to 75% of the items in this domain.

*
p<.008 with Bonferroni corrections for multiple comparisons.

Table 12

Usage Frequency for Learning/Educational/Self-help Activities

Technology	Younger Adults (N=403)		Older Adults (N=217)		t-value
	M	SD	M	SD	
Computer-based Instruction	.86	.65	.76	.66	1.66
Computer Support Group	.63	.66	.23	.47	8.70 *
Digital/Tape Recorder	.31	.54	.64	.62	−6.76 *
Internet Searching	1.80	.45	1.06	.79	12.66 *
Language Learning and Translation	.61	.68	.29	.54	6.39 *
Online Library Database	1.10	.65	.55	.69	9.72 *

Note. 0=never used, 1=occasionally used, 2=frequently used. Data are for participants in each age group who reportedly engaged in learning activities and responded to 75% of the items in this domain.

*
$p < .008$ with Bonferroni corrections for multiple comparisons.

Table 13

Usage Frequency for Leisure/Hobby/Entertainment Activities

Technology	Younger Adults (*N*=423)		Older Adults (*N*=231)		*t*-value
	M	*SD*	*M*	*SD*	
Books on Tape	.27	.50	.48	.58	−4.65 *
Computer/Video Game	1.13	.68	.37	.61	14.74 *
Digital Photography	1.25	.65	.55	.66	12.90 *
Fitness Device	1.02	.72	.69	.73	5.43 *
Hobby-specific Computer	1.41	.68	.57	.74	14.26 *
MP3/IPOD	1.40	.74	.07	.29	32.35 *
Personal Digital Assistant	.22	.51	.09	.34	3.92 *
Recording/Playback Device	1.41	.68	1.05	.72	6.36 *
TV Set-top Box	1.11	.77	.70	.79	6.38 *

Note. 0=never used, 1=occasionally used, 2=frequently used. Data are for participants in each age group who reportedly engaged in leisure activities and responded to 75% of the items in this domain.

*
p<.006 with Bonferroni corrections for multiple comparisons.

Table 14

Usage Frequency for Shopping Technologies

Technology	Younger Adults (*N*=420)		Older Adults (*N*=239)		*t*-value
	M	*SD*	*M*	*SD*	
Credit Card	1.03	.78	1.39	.70	−6.02[*]
Debit Card	1.56	.67	.69	.83	13.68[*]
In-store Automated Kiosk	1.15	.63	.70	.64	8.61[*]
Internet	1.00	.49	.53	.62	10.00[*]
Telephone	.28	.53	.80	.60	−11.06[*]
Television Shopping	.07	.31	.20	.42	−4.17[*]

Note. 0=never used, 1=occasionally used, 2=frequently used. Data are for participants in each age group who reportedly engaged in shopping activities and responded to 75% of the items in this domain.

[*] *p*<.008 with Bonferroni corrections for multiple comparisons.

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Table 15

Usage Frequency for Transportation-related Systems

Technology	Younger Adults (*N*=424)		Older Adults (*N*=245)		
	M	*SD*	*M*	*SD*	*t*-value
Automated Telephone Menu	.36	.57	.66	.70	−5.49 *
Automatic Check-in Station	.70	.72	.48	.65	4.04 *
Automatic Parking Payment	.68	.65	.50	.59	3.77 *
Automatic Ticket Purchase	.70	.32	.43	.62	5.37 *
Cruise Control in Your Car	.78	.73	.81	.79	−.47
In-car Navigation System	.23	.51	.11	.36	3.76 *
On-line Travel Schedule	.86	.73	.53	.66	5.97 *
Personal Digital Assistant	.18	.48	.10	.39	2.34
Person on the Phone	.75	.64	1.10	.74	−6.10 *
Remote Control Car Starter	.11	.38	.07	.34	1.19
Travel/Map Software	1.37	.67	.90	.75	8.65 *

Note. 0=never used, 1=occasionally used, 2=frequently used. Data are for participants in each age group who reportedly engaged in transportation activities and responded to 75% of the items in this domain.

*
p<.004 with Bonferroni corrections for multiple comparisons.